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DISEASES

OF THE

Stomach and Intestines

A MANUAL OF CLINICAL THERAPEUTICS

FOR THE STUDENT AND PRACTITIONER

BY

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AUTHOR'S PREFACE.

My friend Dr. Hurd, of Newburyport, to whom I am already indebted for an excellent translation of the third volume of my "Leçons de Clinique Therapeutique," has asked permission to give to the American medical public such portion of the first volume as pertains to Diseases ot the Stomach and Intestines. I am quite willing to accord to him this privilege.

I know of no study more fascinating than that of diseases of the digestive tube, and it is one to which I have devoted particular attention. Quite recently new light has been thrown on these affections by the brilliant discoveries of Armand Gautier and Charles Bouchard. Gautier has shown us, by chemical researches of the greatest interest, that the living cell produces toxic alkaloids, leucomaines which are constantly being eliminated by the different emunctories of the economy, and in particular by the digestive tube. The process of digestion itself gives rise to such toxic alkaloids, and it is sufficient, as Brieger has demonstrated, to bring gastric juice in contact with fibrin to see them produced.

But let some physiological or pathological circumstance come in to augment the production of these toxic substances, or oppose their elimination, there will then supervene general symptoms which will vary in intensity according to the quantity of the poison which has penetrated the economy.

Bouchard has pointed out one of the pathological conditions the most calculated to favor this empoisonment, namely, dilatation of the stomach. By the disorders which it induces in the digestive functions, by the putrid fermentations which it favors, by the profound alterations in the general nutrition which it entails, dilatation of the stomach ought henceforth to have a dominant place in the pathology of gastric affections. We have here one of the factors of a great number of general states whose origin has thus far been unrecognized.

How many women with ill-defined nervous symptoms owe these symptoms to nothing but dilatation of the stomach? How many rheumatic patients with multiple manifestations connected with different viscera, and especially the liver, are in reality only victims of gastrectasis?

In this work, whose publication was anterior to the official promulgation of these facts, the latter are but briefly alluded to, but enough is stated to show the important practical conclusions deducible from these researches of Gautier and Bouchard, and the fresh impetus which they have given to the study of gastric affections; researches from which pathologists cannot fail to profit.

Although this work is entitled Diseases of the Stomach and Intestines, it is less a treatise on the pathology of those affections than on the treatment, to which, in fact, all other considerations are made subordinate. I have given especial attention to foods and to alimentation. In these disorders hygienic therapeutics occupy the first place. The patient will be much more likely to find the means of his cure in the observance of a strict and well-regulated diet than in the administration of pharmaceutical drugs.

In order to give more system to my exposition of the different therapeutical means which the physician may employ in the treatment of stomach affections, I have adopted a division of dyspepsias which is established on a physiological basis. I recognize, however, that this division is, from a clinical point of view, altogether arbitrary. I am in fact of opinion that the word dyspepsia is destined to disappear from the nosological category of diseases of the stomach, and that we ought to substitute for it the name of the particular gastric, intestinal, or other lesion of which the dyspepsia is the symptom However, the term and the classification have a certain utility from a therapeutic point of view, and I trust that the reproduction in the United States of a work which has had a considerable success in France may not be without profit to American physicians.

I thank Messrs. Wm. Wood and Co. for the pains which they have taken in the typographical execution of this book, which has been issued by them in a convenient and elegant form. For the parallel column arrangement of notes under the text of the French edition, they have substituted an arrangement which I trust will be equally advantageous, whereby the notes in their proper order are made to succeed the chapters. I hope that this disposition, which is not altogether to my liking, (though preferred by the translator), will not lead the reader to neglect these notes which have cost me great labor. I have especially to thank my friend Dr. Hurd for the assiduity, painstaking and accuracy with which he has translated these lectures.

DUJARDIN-BEAUMETZ.

PARIS, FRANCE, *May*, 1886.

TRANSLATOR'S PREFACE.

THE present volume may be considered by American readers as the continuation of the work on "Clinical Therapeutics" published last year by G. S. Davis of Detroit. Doubtless many that have read Mr. Davis's publication and tested its practical character, will welcome another book from the same author, who is now favorably known as a clinical teacher the world over, and whose name the past sixteen years has been so identified with everything that is progressive in therapeutics.

Tô obviate any misunderstanding, it is necessary to state that these books have not appeared in this country in the order of their publication in France. The work entitled "Clinical Therapeutics," published by Mr. Davis, is really the third and last volume of the *Leçons de Clinique Therapeutique,* of which the present is the first volume, with the omission of the First Part, pertaining to Diseases of the Heart and Aorta.

The order of the appearance of this series was as follows: Vol. I., On the Treatment of Diseases of the Heart, Aorta, Stomach and Intestines, 1879: Fourth and revised edition, 1885. Vol. II., On the Treatment of Diseases of the Liver, Kidneys, Lungs, Pleura, Larynx, and Pharynx, 1882: Fourth edition, 1885. Vol. III., On the Treatment of Diseases of the Nervous System, General Diseases and Fevers, 1883: Fourth and revised edition, 1886.

The entire work has gone through four editions in France, and has been translated into Italian, Spanish, and Russian. The translation here presented to the American profession is from the fourth and revised French edition, which appeared in 1885. In this work I have had the sympathy and coöperation of the French author.

There are two ways of treating therapeutics. One is from the standpoint of the remedy. This is the ordinary method of works on therapeutics. The physical and chemical properties of the medicament are described, then the physiological action and the effects under morbid conditions; from these considerations data are derived which are designed to be of use in the treatment of disease. The sum of these data constitutes Materia Medica, and embraces the empirical conclusions, the studies, the researches, the tentative efforts of countless generations. Man may often have gone wrong in the past, but he has not been altogether wrong. There have always been sick persons, and there have always been humane endeavors to relieve and cure them, and out of the accumulated experience of centuries the therapeutics of to-day has come down to us as a survival of the fittest.

The second method is the consideration of therapeutics from the standpoint of the disease. This, especially when the concrete representation of the malady,—the patient,—is present, is the clinical method. The disease is first described, with the symptoms and physical signs by which it may be known; the elements of a sound diagnosis and prognosis are stated, and indications for relief and restoration are sought for from the resources of hygiene and medicine. It is hardly necessary to say that the present work, as far as it is properly a treatise on Clinical Therapeutics, follows the second method, emphasis and predominance being given to therapeutics. If considerable attention is devoted to pathology, symptoms and diagnosis, it is that a stronger illumination may be brought to bear upon the really essential part, the treatment.

To illustrate the above remarks: what is really known about many a disease would fill a large volume, while what is known about the treatment may be comprised in a few pages. The busy practitioner doubtless needs the large volume, but he needs especially the chapter on *therapeutics;* and the volume that gives him a handy resumé of the results of a wide experience in the best modes of treating disease, will be the book which will be of the most practical value to him. See, for instance, how the study of the myelites may be abridged; for, directing his attention to the processes which determine medullary diseases, the physician is not obliged to distinguish the different myelites which are called systematic myelites, such as sclerosis of the posterior columns, sclerosis of the lateral columns, etc. What he has to ask of therapeutics is means to oppose the connective tissue induration which produces these pathological changes. * The same may be said of the general treatment of gastralgic dyspepsia and gastralgia, as is pointed out on page 175; and other illustrations are abundant.

Such a useful guide-book of practice is the work of Dujardin-Beau-

* Clinical Therapeutics, page 168.

metz, in which much that, in ordinary text-books on Materia Medica and Practice, is rather embarrassing than helpful to the practitioner is omitted; while the important data, set forth in strong light and grouped in a few masterly generalizations, indicate to him where he can be truly useful, where his intervention is demanded, as well as the limits of that intervention.

To do such work as this well, the clinical instructor must have extraordinary resources at his command. He must see diseases in their manifold and diversified forms, and in their relation to different constitutions, constantly before him; he must not only have a keen personal interest in his cases, but he must have a corps of competent assistants to record observations and to tabulate the results of therapeutic tentatives. The course of the disease under medication must be critically watched, and all favorable modifications due to the remedy must be carefully discriminated from such modifications as are solely the result of natural efforts toward cure; by no means an easy task, and demanding the critical acumen of a master. It is needless to say that it is only in our large hospitals that these conditions of successful clinical teaching can be found. Valuable as ever must be the contributions of physicians in private practice, (and I do not mean to disparage such contributions, for many a humble country practitioner, like the late J. Marion Sims, has made valuable discoveries and been a benefactor to the profession), yet it is to the great workers in our large hospitals that we are to look for the most practical and thorough testing of remedies.

But this is not all. Clinical observation must go hand in hand with physiological experimentation. If the "provings" of medicinal substances in non-toxic doses by healthy human subjects have proved utterly barren of all useful results, it is not so with experimental toxicology in animals, and most valuable knowledge has been gained by such experimentation. No one at all conversant with modern therapeutics will deny this. An important place is now assigned in all works on therapeutics to such toxic effects, as determined in the case of each individual drug by careful experiment. Clinical experience is elucidated and confirmed by experimentation on animals. We owe here a debt of gratitude to the French and Germans, and he who would duly appreciate what physiological experimentation has done for medicine, must acquaint himself with the works of Continental physicians, who have distinguished themselves by laboratory researches as well as by clinical provings.

Few persons of our day have more completely realized in themselves and in their surroundings the conditions for successful clinical study and teaching than the author of this work. His hours of labor are divided between the laboratory, the hospital, his large private clientele, his books, and the several learned societies to which he belongs. His early training was under such masters as Behier, Velpeau, Trousseau, Chassaignac, Magendie, and his daily associates are the magnates in the profession in France, such as Jaccoud, Seè, Huchard, Debove, Bouchard, Vulpian and Brown-Sequard. At Saint Antoine he has been physician-in-chief, an office which he now holds at the Cochin, where the administration has lately erected a fine amphitheatre and physiological and chemical laboratory as adjuncts to his clinical teaching. Join to this his position as editor-in-chief of one of the leading medical journals, the Bulletin General de Thérapeutique, and it is not to be wondered at that he has ever kept abreast of the best medical work of the day, and that his "Leçons de Clinique Thérapeutique" is an epitome of the useful labors of his contemporaries, as well as of his own valuable contributions to the healing art.

Dr. Dujardin-Beaumetz has already been quite a voluminous writer. His earlier writings on certain diseases of the spinal cord (Locomotor Ataxia, Ocular Troubles in Spinal Diseases, Acute Myelitis) attracted wide attention at the time they appeared, and the treatise on Acute Myelitis is still an authority on the subject. On almost all the new modes of treatment and the new remedies of the past twenty years he has published elaborate articles. The following deserve special mention: "Researches on Gelsemium;" "Researches on Nutritive Lavements;" "On the Treatment of Aneurisms of the Aorta by Electro-Puncture;" "Researches on Pelletiérine;" "A Study of Boldo;" "Researches on Phosphorus Medication;" "On Expectancy as a Method of Treatment in Acute Rheumatism;" "Studies on the Physiological and Therapeutic Applications of the Ammonia Compounds," etc.

The "Experimental Researches on the Toxic Power of the Alcohols" is a work of great merit, and was published in 1878. The reader will find in the long chapter on Complex Aliments (Lecture III.) a resumé of the more important conclusions of that volume, also of the smaller work which succeeded it, and which is entitled: "Researches on Chronic Alcoholic Poisoning."

The "Dictionnaire de Thérapeutique" in four large volumes, which is advancing toward its completion, is also a laborious undertaking. Here every means which Hygiene or Medicine utilizes for the cure of disease is exhaustively discussed.

The reader of the following work cannot fail to remark the large place that is assigned to hygiene in the treatment of disease. The utility and the necessity of pure air, of suitable exercise, of a proper dietary regimen, etc., are everywhere insisted upon, and emphasis is put upon Bouchardat's declaration that etiology is as indispensable to therapeutics as is hygiene, or the administration of medicines. In fact, in the presence of a sick person, the first question to ask, after having ascertained the malady, is What is the cause? and often the answer to this question indicates the remedy. In conformity with the views of the author as to the importance of hygiene, (especially in the treatment of the dyspepsias), the first five chapters are devoted to the subject of regimen, which plays so preponderant a part in the causation of the stomach diseases as well as in their treatment. It is not possible for the practitioner to be too familiar with the subjects embraced in these chapters. A great amount of valuable information, moreover, will be found condensed in the notes. I cannot too strongly exhort the reader to study especially this part of the work, which gives so concise a summary of the fruits of Continental research.

The chapters on the Dyspepsias and Neuroses of the Stomach, on Ulcer and Cancer of the Stomach, on The Various Intestinal Diseases, will be found profitable for study; in fact the diseases here discussed are those which the ordinary practitioner will be oftenest called upon to treat.

If I have taken any liberties with the notes in portions of this work, it has been in the direction of abridgment and condensation; some I have omitted altogether in order to bring the work within the number of pages prescribed by the publisher. I have endeavored to make the work thoroughly American, both by addenda of my own, and by adapting it throughout to the U. S. Pharmacopœia.

TRANSLATOR.

NEWBURYPORT, MASS., *June*, 1886.

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LECTURE I.

PRIMORDIAL ALIMENTARY PRINCIPLES.

SUMMARY.—The Diseases of the Stomach—General Therapeutics of Diseases of the Stomach—Hygienic Therapeutics—Etiological Therapeutics—Divisions—Concerning Ingesta—Aliments and Alimentation—Definition of Food—Nutribility and Digestibility of Foods—Experiments performed on Man—Gastric Fistulas—Intestinal Fistulas—Foods difficult or easy of Digestion—Division of Alimentary Principles—Digestion of Albuminoid Matters—The Gastric Juice—Albuminoid Substances—Peptones, their Characters, their Varieties, their Nature—Nutritive Value of Albuminoid Principles—Digestion of Starch, of Sugar, and of Fat—Saline Principles.

GENTLEMEN: The diseases of the digestive organs, like the diseases of the heart, are affections which, notwithstanding their chronicity, quite often show what can be accomplished by therapeutics when well understood and directed, therefore I have chosen this subject as the continuation of my instruction in Clinical Therapeutics.

From the very beginning of your practice, you will often be consulted with reference to functional troubles of the digestive tube, and as these disorders, generally of long duration, present themselves under manifold and ever-varying aspects, you will be obliged not only to institute the proper treatment, but to modify it in accordance with the changing forms of the affection. In our hospital service you have a vast field for observation; our wards set apart for male patients will at any time display to you, in their most varied forms, cases illustrative of the chronic stomach maladies; our Saint Mary's ward, devoted to children's diseases, will enable you to study that interesting type of dyspepsia which is peculiar to young infants. It is in basing myself on all these facts, which pass daily before your eyes, that I am about to devote these lectures to the study, from a clinical point of view, first of the therapeutics of affections of the stomach, then of those of the intestine.

But before entering upon the consideration of the treatment of each of these affections, it seems to me desirable to occupy several lectures with the general therapeutics of disorders of the digestive apparatus. In these lectures I propose to make etiological and hygienic therapeutics march side by side, and shall show you the advantage to be derived from this manner of treating the subject, and the necessity imposed on one who would be successful in the therapeutic management of gastric and intestinal maladies, of well understanding the intricate phenomena of digestion. Hence it is that I have summarized in the chapters pertaining to that subject the most recent acquisitions of modern physiology respecting aliments and alimentation.

"All therapeutics is comprised in etiology," says Professor Chauffard; if there were needed, gentlemen, a confirmation or demonstration of this fact, the treatment of diseases of the stomach, and in particular of dyspepsia, would furnish us such demonstration.

Among the causes which have the most influence in the development of functional troubles of the stomach, we must assign the first place to the bad hygienic conditions in which so many people live, and we shall find in this chapter of hygienic therapeutics both the source of the evil and its remedy; in fact, it will often be sufficient to correct the hygienic errors to see the morbid state disappear. This is then, you perceive, one of the most important points in this part of our practical study, namely, the association of therapeutic etiology and hygiene with a view to more intelligently combating the dyspepsia.

In order the more methodically to set forth the details of this vast chapter which we begin to-day, and which embraces the study of the treatment of the dyspepsias, we will follow, if you please, from the standpoint of hygiene, the old classification of Hallé—that is to say, we will consider in their order the *ingesta*, the *gesta*, the *circumfusa*, the *applicata*, the *excreta*, and the *genitilia*. In each of these divisions we shall see at once the influence of the bad hygienic conditions which determine affections of the stomach; this properly belongs to etiological therapeutics; then we shall examine the advantages which the physician may obtain from hygienic means in the treatment of these diseases; this will constitute the true hygienic therapeutics.

The *ingesta* are the most frequent cause of the functional troubles of the stomach; therefore we shall study at considerable length the influence of food and of alimentation in the development and treatment of dyspepsia. Perhaps these details will seem to you very long and very tiresome, but they are absolutely necessary in order properly to establish the foundation of alimentary hygiene. Recent discoveries respecting the physiology of digestion will find here their proper application, and it is impossible to trace the rules which should direct alimentation, without an accurate knowledge of the modifications which foods undergo in the economy.

This subject is of the utmost importance, gentlemen, therefore I shall be obliged to consider it under several heads, and these are the divisions which I propose: We will begin with the study of foods, and we will divide this study into three parts. In the first part we will examine the *primordial alimentary principles*, that is to say the substances which by their presence characterize the *aliment;* in the second part we will occupy ourselves with foods which contain all the principles necessary for nutrition, that is to say, with the *complete aliment;* in a third part we will study the other foods under the name of *complex aliments.* Finally, gentlemen, when once these facts have been fixed in your minds, we will pass in review the aggregate of these aliments, and the care to be taken in the selection of the diet; or in other words, I shall discuss *alimentation.* Such is the plan which I propose to follow.

We give the name of food to every substance which, when introduced into the economy by the digestive tube, serves for nutrition. But before approaching the study of foods, I must examine with you one of the most difficult points of the question; what are we to understand by the words, nutritive value of an aliment, or *nutribility,* and digestive value, or *digestibility?* This is, I repeat, a very difficult point, and before adopting any conclusion whatever with regard to it, I shall have to state the experiments on which have been based the study of the digestibility of foods. I shall only concern myself with experiments made on man, for the digestive value of foods is so variable with the animal species that it is difficult to compare that which takes place in the dog and in the ruminant with what takes place in the human subject.

Some, as Spallanzani, have introduced into the stomach hollow bulbs, tubes or sacks containing alimentary substances, and then when these bulbs or tubes were expelled, whether by vomiting or by defecation, they have noted the modifications effected in the substances contained in their interior. Thus it was that Stevens * taking advantage of the faculty which a juggler possessed of swallowing foreign bodies and then easily vomiting them up again, was enabled to study the digestibility of alimentary substances. These experiments have little value; they, in fact, deprive the aliments of the muscular action of the stomach, and only the effects of impregnation by the gastric juice are observed; moreover, as these foreign bodies were rendered at indeterminate hours, it was difficult to obtain reliable results from this experimental method.

In other instances physiologists have profited by the ability which some persons have had of vomiting at will, as in the case of Gosse, where the vomiting used to come on after swallowing a mouthful of air; or else observation has been taken of what was going on in the stomach where a communication had been established between that organ and the outer world by means of a permanent fistula.[1]

Such observations Beaumont made on his Canadian, Alexis St. Martin, and still more recently and even more rigorously, Charles Richet on a man named Marcelin, on whom Professor Verneuil had successfully

* Stevens in Milne Edwards' Lessons on Comparative Physiology and Anatomy, vol. v.

practised gastrotomy.[2] You all know the history of this lad, who, in consequence of having accidentally swallowed some caustic potash, had complete obliteration of the œsophagus. Verneuil, by the operation of gastrotomy, enabled him to live, and what was most extraordinary, this boy, thus deprived of his œsophagus and unable to drink, succumbed at last to tuberculosis brought on by abuse of alcoholic liquor, which he was in the habit of introducing into his system by his gastric fistula.

It was by reason of his careful observation of this man that Charles Richet has been able to give to the world that painstaking and masterly study on the gastric juice to which I shall have occasion often to refer while on the subject of digestion.

This method of observation, although superior to those before mentioned in the information which it gives respecting the digestibility of aliments, nevertheless lacks completeness. The digestibility of food cannot, in fact, be judged by the results of the function of any one part of the digestive apparatus; it can only be appreciated by the results of the aggregate of the digestive forces. Hence the data obtained by such experiments as those above mentioned concern only the digestibility of certain aliments in the stomach.

The operation of lavage * of the stomach has likewise been applied to the study of the digestibility of food, and it has enabled Leube, as we shall see farther on, to establish the basis of the diagnosis of the different affections of the stomach; but the same criticism which we have just had occasion to make with reference to the experiments of Beaumont and Richet is applicable to Leube's researches, which, though very important from the point of view of the gastric digestion, give us no information respecting the complete digestion of aliments.†

The experiments of Leube, Lallemand, and those still more recent of Braune, made on individuals affected with artificial anus, whereby these physiologists were enabled to examine at a given moment matters introduced previously into the digestive tube, seem better to fulfil the requirements, and great account should be made of observations obtained in this way.[3] What do these observations teach? They show us that certain substances rapidly traverse the digestive tube, but without undergoing there very appreciable modifications; this is what happens to foods containing vegetable cellulose. Will any one say that these aliments are more digestible than others because they more rapidly traverse the intestines? This would be a mistake. It is, in fact, not enough in order that a certain food may merit the qualification of digestible, that it shall pass quickly from the mouth to the anus; it must be of a character to furnish to the economy the largest possible amount of nutritive elements;

* See Lecture VI.

† Leube, Deutsches Archiv. für Klin. Medicin, xxiii., 1883. p. 1.

therefore while distinguishing the nutritive value from the digestive value of the aliment, I would say with Trousseau: "The most digestible food is that which furnishes to the economy the greatest quantity of reparative elements, while demanding the least possible labor on the part of the digestive forces."*

Do not, however, think, gentlemen, that the most nutritive foods are the most digestible; we shall see, on the contrary, that certain substances, of a very nourishing character, are of slow and laborious digestion. It is necessary to remember, moreover, that there are many causes which come in to modify the precise rules which one would fain establish from the point of view of the digestibility of aliments; it would indeed be difficult to-day to class alimentary matters into foods hard and easy of digestion.

One of the principal obstacles to such classification is the fact of individual predisposition; one person, in fact, digests substances which would infallibly produce in another person an indisposition.

Add to this the power of habit, which enables the digestive tube to accommodate itself to this or that kind of food. If on this point the want of uniformity is very great, there is, on the other hand, another particular on which everybody is agreed, both clinicians and physiologists, namely, the importance of the state of cohesion which the aliment presents; the more feeble this cohesion, in other words, the more finely divided the alimentary bolus, the more rapid is the digestion. There exist in regard to this matter of cohesion very great differences in the same substance, according to the varying aspects under which it is presented, and nothing is more curious than the results which Schiff gives respecting the digestibility of a quantity of albumen, whether taken in a solid and compact mass, or whether administered in a state of fine division. We shall have, moreover, to return to this question when we take up the subject of alimentary powders.[4]

The primordial alimentary principles form three distinct groups. The first is composed of the tissue-making or nitrogenous elements; these are constituted of albuminous or protein substances, to which the name has also been given of quaternary substances, because they consist of a definite number of atoms of oxygen, hydrogen, carbon, and nitrogen. Those of the second group, called respiratory, or hydro-carbonaceous elements, consist of the sugars, the starches, and the fats. The last group comprehends the inorganic substances, such as the salts of potassa, soda, and lime.

We will proceed to study the action of digestion on each of these principles. Let us commence by the digestion of albuminoid matters, which are digested almost exclusively by the gastric juice. But before explain-

* Trousseau, On Alimentary Principles from the point of a View of their Digestibility and Nutritive Value. Thèse de Concours, 1838.

ing the mechanism of this digestion I must briefly recall to your minds the principal data concerning the two factors which are here found together; I refer to the gastric juice on the one hand and to the proteinous compounds on the other.

Since the first labors of Réaumur * on the digestive action of the juices of the stomach, followed by the curious experiments of Spallanzani on digestion, the study of the gastric juice has been completed little by little, and to-day we are able, thanks to recent researches, and especially those of Charles Richet, to have a tolerably complete understanding of this subject.

When we examine this juice we find that it is composed of two essential parts; an acid ingredient and an azotized matter. The nature of this acid has been long discussed, and it is curious to review what has been written by physiologists on this subject since the commencement of this century. Some, as Tiedemann and Gmelin,† think that the acidity is due to acetic acid; others, as Blondlot, attribute it to acid phosphate of lime. These views are now no longer entertained, and to-day the dispute is between lactic and hydrochloric acids. While Berzelius, Chevreul, Leuret and Lassaigne, Lehmann, Smith, and more recently Laborde, think that the free acid in gastric juice is lactic, we see Prout, Children, Schmidt and Maly maintain that it is hydrochloric. The experiments of Charles Richet seem to us to have closed the debate; they demonstrate that this acidity is due in great part to hydrochloric acid, and that the latter presents itself in a state of combination with an azotized substance under the form of chlorhydrate of leucine.[5]

As for the azotized matter contained in the gastric juice—discovered by Eberle in 1834, separated by Schwann in 1836, studied by Wassman and Papenheim, this substance, described under the name of *gasterase*, of *chymosine*, of *pepsin*, has been the subject of numerous researches. But in order that the gastric juice may possess digestive properties, it is necessary that the pepsin shall be associated with its acid, and this union is so essential to digestion, that in the estimation of certain physiologists, Schiff in particular, the acid and the albuminoid matter form a compound body described under the name of *chlorhydro-peptic acid*. Such is, in brief, the constitution of the gastric juice. Let us now take up that of the proteinaceous or albuminoid substance.[6]

The albuminoid principles have a constitution almost uniform, and according to Mulder, the fundamental part of these proteinaceous substances is a body to which he has given the name of *protein;* ‡ some are

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* Mem. de l' Acad. des Sciences, 1752.

† Tiedemann and Gmelin, Experimental Researches on Digestion. Leuret and Lasaigne, Researches on Digestion, 1825.

‡ Protein (πρῶτος, first) is obtained by dissolving an albuminoid matter in an

soluble, others insoluble. Under the influence of heat and of acids they furnish insoluble precipitates which are an isomeric modification of the albuminoid material which has furnished them.

In presence of certain reagents, and in particular of concentrated nitric acid, there is produced a yellow precipitate to which has been given the name of *Xanthoproteic acid.* With acid nitrate of mercury, or the reagent of Millon, you obtain a characteristic orange-red color. The quaternary albuminoid substances are very widely distributed throughout organic matters; they constitute the gelatine of bones, the musculine or myosine of meat, the fibrin of blood, the casein of milk, the albumen of egg, the gluten of bread, etc.*

When you bring them in contact with the surface of the stomach, or when you practise artificial digestion, these albuminoid matters in the presence of gastric juice undergo different modifications; at first precipitation, or incomplete solution of the albuminous substance. Mialhe, who has well studied this problem, called the new body thus formed *caseiform* albumen; it is what is described at the present day under the name of syntonin, which is simply the result of the action of acids on protein matters. Then if the action of the gastric juice continues, there supervenes another modification of these albuminoid matters, which acquire new properties; you obtain what Mialhe has called *albuminose*, and Lehmann, *peptone.*

What differences are there between the albuminoid matters and the peptones? These, namely, that while the peptones preserve the characteristic reactions of albuminoid matters, that is to say, while they furnish with Millon's reagent (nitrous nitrate of mercury), the characteristic orange-red color, and while they give with concentrated nitric acid the yellow precipitate of xanthoproteic acid, they have at the same time lost the property of coagulating under the influence of heat and of acids; moreover, while the albuminoid matters are scarcely susceptible of dialysis, the peptones readily diffuse themselves through animal membranes. Finally, when you inject into the veins of an animal an albuminoid substance not modified, you find it in the urine; it is not so with the peptones, which are absorbed into the economy, and not a trace of which is discoverable in the urine when the quantity injected is not too large. Such are the essential differences which separate the albuminoid matters from the peptones.

But physiological chemistry has gone even farther than this; Meissner has made it the subject of a special study to ascertain the differences

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aqueous solution of potassa, maintained at a temperature of 50° C. On adding to this solution a slight excess of acetic acid, you obtain a gelatinous precipitate, protein. Mulder's analysis is C_{40} H_{30} N_{10} O_{12}. Protein is insoluble in water, alcohol and ether.

* The albuminoid matters properly so called are: the albumen of eggs (of all animals), albumen of the muscular plasma, the serine of serum, vitellin, globulin, hæmoglobin, casein, legumin, the fibrin of blood, the musculine of muscles, the fibrin of glutine and gluten; the coagulated albumens, cooked musculine, osseine, gelatine, etc.

between the various peptones, and has described numerous varieties. He has found successively parapeptone, metapeptone, dyspeptone, and even the peptones *a*, *b*, *c*.[7]

I shall not enter into the description of these different kinds, because the views of Meissner are not universally adopted, and for several years there has been a tendency on the part of physiologists to abandon his conclusions; the opinion now prevalent—and it is the view supported by Henninger, and is the more rational—being, that the peptones differ according to the substance which furnishes them, so that it would be incumbent on us to study successively the fibropeptones, the albumipeptones, the caseipeptones.

If chemistry is incapable of giving by analysis the differences which exist in the atomic constitution of these peptones, the application of polarimetry shows that these substances modify in a different manner polarized light, and this fact warrants us in thinking that each peptone ought to constitute an individuality.[8]

As for the nature of the peptones, there are two notions prevalent. According to the first, these bodies are polymerous forms of protein substances; according to the second view there is a special molecular modification, and Wurtz, Hoppe-Seyler, Henninger regard the peptonization of albuminoid matters as a hydration of those substances. The alimentary principles dissolve more or less rapidly in the gastric juice, and in the order of their digestibility; casein is the most rapidly digested, then comes fibrin, and lastly albumin.[9]

As for their nutritive value, it is well shown by the experiments of Magendie, of Leuret, of Lassaigne, of Tiedemann and Gmelin, of Boecker, of Tegard, of Brown-Séquard, and of Hammond, that taken singly these albuminoid matters cannot support human or animal life, and in order that they may acquire a real nutritive value they must be associated together.[10]

This is, you see, a very important fact, which experiments on animals have demonstrated, and which experimentation on man has well brought to light, in its connection with the question, to-day forgotten, and yet so interesting, of *gelatine soup*, first brought into vogue by Darcet.[11] This broth, in fact, instead of sustaining patients was found to be destitute of all nutritive value.

We shall see, however, that considered under another aspect, this question deserves to be studied anew, and that if certain of these substances taken singly are not nutritive, they may nevertheless favor the secretion of gastric juice, and in this way, if in no other, play an important part in digestion.

Is this rôle of peptonization reserved exclusively for the stomach? No; if the greater part of the digestive process goes on in the presence of the gastric juice, it must still be owned that other liquids secreted by the digestive tube possess the same properties. Claude Bernard, Corvisart, Meissner and Kuhne have in fact shown that the pancreatic juice may transform albuminoid matters into peptone, and the ferment having this property is trypsin; what characterizes the action of this ferment is that it can produce in an alkaline medium the transformation into peptone."[12]

It has been asserted that the intestinal juice possesses the same property, but here the matter is not so clear, for without denying the presence of this juice some have affirmed that it has no digestive properties at all. I am of opinion, from experiments to which I shall return later, that the intestinal juice does have a real digestive property, feeble though it be.

Such is the digestion of albuminoid matters which certain physiologists, and in particular Charles Richet, have considered as a veritable oxidation. We are then led to believe that this particular act of digestion is a sort of fermentation, and that between fermentation, peptonization, and putrefaction, the points of contact are very close. You will see, as we proceed, how useful is this idea of fermentation in the explanation and treatment of certain forms of dyspepsia.

The feculents are the subject of a quite special digestion. It is the salivary glands and the pancreas which furnish the elements of this digestion, which consists in a special action of that body which Dubrunfaut discovered and described under the name of diastase, in the fermented grain of cereals, and which Mialhe found in saliva; it is this body which transforms starch and renders it assimilable.

This transformation is very complex, and has been the subject of investigation by Musculus, O'Sullivan, and especially William Roberts, who have shown us that the molecule of starch undergoes transformation, on the one part, into a particular sugar, maltose, and on the other into a series of dextrines of an inferior type, to which has been given the name of *achro dextrine*."[13]

This action is limited to the salivary glands, but is continued in the digestive tube, and Charles Richet has shown that the acidity of the stomach, instead of weakening the transformation of amylaceous matters, notably favors it. But take note that the gastric juice of itself is incapable of effecting this transformation. It is not so with the secretion of the pancreas, and the remarkable labors of Bouchardat and Sandras have put into clear light the saccharifying action of pancreatic juice."[14]

As for cane sugar, Claude Bernard was the first to show that this sugar, in order to be assimilated, must go through a process of digestion, and it is the intestinal juice that has the curious property of transforming cane sugar into inverted or assimilable sugar. Richet has, however, shown that this property of transformation of cane sugar into inverted sugar may also be attributed to the saliva (Researches on Gastric Juice, p. 116). The presence in great quantity of these saccharine matters in the stomach retards the digestive process in a notable manner."[15]

Finally, fatty matters are neither modified by the gastric juice, nor by the saliva; their digestion is reserved for the pancreatic juice which emulsifies them. I cannot, gentlemen, too earnestly call your attention to the important rôle of the pancreas, which, placed at the termination of the buccal and gastric cavities, has for function to complete the digestive processes which have been going on in these parts of the digestive tube; its secretion modifies not only the albuminoid and feculent matters which have escaped the action of the saliva and gastric juice, but it also possesses the exclusive property of digesting fatty matters. Quite recently Defresne, who has made the study of the pancreatic juice the subject of long researches, has attributed to three distinct ferments found in this liquid, the three properties which I have just mentioned. *Amylopsin* has for function to saccharify starch, *steapsin* favors the breaking up of fat, while *myapsin* dissolves the alimentary albuminoid matters.

As for the saline substances, they are also as useful as the histogenetic and respiratory principles. Liebig a long time ago showed this fact, and the more recent experiments of Forster are in this regard demonstrative. In fact all animals die rapidly when deprived of the saline ingredients of food. Büng has shown also, with respect to the salts of potassa and soda, that while in the meats there exists an equal proportion of the salts of soda and potash, in vegetables, on the contrary, the salts of potash predominate. Hence the importance of adding common salt to a vegetable diet.

Such are, gentlemen, the conditions which preside over the digestion and absorption of the primordial alimentary principles. In the next lecture we shall enter still more deeply into the question, and shall take up the subject of complete and complex aliments.[16]

NOTES TO LECTURE I.

[1] Gosse, of Geneva, put to profit the faculty which he possessed of vomiting at will on swallowing a mouthful of air, in studying the degree of digestibility of aliments. He remarked that the substances which were the most easily digested, *i.e.*, in one or two hours, were: raw eggs, milk, veal, lamb chops, the flesh of young fowls, broiled fresh fish, spinach, asparagus, artichokes, celery, cooked fruits, apples and prunes, gruel, stale bread of wheat or of rye, potatoes and sago.

Other substances were not digested till at the end of four, five, or six hours; such as pork, cooked blood, hard-boiled eggs, oysters, salads, lettuce, chicory, watercresses, cabbages, cauliflowers, carrots, onions—raw or cooked, radishes, pastry.

Other substances, finally, were very difficult of digestion, and remained a long time in the stomach; such were tendinous and aponeurotic parts, fragments of bone, the rind of pork, mushrooms, truffles, fatty matters, nuts, sweet almonds, pistachios, peanuts, cocoanuts, raisins, orange peel, preserved citron, string beans, also the seeds of grapes, of cherries, prunes, apples, pears, etc., as well as the skins of these fruits, all of which Gosse found to be completely indigestible.

Dr. Beaumont having for several years observed the various phases of digestion in a robust Canadian, Alexis St. Martin, who was the subject of fistula of the stomach, consecutive to a gun-shot wound, has given the following table, which indicates the result of his experiments:

ARTICLES OF DIET.	MEAN TIME OF CHYMIFICATION.			
	IN STOMACH.		IN VIALS.	
	PREP.	H. M.	PREP.	H. M.
Flounder, fresh	fried	3 30		
Catfish, fresh	fried	3 30		
Salmon, salted	boiled	4 00	boiled	7 45
Oysters, fresh	raw	2 55	raw, entire	7 30
Oysters, fresh	roasted	3 15		
Oysters, fresh	stewed	3 30	stewed	8 25
Beef, fresh, lean, rare	roasted	3 00	roasted	
Beef, fresh, lean, dry	roasted	3 30	roasted	7 45
Beef, steak	broiled	3 00	masticated	8 15
Beef, steak	broiled		cut fine	8 00
Beef, steak	raw		cut fine	8 15
Beef, with salt only	boiled	2 45		9 30
Beef, with mustard, etc.	boiled	3 30		
Beef, fresh, lean	boiled		masticated	
Beef	boiled		entire p.	9 00
Beef	fried	4 00		12 30
Beef, old, hard, salted	boiled	4 15		
Pork, steak	boiled	3 15		
Pork, fat and lean	roasted	5 15		
Pork, recently salted	boiled	4 30	masticated	6 30
Pork, recently salted	fried	4 15		
Pork, recently salted	broiled	3 15		
Pork, recently salted	raw	3 00	raw	8 30
Pork, recently salted	stewed	3 00		
Mutton, fresh	roasted	3 15		
Mutton, fresh	broiled	3 00	masticated	6 45
Mutton, fresh	broiled		unmasticated	8 30
Mutton, fresh	boiled	3 00		
Veal, fresh	broiled	4 00		
Veal, fresh	fried	4 30		
Fowls, domestic	boiled	4 00	masticated	6 30
Fowls, domestic	roasted	4 00		
Ducks, domesticated	roasted	4 00		
Ducks, wild	roasted	4 30		
Suet, beef, fresh	boiled	5 30	entire p.	12 00
Suet, mutton	boiled	4 30	divided	10 00
Butter	melted	3 30		
Cream			raw	25 30
Cheese, old, strong	raw	3 30	masticated	7 15
Cheese, old, strong			entire p.	18 00
Cheese, new, mild			divided	8 30
Oil, olive			raw	60 00
Soup, beef, vegetable and bread	boiled	4 00		
Soup, marrow bones	boiled	4 15		
Soup, bean	boiled	3 00		
Soup, barley	boiled	1 30		
Soup, mutton	boiled	3 30		
Green corn and beans	boiled	3 45		
Chicken soup	boiled	3 00		
Oyster soup	boiled	3 30		
Hash, meat and vegetable	warmed	2 30		
Sausage, fresh	broiled	3 20		
Heart, animal	fried	4 00	entire p.	13 30
Tendon	boiled	5 30	masticated	12 45

Articles of Diet.	Mean Time of Chymification.			
	In Stomach.		In Vials.	
	Prep.	H. M.	Prep.	H. M.
Tendon			entire p.	24 00
Cartilage	boiled	4 15	masticated	10 00
Cartilage			divided	12 00
Aponeurosis	boiled	3 00	boiled	6 30
Bone, beef's, solid			entire p.	80 00
Bone, hog's, solid			entire p.	80 00
Beans, pod	boiled	2 30		
Bread, wheat, fresh	baked	3 30	masticated	4 30
Bread, corn	baked	3 15		
Cake, corn	baked	3 00		
Cake, sponge	baked	2 30	broken	6 15
Dumpling, apple	boiled	3 00		
Apples, sour, hard	raw	2 50	entire ps.	18 00
Apples, sour, mellow	raw	2 00	masticated.	8 30
Apples, sweet, mellow	raw	1 30	masticated.	6 45
Parsnips	boiled	2 30	mashed.	6 45
Parsnips	boiled		entire p.	13 15
Parsnips	raw		entire p.	18 00
Carrot, orange	boiled	3 15	mashed.	6 45
Carrot, orange			entire p.	12 30
Carrot, orange			raw, do.	17 15
Beets	boiled	3 45		
Turnips, flat	boiled	3 30		
Potatoes, Irish	boiled	3 30	mashed.	8 30
Potatoes, Irish			entire p.	14 00
Potatoes, Irish	roasted	2 30		

[2] Prof. Verneuil made a very interesting communication to the Academy of Medicine concerning this patient, in which he minutely described the brilliant operation which he performed on him. This report will be found in the Bulletin of the Academy, session October 21, 1876. The following is a brief resumé of this case: R. M., aged seventeen years, mason's apprentice; on February 4th swallowed by mistake a solution of caustic potash. This accident determined a very intense inflammation of the œsophagus ending in its complete obliteration. Prof. Verneuil performed gastrotomy on July 26th, and by the month of November the patient was completely cured.

[3] Lallemand, experimenting with individuals possessing an artificial anus, has remarked that vegetable substances sojourn in the stomach one-half as long as animal foods, and that they present themselves much more speedily at the fistulous orifice. This physiologist has noticed that beans, peas, lentils, potatoes in a mashed state, undergo little alteration; raw fruits were not changed; spinach, prunes, etc., rapidly provoked diarrhœa and appeared with their usual aspect and color at the mouth of the fistula. Milk also caused a looseness, and at the end of half an hour to an hour appeared in the form of curds. Roast meats in these individuals sojourned longer than bread and boiled meats.

From his numerous experiments (which we are obliged to omit), Lallemand has arrived at the following conclusions:

1. If it be true that those alimentary substances which are the most *animalized* are those that nourish the most, and *vice-versa*, it does not follow that they are more promptly digested.

2. On the contrary, the work of digestion is the more protracted and

painful the more of nutritive materials the food contains in a given bulk, and *vice-versa*.

3. Foods do not leave the stomach in the order in which they are introduced; it is not those which are the most altered by digestion which are the first to pass the pylorus, but those which, containing more of alimentary materials, are most refractory to the digestive forces.

Braune has still more recently made some observations on a subject possessing an artificial anus in the small intestine, about twenty-four centimeters from the ileo-cæcal valve. According to this observer, the chyme is neutral during fasting and acid during digestion.

The mucous membrane is always alkaline. Fresh meat, ingested by the mouth, takes three hours to appear at the fistula, and at the end of five or six there remain no more traces of it.

'Leven has recently made a number of experiments touching the cohesion of aliments, which go to confirm those of other experimenters. He gives to a dog two ounces of liquid white of egg, and kills the animal an hour afterward; the stomach is found completely empty. Then he gives to another dog an ounce of white of egg hard boiled, and kills him two hours afterward; in the stomach is discovered half an ounce of undigested white of egg. To another animal he administers three ounces of hard boiled white of egg, and after three hours one ounce of this hardened albumen is found in the stomach.*

'Leucine is present normally in the pancreas, spleen, thymus, thyroid, and salivary glands, the liver, kidneys, suprarenal capsules, the brain and the lymphatic glands. It has for formula $C_6H_{13}NO_2$. It crystallizes in white plates. Insoluble in ether, it dissolves in 27 parts of cold water, and more readily still in warm water. It melts at 170° C. Treated to a higher temperature it decomposes into CO_2 and amylamine, $C_6H_{13}NO_2 + CO_2C_5H_{13}N$. It forms combinations with acids and bases. In the stomach leucine is combined with HCl in such a way as to moderate somewhat the action of the acid, and it is probably under this form of combination that the HCl is secreted by the gastric glands.

The formula of chlorhydrate of leucine is HCl, $C_6H_{13}NO_2$. This is the way that Charles Richet proceeds in the search for leucine: "Having prepared an infusion of the rennets of eight calves, I obtained about 800 c.c. of a chlorhydric solution, the addition of hydrochloric acid being necessary to remove the active substances contained in the mucous membrane, and prevent putrefaction. This solution was treated by a sufficient quantity of carbonate of silver recently precipitated, and slightly heated, and then filtered, so as to be completely deprived of hydrochloric acid. On passing through it a current of sulphuretted hydrogen there is precipitated in the state of sulphide the oxide of silver which is formed in part during the reaction. But the sulphide of silver cannot all be separated by filtration; it is necessary to evaporate the supernatant liquid slowly in a vacuum or at a moderate heat. When the liquor is evaporated to a syrupy consistence, it is treated with boiling alcohol till all the ingredients are dissolved. We thus obtain a solution of leucine, of tyrosine, and such like substances, while the peptones, the sulphide of silver, and the mineral salts are insoluble in these conditions. In the alcoholic liquor evaporated, then abandoned to itself, we note the presence of tryosine and especially of leucine."

* Leven, Traité des Maladies de l'Estomac, 1879, p. 33.

"These eight rennets when treated by 2.5 grammes of hydrochloric acid, gave about 5 grammes of leucine. The quantity of tyrosine is more feeble. By separate crystallizations, it is easy to isolate leucine from tyrosine, and obtain both in a sufficient state of purity to determine their chemical and crystallographic characters." (Richet on Gastric Juice, p. 45.)

[6] Roberts has lately found in the gastric juice a coagulative ferment. In his opinion the coagulative property of gastric juice is not due to the pepsin; and according to the experiments of Brucke and of Burger, there are certain pepsins which do not coagulate milk. Neither is this coagulation due to the acidity of the gastric juice, for the same coagulative ferment is found in the pancreatic juice, which is alkaline.

[7] According to Henninger, who operated with 10 per cent. watery solutions of peptone, these peptones are not coagulated by heat, nor by HCl, NO_3, H_2SO_4, or acetic, cold or warm, or after the addition of the neutral salts of alkaline metals. Alcohol precipitates curdy flakes, soluble in water, even after prolonged contact with alcohol. KI gives a reddish brown precipitate; tannin, a voluminous white precipitate; so also picric acid. Biliary salts give no precipitate, but the addition of a drop of acid is followed by an abundant precipitate, soluble in excess of the acid, and reappearing with the addition of water. The solution of the biliary salts, when but little concentrated, gives with acetic acid but slight turbidity; but if you add a solution of peptone, a thick precipitate follows, which is a combination of peptones with biliary acids; alcohol containing a little HCl decomposes it, taking the biliary acids and leaving hydrochlorate of peptone. The reaction of the biliary salts with peptone is very noticeable, but in no way characteristic, for albumen, fibrin, syntonin dissolved in acetic acid behave in the same way. The solution of peptones is stained greenish blue by sulphate of copper without precipitation; if you add excess of potassa the liquid assumes a magnificent deep coloration. The shade is of a beautiful rose color if the quantity of cupric sulph. employed is small, and passes to purple, and finally to blue as the proportion of the cupric salt is greater. The purple color is due to partial absorption of the green rays; the yellow and blue radiations are equally enfeebled.

Liquor cup. potassa and sugar.—The peptones prevent the reduction of Fehling's solution by sugar, or rather, they prevent the precipitation of the cupric oxide produced. (Gelatine, creatine, tyrosin, leucin, glycocoll, etc., do the same).

Acetate of Lead.—No effect.

Mercuric Chloride.—White precipitate, soluble in excess of potassa, little soluble in water or excess of the mercuric chloride solution.

Nitrate of Silver.—No reaction; after the addition of a little ammonia you obtain a white precipitate, soluble in ammonia and in nitric acid.

Anhydrous Acetic Acid.—Dry peptone heated to 80° C., with this reagent (10 grammes desiccated peptone, 25 grammes anhydrous acetic acid), soon becomes liquid, and takes a light brown tint. Certain curious reactions follow, as the heat is maintained, and the mixture is submitted to various chemical reagents, for which we must refer the reader to Henninger's thesis.

Concentrated Nitric Acid.—A yellow color, passing to orange-red after the addition of ammonia (xantho-proteic acid.)

Millon's Test.—A rose color.

The solution of peptone in glacial acetic acid takes a violet-blue color when you add sulphuric acid, and at the same time gives a feeble green fluorescence.

With regard to the formation of peptones in the stomach; according to Meissner, albuminoid matters in that viscus break up into assimilable peptones, and into parapeptone not susceptible of undergoing transformation later by the action of the gastric juice. According to Mulder and Brake, parapeptone may ultimately undergo conversion into peptone. Schiff denies this, and adds that if, after having isolated the parapeptone, you submit it to artificial digestion, you cannot succeed in transforming it into peptone; but that, on the contrary, it becomes less and less soluble, and resembles more and more dyspeptone.

Metapeptone is precipitated by concentrated mineral acids. You will find it in great quantity in the matters vomited by infants, and it is produced by the digestion of casein. By the prolonged action of pepsin, it is transformed into peptone.

Dyspeptone is the insoluble residue which results from the prolonged action of gastric juice on casein; it is insoluble in water and alcohol, and is no longer modified by pepsin. When you extract from the products of stomach digestion parapeptone, metapeptone, and dyspeptone, there still remain, as Meissner observes, the three peptones, *a*, *b*, *c*.

The peptone *a* is precipitated by ferrocyanide of potassium after the addition of a little acetic acid; it is also precipitated by concentrated nitric acid.

The peptone *b* is precipitated by ferrocyanide of potassium and acetic acid, but not precipitated by concentrated nitric acid.

The peptone *c* is not precipitated by either nitric acid or ferrocyanide of potassium. This peptone alone is regarded by Schiff as the definitive product of digestion.

The peptones *a*, *b* and *c* are soluble in water and dilute acids.

[1]The peptones are lævogyrous, and according to the observations of Corvisart, the deviation of 1 degree of the saccharimeter of Soleil corresponds to 80 milligrammes of fibrine peptone, 100 milligrammes of myosine peptone, 104 milligrammes of gelatine peptone, 140 of albumin peptone dissolved in 100 cub. cent. of water.

According to Henninger, casein peptone possesses a rotatory power much more elevated than fibrin peptone.

Henniger considers also as too great, the difference between the rotatory power of albumin-peptone and that of fibrin-peptone, indicated by Corvisart.

[2]According to Mialhe the peptones are isomeric modifications of albuminoid substances, Adamkiewick, on his part, maintains that they are albuminoid matters deprived of mineral salts.

Herth and Lehmann have combated this view, and have affirmed that the peptones are "polymeres" of albuminous matters.

This view is not accepted by all the chemists; Wurtz and Hoppe Seyler claim that the peptones are formed by a hydration of albuminoid matters.

Henninger has studied the action of dehydrating substances on fibrin-peptone, and has thus obtained a body which resembles syntonine freed of its acid by dialysis; hence, according to this chemist, the peptones result from a fixation of water by the albuminoid matters; and the peptones may hence be compared with the uræmic acids, such as alloxanic, oxaluric, etc., which result from the action of water on the ureides.*

[10] Hammond, after having subjected himself to an alimentation exclusively of albumin, found: 1, that there was no fall of bodily heat; 2, that he became emaciated; 3, that the quantity of albumin increased; 4, that the proportion of azotized substances augmented in the urine. After ten days of this exclusive alimentation he was obliged to leave off; diarrhœa, abdominal pains, and cephalalgia having acquired a great intensity. During ten other days he ate nothing but starch, and he still suffered cruelly from pyrosis and from headache, and the loss in weight was yet greater than under a diet of albumin.*

[11] The idea of Papin in 1681, of Changeux in 1775, of Proust in 1791, of employing for food gelatine extracted from bones, was taken up again by Darcet, in 1810, who devised a way of preparing soups from gelatine extracted from bones by steam.

There was at once a great furor for this new aliment, and a gelatine factory was established at Gros-Caillon, and works of the same kind were instituted at Paris, at Lisle, at Lyons, at Strasbourg, in Russia, in Poland, in Holland, in Mexico, and in New Orleans.

At Paris, from the seventh of October, 1829, to 1840, the apparatus of the Hospital St. Louis furnished 1,463,950 litres of gelatine soup, and 7,240 kilogrammes of fat, and these products served for the preparation of 3,456,307 alimentary gelatinous rations. During this eleven years there were (including sick, convalescents, employees, and paupers), 94,542 persons fed on this gelatine diet. In the drug shops and groceries gelatine converted into thin flakes or tablets was a common article of trade for culinary preparations.

Complaints, however, were made of this diet, for patients subjected to it did badly; the experiments of Donné, of Magendie, of Lecœur, etc., came to throw discredit on the value of Darcet's preparation; a commission was nominated by the Academy of Sciences, and its conclusions were not favorable.

It is true that other commissions, such as the one nominated by the Academy of Paris, in 1814, had admitted that gelatine soup prepared by the process of Darcet was quite as agreeable as the ordinary *bouillon* of the hospitals. Despite all that, despite its ardent defenders, Girardin, Arago, Balzac, etc., the "*bouillon à la gelatine*" was almost completely discarded from hospital and private use. There are the conclusions of the so-called *Gelatine Commission:*

1. Dogs allow themselves to die of hunger by the side of their gelatine food, after having partaken of it or not, during the first few days.

2. If instead of this insipid gelatine these animals were given that agreeable *jelly* which the pork butchers prepare from a decoction of the different parts of the hog, and the giblets of fowls, the dogs eat it with great relish the first few days, then they will touch it no more, and they die about the twentieth day, almost as soon as if they had not eaten.

3. If you associate the gelatine in notable quantity with a small pro-

* Henniger, On the Nature of the Peptones, 1878, p. 57.

† Hammond, Researches on the Nutritive Value of Albumin, Starch, and Gum, employed as an Exclusive Aliment, Trans. Am. Med. Assoc., 1857.

portion of bread, or of meat, or of both, the animals live longer, but they grow lean, and they perish about the sixtieth or eightieth day.

4. Finally if you experiment with the broth of meat alone and that which results from a mixture of a little quantity of meat and an equivalent of gelatine, you notice that the dogs which speedily became lean with gelatine soup, recover their plump condition with that made from meat.*

"[12] William Roberts has studied the comparative action of pepsin and of trypsin on albuminoid matters, and has pointed out this interesting fact, that pepsin attacks much more rapidly than trypsin, the albumin of egg, but that with respect to milk, the digestion is much more complete with trypsin than with pepsin.†

"[13] William Roberts, who has investigated with great care the digestion of feculent matters, has shown, in accordance with the experiments of Musculus, of O'Sullivan, of H. F. Brown, and J. Heron, that under the influence of diastase the supposed breaking up of the starch molecule $(C_{18}H_{30}O_{15})$, into one molecule of dextrine and one of grape sugar, is not strictly accurate, and that we ought to consider this molecule as constituted by the reunion of a great number of other molecules, and that the final reaction should be represented by the following formula.

$$\underset{\text{Soluble starch.}}{10\,(C_{12}H_{20}O_{10})} + \underset{\text{Water.}}{8\,(H_2O)} = \underset{\text{Maltose.}}{8\,(C_{12}H_{22}O_{11})} + \underset{\text{Achrodextrine.}}{3\,(C_{12}H_{22}O_{10})}$$ ‡

"[14] Leven maintains that gastric juice changes starch into dextrine, but cannot transform the latter into glucose. To demonstrate this, he turns some starch into a liquid in which has been macerated the mucous membrane of the stomach of an animal, and immediately the starch has lost its property of becoming blue by tincture of iodine. This change, he says, is due to the pepsine and not to the acid, but the modification of the starch stops there, for the liquid thus obtained cannot reduce Barreswill's solution §

"[15] Cane sugar, or saccharose, which is obtained from the sugar cane, maple, beet, undergoes in the living plant the action of a ferment which transforms it into inverted sugar. The intestinal juice has the same property, and acts as a ferment, transforming cane sugar into inverted sugar, as the following formula shows:

$$\underset{\text{Saccharose.}}{C_{12}H_{22}O_{11}} + \underset{\text{Water.}}{2\,H_2O} = \underset{\text{Dextrose.}}{C_{12}H_{24}O_{12}} + \underset{\text{Laevulose.}}{C_{12}H_{24}O_{12}}$$ ‖

* (Papin, A new way of Softening Bones and Dissolving out their Nutritive Ingredients, Paris, 1682. Changeux, On the Extraction of Gelatine from Bones, 1775. Proust, A new way of Improving the Diet of Soldiers, 1791. Darcet, Memoir on a new means of Extracting the Gelatinous Substance from Bones, Paris, 1829. Girardin, Report on the Employ of Bone Gelatine as a part of the Alimentary Régime, Rouen, 1831. Donné, Experiments on the Properties of Gelatine, 1841. Magendie, Report in the name of the Gelatine Commission, 1841. Lecœur, Experiments on the Effects of he Gelatinous Solution in the Hôtel Dieu, 1844. Bernard, Cours de Phys., 1848.)

† William Roberts, On the Digestive Ferments, London, 1881.

‡ O'Sullivan, Jour. Chem. Society, 1872, 1876. F. H. Brown and J. Heron, Jour. Chem. Society, 1879. William Roberts, On the Digestive Ferments.

§ Leven, Traité des maladies de l'Estomac.

‖ Claude Bernard, Leçons sur les phénomènes de la vie, t. ii., p. 36, Paris, 1879.

[16] Numerous experiments of Kemmerich, Liebig, Voit, Forster, Bischoff, etc., have shown the necessity and importance of salts in diet. According to Kemmerick the nutritious effect of meat broth is due to the salts of potash which it contains, and the residues of the meat, without these saline elements, cannot sustain animals nourished on them.

Bischoff has seen a dog fed on bread alone have an attack of acute mania, then, at the end of a little time paralysis showed itself in the hind limbs. If the experiment were continued, the dog would inevitably succumb, while it would regain its health on having its proper nourishment given to it again.

Forster has given pigeons, mice and dogs food very poor in salts, and has remarked that the mice lived 20 to 23 days, the pigeons 13 to 29 days; the dogs 26 to 36 days. The experiments of Boussingault on bulls have also shown the importance of salts and their utility in alimentation.

According to Barbier, a man ought to eat every day in one shape or another from half an ounce to an ounce of common salt. When a man cannot from any cause obtain the necessary quantity of salt, he suffers the same physical ailments as the animals, he falls into a state of languor and enfeeblement, and presents at the end of a certain time, all the symptoms of the most pronounced anæmia from diminution in the production of globules and albumin in the blood.

LECTURE II.

COMPLETE AND COMPLEX ALIMENTS.

SUMMARY.—Complete Aliments—Milk, its Composition—Digestion of Milk—Milk Diet—Whey, its Composition—The Whey Cure, its Advantages and Disadvantages—Koumiss, its Composition—Eggs—Complex Aliments, their division—Meats, their division—Digestion of Meats—Nutritive value of Meats—Varieties—Azymous and Metazymous Aliments—Comparison between the flesh of Mammals, of Fish, of Crustaceans and of Mollusks.

GENTLEMEN: In the preceding lecture we have studied the digestion of the immediate alimentary principles; these principles taken singly cannot serve for nutrition, and do not become really aliments, except on condition of being associated together. When you find them combined in suitable proportions in the same alimentary substance, you can say that you have a complete aliment; when one or more, on the contrary, predominate, or are lacking, you have a complex aliment. It is the study of these complete and complex foods that I am about to undertake with you to-day, from the special point of view of the etiological and hygienic therapeutics of affections of the stomach.

The truly complete aliments are few, and we can really give this name only to two substances, milk and eggs. Milk in fact contains albuminous matters, caseine, lacto-protein and albumen; fatty matters—butter; a saccharine matter—lactose, or sugar of milk; and certain saline principles, phosphates and chlorides. We find here, then, as you see, all the immediate principles which I have described in the previous lecture.

I shall not in this place dwell on the chemical and comparative study of milk, but when I come to speak of the dyspepsia of new born babes, I shall return to this point at some length, and shall then set forth the differences which milk presents according to its source. I intend just now to occupy your time only with the consideration of milk in general, and its employment in the adult.[1]

These are the changes that milk undergoes in the presence of gastric juice: First of all it coagulates from the action of the gastric juice; the insoluble casein which results is transformed, under the influence of pepsin, into a soluble pepto-casein; then the gastric juice acting still further as a ferment on the sugar of milk or lactose, the milk ferments and lactic acid is formed.

Charles Richet has studied with care this special action of digestion on milk, and has demonstrated two facts that are very important from a therapeutical point of view. The first fact is that milk is, so to speak, the regulator of the acidity of the gastric juice; that is to say, that while a little quantity of gastric juice may very rapidly induce the lactic fermentation in a great quantity of milk, a very small quantity of milk in presence of a great quantity of gastric juice, diminishes or attenuates the acidity of the latter. We shall see later the utility from a therapeutical stand-point of this regulating property. The second important fact is that lactose when alone in the presence of gastric juice does not ferment; it is in fact necessary that there be in the mixture a certain quantity of casein in order that the lactic fermentation may take place.

The digestion of milk is the speediest of all digestions; it is the aliment which the most rapidly penetrates the economy, while demanding the least possible digestive labor. As for its nutritive value, this is not at all doubtful; the sole aliment of the infant during the first months after birth, milk furnishes it the elements of rapid growth; in the adult it may, when employed alone, likewise suffice for alimentation; and you will often observe that certain patients subjected to a rigorous milk diet, obtain by this regimen a sufficient nutrition.

Milk is an admirable medicament in certain forms of stomach affections; it is even, as you will see, almost the only treatment of catarrh and of ulcer of this organ. When we come to treat of these disorders I will show you by facts the utility of this therapeutic means.

What I desire to establish now is the manner in which you should institute the milk regimen. When you have occasion to order a milk diet, you will take care generally to prescribe milk which is raw and uncooked; in fact the nearer you come to the living milk, that is to say milk just as it comes from the udder, the more favorable are the conditions for the absorption of this aliment. Boiling causes the milk to lose, in coagulating, certain albuminous principles, and diminishes, within narrow limits, it is true, the digestibility and nutritiveness of this liquid. You will employ, then, in most cases raw milk, and order one, two, or three quarts a day to be taken. Add to this regimen milk porridge, and you will thus have instituted what has been designated under the name of milk diet.

To cause milk to be tolerated by the stomach, and to favor its digestibility, especially in cases of acid or irritative dyspepsia, you will do well to associate with the milk certain alkaline principles which shall contribute by their presence to moderate the acidity of the gastric juice. Ordinarily with each quart of milk, I order a tumbler of Vichy, St. Jean or Vals water; you can also medicate each cup of milk with a tablespoonful of these mineral waters.

One of the inconveniences of the milk diet results, not from the aliment by itself, but from the insurmountable disgust which its prolonged use causes in certain patients. To overcome this repugnance, it has been proposed to aromatize this liquid with different essences, such as anise, vanilla, etc. These means may be more or less successful; nevertheless, as a general rule, it will not do to prolong the milk regimen against the will of the patient, for as soon as the disgust manifests itself, in spite of all you can do, the patient will refuse to continue the milk, however necessary it may be for his restoration.

Another preparation of milk which also gives excellent results in affections of the stomach is whey. You will observe its good effects in certain atonic dyspepsias, in stomachs fatigued by excesses of the table, and in certain hypochondriases of gastric form, which Bosquillon has described under the name of hypochondriac dyspepsia.[2]

Whey is milk minus its fatty matter and its casein; it contains then the lactose and the salts of the milk, as well as the protein matters which have not been precipitated by the rennet or the acid which has been used in its preparation. But, as Charles Richet has remarked, in order that this nutrient beverage may be digestible, it is necessary that the coagulation and precipitation of the casein shall not be complete, for if the whey were completely deprived of casein, it would become quite indigestible, by reason of the absence of fermentation of the saccharine matter. In certain cases we see whey badly supported; this, you may be sure, results less from individual predisposition than from a faulty preparation of the whey, which does not contain enough casein to induce fermentation, this fermentation being absolutely necessary to supply to the digestive tube an acid necessary to digestion, namely lactic acid.

Carrière, Aran, and Labat have shown how the whey cure establishments are conducted, and to-day in Switzerland, in Tyrol, and in Hungary, you will see numerous stations of this kind. It is principally in the canton of Appenzell, at Weisbad; in the Bernese Oberland, at Interlaken; in Tyrol at Ischl, that are found the best known establishments where this kind of treatment is practised, which consists in taking in the morning, fasting, a small cupful (about a gill) of whey, and a quarter of an hour afterward, the same quantity. The patient is made gradually to increase the amount ingested without at the same time carrying it too far, in which event vomiting and colic would be experienced.[3]

As Aran has judiciously remarked, in this treatment the aliment plays only a secondary part, and in estimating the favorable results obtained in gastric affections, due credit should be given to the open air, to exercise, and to the numerous excursions (on foot and in carriage) which sojourners in these regions of mountains undertake.

By the side of whey, there is another of the milk preparations which also has an important rôle in the treatment of gastric disorders; I refer to koumiss, or fermented milk.[4]

There are, you know, on the plains bordering on the Caspian Sea, certain Tartar and Kirghizes tribes, which prepare this fermented beverage from mare's milk, and it is to the tents of these people that the rich inhabitants of St. Petersburg and Moscow are wont to repair to seek cure from pulmonary complaints. In France it is as a result of the labors of Landowski, that attention has been so generally called to this question of koumiss, and we are able to-day to give to our patients, not exactly the true koumiss made from mare's milk, but a koumiss from cow's milk which has undergone the same fermentation, and possesses similar therapeutic properties.

The name Kefir is given to this fermented milk of the cow. This Kefir is to-day very much in use in Russia, and is prepared by means of a special kind of ferment, which is found chiefly in Caucasus, and goes by the name of *Kefir grains.*

This fermented milk, which you have often seen employed in our hospital wards, is a whitish sparkling liquid of a tartish and quite pronounced buttery odor, and has been prescribed under the felicitous name of milk of champagne. Like the wine of that name, it contains alcohol and carbonic acid, and besides, casein, sugar of milk, and lactic acid. This spirituous beverage quite speedily causes intoxication, and is medicinally a powerful tonic, which has a special use, as you will see, in enabling us, in the case of an inebriate affected with catarrh of the stomach, to institute a milk diet treatment which does not at the same time abruptly deprive the patient of alcohol, a deprivation which, as you know, may in certain cases determine grave consequences. It is, in a word, a useful intermediary between the habitual alimentation of the drunkard, and an exclusively milk diet. Unfortunately, the peculiar taste of koumiss is unpleasant to certain patients, and it is sometimes impossible to effect its administration by reason of this disrelish. The dose to administer varies, according to the strength of the patient, from one to four glasses; but it is necessary to bear in mind that in persons that are feeble, this beverage, which contains considerable alcohol, may determine a brief intoxication.

It has also been proposed that milk shall be made use of to introduce certain substances into the stomach, and medicinal milks and wheys have been fabricated. These are particularly appropriate for the treatment of affections other than those of the stomach, and I shall not treat of them here.[5]

Eggs constitute, like milk, a complete aliment; they contain, in fact, azotized matters (albumin, vitelline, yellow coloring matter, extract of meat), fatty substances (margarine and oleine), and salts.[6]

They also constitute an aliment often well supported, and of easy digestibility; but we ought to note here the marked influence which cooking exercises on this digestibility; while, in fact, soft boiled eggs are rapidly peptonized, eggs hard cooked are of slow peptonization.

The complex aliments are very numerous, and we will, if you please, In order to take a methodical survey of them, divide them into two great groups; solid aliments and liquid aliments; the first having an origin which enables us to establish two sub-divisions, solid aliments of (*a*) animal and (*b*) of vegetable origin.

The first are constituted by the flesh of mammals, birds, fishes, and crustaceans.

Meats are digested almost exclusively in the stomach. It is interesting to know how the peptonization of this azotized aliment is effected. Schiff, and more recently Charles Richet, have studied this digestive process: they have shown that when you examine attentively what becomes of morsels of muscular fibres introduced into the stomach of animals or of men, the subjects of gastric fistula, you observe a dissociation of the muscular mass, then imbibition with gastric juices, which modify the cohesion of the muscle, reducing the latter to the state of muscular fibrillæ; and you see the sarcolemma broken in places, allowing the gastric juice to penetrate into the interior of the fibril and destroy the myolemma, breaking it up into little fragments, which then more readily undergo the action of this liquid. Moreover, while the longitudinal striation of the muscle disappears, the transverse striation, which, you know, characterizes the muscular fibres of animal life, and which is described under the name of Bowman's striæ, is more pronounced; then at the end of a certain time, all the solid muscular mass is peptonized and transformed into a liquid pulp, which penetrates the economy in the state of peptone.

Leven has had much to say on the digestion of meats by the stomach, and he has made numerous experiments on which he has based his theory, which accords to the stomach only a mechanical rôle; according to him the peptonization of meats is not effected in this organ, but rather in the intestine. In the stomach there is nothing but simple impregnation by the gastric juice.

When you read the experiments that Leven has made in reference to this subject, you see that they are far from giving support to the exclusive view which he maintains; they seem only to demonstrate one thing: namely, that in the dog, when once the peptones are formed, they pass rapidly into the intestines without sojourning in the stomach.'

What do we in fact see in these researches? This, namely, that when one administers 200 grammes of meat to a dog while fasting, the gastric juice, at first hardly appreciable in the first hour, becomes very abundant in the second and third; then the alimentary mass is reduced to pulp, and it is in this state that, impelled by the muscular fibres of the stomach, it penetrates the intestines. But this transformation of the meat thus reduced to fine granulations, is not a purely mechanical but rather an exclusively chemical act. In short, these facts come to the support of all that we know thus far relative to stomach digestion, namely, that meats, to be digested, have need of a double action, mechanical and chemical, produced in the stomach.

Nevertheless the tendinous matters and the fats do not undergo the action of the gastric digestion, and remain unattacked by the gastric juice. We know, moreover, that these fatty substances find in the first part of the intestinal canal a liquid adapted to their digestion, but it is not so with the cartilaginous and fibrous substances, which resist the different digestive fluids. The epithelial tissues, especially, present the greatest resistance to the action of these juices, and it is even owing to these epithelial substances, which constitute in certain entozoa a membrane described under the name of *chitinous* membrane, that these latter are enabled to live in the gastric juice without undergoing digestion. Such is, in general, the action of gastric juice on the meats; but the digestibility of these aliments depends on a number of circumstances. The age and the kind of meat and its mode of preparation have a great influence.

From the point of view of varieties, one may distinguish the meats of mammals, of birds, of fishes, of mollusks, and of crustaceans. In the group of mammals we have our ordinary meats, beef, mutton, pork, etc.*

If we are to judge from the experiments of Beaumont, and from ordinary experience, the most digestible meat is mutton, then beef, and lastly pork. But the age of the animal has, as we have said, a notable influence on the digestibility; veal, for instance, is more digestible than beef, and lamb than mutton. It is easy to understand that the more ready disintegration of these meats, due to their young age and lessened cohesion, renders peptonization more prompt. I speak, be it understood, of digestibility, and not of nutritive value, for in the latter case the order

* Proust. in his Treatise on Hygiene, gives the following table (borrowed from Gautier), which indicates the composition of the different meats. Thus, 100 parts of the *lean* of the following meats, deprived of their tendinous portions, contain:

Names of meats.	Soluble albumen and Hæmatine.	Musculine and like principles.	Matters gelatinizing by cooking.	Fatty matters.	Extractives.	Creatine.	Ashes.	Water.	Authors.
Beef........	2.20	15.80	1.90	2.93				77.50	Berzelius.
	2.25	15.21	3.21	2.87	1.39	0.07	1.60	73.39	Moleschott.
Veal........	2.27	14.36	5.01	2.56	1.27	....	0.77	73.73	"
Goat's meat.	2.10	16.98	0.50	1.90	2.52	....	1.12	75.17	"
Pork	1.63	15.50	4.08	5.73	1.29	....	1.11	70.66	"
Mutton	2.17	15.25	3.16	1.60	0.09	3.72	1.14	72.87	"
Poultry.....	3.03	16.50	....	0.94	0.32	1.42	1.37	76.22	V. Bibra.
Frog's meat.	1.86	11.77	2.48	3.46	....	0.10	....	80.33	Moleschott.
Salmon.....	4.34	16.96		1.78	....	4.79	1.26	76.87	Payen.
Carp	2.93	10.21	2.02	1.45	....	2.84	2.00	78.54	"
Sole	13.71	Nitrogenous matters		3.498	1.09	....	1.33	79.97	"
Mackerel ...	24.867	"	"	3.748	....	6.76	1.85	68.27	"
Gudgeon ...	20.435	"	"	2.780	....	2.676	3.44	76.89	"
Eel	19.063	"	"	2.000	....	23.86	0.773	62.07	"

would be reversed; it is in fact the adult animals which give the most nutritious meats.

Among the birds we must distinguish the common fowl and the wild fowl, and from the point of view of digestibility, the latter presents special conditions, to which Professor Gubler has called attention. These birds of game, you know, undergo a certain degree of putrefaction, and generally are served on our tables a little "high." This putrefaction is a sort of fermentation which resembles in certain points peptonization, and on this very account favors stomach digestion. These aliments, which Gubler has characterized by the happy word *metazymous* aliments, in contradistinction to the *azymous* aliments, bring with them their ferment; the meats which are high (a little tainted), sourcrout, koumiss, sour whey and buttermilk, the spotted cheeses (and such as are old and mouldy), come into this category. So when you have to treat certain feeble stomachs in which the secretion of gastric juice is tardy and deficient, you will order game that is a little high.

As for fish, they are divided into three groups; those with white meat (trout, sole, whiting)—these are certainly the most digestible, but are also the least nourishing; those with yellow meat (salmon), are more slowly digested but contain more of nutritive principles; lastly, those with fat meat (the mackerel and eel), are very nourishing but of laborious digestion, because they require digestion in the intestines.[8]

Moreover, Prof. Almen, of Upsal, has recently published a very complete analysis of the flesh of different fishes, fresh, cured, and in the dried state, as compared with the flesh of beef. [See next page.]

Crustaceans and Mollusks are also much in use as articles of diet. I shall only allude to oysters, which are rapidly absorbed and constitute a useful aliment in certain affections of the stomach.[9]

Do not think that the composition of these various kinds of meat is widely different. Compare, for instance, the analyses furnished by Schutz, Payen, Gautier and Almen, and you will see that between the flesh of the carp, of beef and of the oyster, there are great similarities of composition.[10]

The mode of preparation of these divers aliments has a great deal to do with their digestive and nutritive properties. In order not to devote too much space to a consideration of this question, I shall here give particular attention to the meats only. Ought these to be eaten raw, roasted or boiled? But this is a question which, in order to be treated satisfactorily, requires certain details which I will defer till the next lecture.

PROFESSOR ALMEN'S TABLE.

SUBSTANCES.	FRESH FISH AND FLESH OF BEEF.									SALT FISH.					DRIED FISH.		
	Eel. Muræna anguilla.	Mackerel. Scomber scombrus.	Salmon. Salmo salar.	Herring. Clupea harengus.	Beef. Bos taurus.	Flat fish. Pleuro-nectes platessa.	Perch. Perca pluviatalis.	Hake. Gadus callarias.	Pike. Essox lucius.	Herring. Clupea harengus.	Mackerel. Scomber scombrus.	Salmon. Salmo salar.	Cod. Gadus morrhua.	Swedish herring. Clupea harengus, var. membras.	Hake. Gadus virens.	Whiting. Gadus merlangus.	Ling. Gadus molva.
Soluble albumen	1.45	2.74	3.39	2.64	2.13	1.72	3.61	1.78	2.52	1.71	1.28	2.73	0.06	1.00	5.36	3.38	1.86
Insoluble protein matters	8.14	11.84	11.02	11.76	14.29	12.31	9.01	9.33	7.64	11.31	15.68	15.10	16.07	13.82	54.01	50.56	38.60
Gelatinous matters	2.04	1.01	1.50	2.53	1.46	3.17	3.74	2.69	2.82	1.93	1.50	1.41	7.06	1.70	12.35	10.47	13.72
Total of protein matters	11.64	15.59	15.91	16.93	17.88	17.20	16.36	13.80	12.98	14.95	18.46	19.24	23.73	23.76	71.72	64.41	54.18
" extractive matters	1.78	1.87	2.15	2.30	1.95	2.15	1.76	1.58	1.85	5.52	2.74	3.02	3.70	2.82	6.48	9.14	4.90
Fat	32.88	16.41	10.12	5.87	2.28	1.80	0.44	0.20	0.15	21.30	14.10	12.00	0.40	7.05	1.20	0.70	0.57
Salts	0.92	1.70	2.49	1.65	1.13	1.46	1.38	1.44	1.13	15.66	17.27	14.70	19.75	17.93	6.89	8.73	11.82
Water	52.78	74.43	70.33	73.25	76.76	77.39	80.06	82.98	83.89	42.57	48.43	51.04	52.42	55.62	13.71	17.02	29.53
Dry residue	47.22	35.57	29.67	26.75	23.24	21.61	19.94	17.02	16.11	57.43	51.57	48.96	47.58	44.37	86.29	82.98	71.47
Nitrogen (per cent.)	2.10	3.22	3.10	3.01	3.32	3.49	2.89	2.67	2.37	2.92	2.33	3.58	4.57	3.10	12.79	12.17	9.46
Protein substances estimated at	11.24	17.22	16.57	16.90	17.77	17 08	16.48	14.28	12.66	15.62	17.79	19.12	24.43	16.55	68.80	65.00	50.51
Soluble salts	0.26	0.25	0.32	0.89	0.65	0.44	0.57	0.75	0.22	1.43	1.13	0.72	1.42	0.84	3.83	17.00	2.29
Insoluble salts	0.66	1.45	1.17	0.76	0.48	1.02	0.81	0.69	0.61	14.23	15.14	13.98	18.33	17.10	3.06	1.73	9.53
Chlorine	0.01	0.17	0.04	0.07	0.05	0.14	0.06	0.09	0.18	13.65	14.50	15.81	18.00	16.24	0.19	0.60	9.08
Estimate for the dried meat. Protein matters	24.65	43.85	53.62	63.29	76.94	76.07	82.04	81.08	80.57	26.03	35.80	39.30	49.88	37.36	83.11	77.62	75.81
Extractive	3.77	5.26	7.25	8.00	3.39	9.51	8.83	9.28	11.48	9.61	5.31	6.17	7.77	6.35	7.51	11.02	6.86
Fat	59.63	46.14	34.11	21.94	9.81	7.96	2.21	1.18	0.93	37.09	27.34	24.51	0.84	15.89	1.39	0.84	0.79
Salts	1.95	4.77	5.02	6.17	4.86	6.46	6.92	8.46	7.02	27.27	31.55	30.02	41.51	40.40	2.99	10.52	16.54
Nitrogen (per ct).	4.46	9.07	10.47	11.26	14.32	14.14	14.53	15.71	14.71	5.09	6.45	7.31	9.62	6.98	14.82	14.67	13.23

NOTES TO LECTURE II.

[1] The mean density of milk is from 1032.2 (minimum) to 1038.8 (maximum). The milk of the human female has an average density of from 1024 to 1030.

In a recent investigation made at the experimental "*crèche*" (nursling department) of the Foundling Hospital, M. Henry Fery has established the following average, from the point of view of the comparative composition of the different kinds of milk.

MEAN COMPOSITION, PER LITRE.

	WOMAN'S.	ASS'S.	COW'S.	GOAT'S.
Density, . .	1033.50	1032.10	1033.40	1033.85
	grammes.	grammes.	grammes.	grammes,
Water, . .	900.10	914.00	910.08	869.52
Dry extract, .	133.40	118.10	123.32	164.34
Butter, . .	43.43	30.10	34.00	60.68
Sugar, . .	76.14	69.30	52.16	48.56
Casein, . .	10.52	12.30	28.12	44.27
Salts, . .	2.14	4.50	6.00	9.10

The following table gives the composition of the ashes from 1000 parts of woman's and cow's milk.

	Woman's,	Cow's.
Chloride of sodium, ...	1.34	0.81
" " potassium, ...	0.41	3.41
Phos. lime, ...	3.95	3.87
" soda, ...	traces	traces
" magnesia, ...	0.27	0.87
" iron	traces	traces
Carbonate soda, ...	"	"
Lactate of soda, ...	"	"
Fluoride of calcium, ...	"	"
Sulphate and silicate of potash, . .	"	"
Total, ...	5.98	8.96

Albumen has sometimes been found to exist normally in milk; it is always present (10 per cent.) in the colostrum and milk of the sow, which does not contain casein. E. Marchand has remarked that when cows are spayed their milk becomes quite rich in albumen. Besides the substances mentioned above, there have been found in milk, gases, such as oxygen, hydrogen, nitrogen, and carbonic; acids, such as lactic, butyric, and silicic, urea, hæmatine, cholesterine and lecithine in woman's milk.

Divers circumstances, moreover, influence the composition of milk; the climate, surroundings, repose, fatigue, alimentation, gestation, the act of milking and disease. During repose the milk is richer in butter; with a generous diet there is more butter, and milk may even be made to acquire different qualities. Moreover when a bitch has been fed exclusively on meat, albumen is seen to appear. According to Lassaigne, before parturition cow's milk contains albumen. Milking has also an influence. In fact at the commencement of milking, milk is less rich in cream and butter. According to Quevenne, it contains at the beginning six per cent. of cream, at the middle 15 per cent.; and at the end 20 per cent.

The composition of milk changes during sickness, hence at this time milk should be rejected. Husson has remarked that the milk of cows affected with phthisis is much richer in phosphates, and Herberger has noted in the milk of a cow affected with hoof disease the presence of carbonate of ammonia. In certain cases, lastly, pus and blood are found.

In fine, various medicinal substances ingested by an animal are found in the milk. This it is which has suggested the idea of giving such milk, thus become medicinal, to sick infants or adults.*

[2] When milk is exposed to the air it coagulates and the coagulum floats in the midst of a greenish yellow liquid (whey) containing the sugar and the salts of the milk. In pharmacy whey is prepared after the following formula of the Codex:

Take of pure cow's milk one quart. Heat to ebullition and add little by little a sufficient quantity of the following solution—

℞.	Acid tartaric	gr. xv.	
	Water	℥ ij.	M.

When the coagulum is well formed, strain off the whey. Put the whey again over the fire, with the addition of the white of one egg beaten up in a little water; bring it anew to the boiling point, pour in a little cold water to settle the froth, and as soon as the liquid becomes clear filter it through paper.

Gay proposes the following speedy means of obtaining whey: Beat up the white of an egg with a little water; add successively a quart of milk, and five or six teaspoonfuls of vinegar, or an equivalent quantity of tartaric acid solution, taking care to agitate well the mixture. Bring to a boiling point, pour in a little water to settle the scum and filter.

In the mountains whey is prepared from fresh milk by means of rennet. The milk is suspended over the fire in large kettles, the rennet is added, and the milk is brought to a boiling point, then skimmed and strained through a cloth, and the whey is put into wooden bowls previously scalded, these bowls are set into larger wooden bowls, the smaller being kept separated from the larger by a stratum of quite warm water; the whey is generally drank when warm; in some stations, however, it is taken cold.

Composition of Whey.—Whey from cow's milk contains about 93 per cent. of water; 1.08 per cent. of albuminoid matters, (albumen and casein); 5 per cent. of sugar of milk; 0.116 of fatty matters; 0.410 per cent. of salts and extractives. The salts consist of chlorides of sodium, and potassium, lime, potassa, magnesia, ferric phosphate, phosphoric and sulphuric

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* Henri Fery, Comparative study of the Milk of Women, Asses, Cows and Goats, Paris, 1884. Payen, Précis historique et pratique des subst. alimentaires, 1865. Michel Levy, Traité de Hygiène. Wurtz, Dict. de Chimie, 1869, t. iii. Husson, Milk, Cream, and Butter, 1878. Proust, Traité d' Hygiène, 1877. Coulier, Dict encyclop. des sciences médicales, 2 series, t. iv.

acids; of these salts KCl largely predominates; of the acids, phosphoric is in much the larger proportion.

[3]According to Dr. Helft, the whey treatment generally requires six or eight weeks at the longest. At the beginning of this treatment, from a gill to a half pint of fresh whey is drank in the morning; then the patient takes a walk in the open air for a quarter of an hour, then drinks another cup of whey. If no intestinal or digestive derangements supervene, the patient will soon get accustomed to drinking four or five tumblerfuls a day.

Some persons cannot tolerate whey; it oppresses the stomach and sometimes provokes vomiting, colic, gastralgia, and slight jaundice. It has been proposed in these cases to "cut" the whey with the mineral (gaseous, alkaline and even ferruginous) waters. In this way it is sometimes better borne. The taste of whey is a little insipid and sometimes is decidedly unpleasant to patients, but they soon get used to it.

During the whey treatment, patients are subjected to a special régime.

According to Carrière, the strong meats, game, veal, and even fish, should be interdicted, and instead, such aliments should be permitted as mutton, poultry, and preferably, the herbaceous vegetables deprived of their fibres, and prepared with milk and sugar or even butter and fat.

To patients very weak and emaciated, a more substantial azotized nourishment should be given. In the case of temperaments characterized by excess of irritability or of erethism, a more bland diet should be prescribed. Such persons may eat to advantage stewed fruits which are of easy digestion. Dr. Helft advises to be chary in the administration of farinaceous and saccharine foods; the quantity of food *per diem* should be exactly regulated; if wines are allowed they should be well diluted with water; and distilled liquors should be forbidden. The order of the meals should be judiciously arranged and exercise should be insisted on.*

[4] Long known in the writing of travellers, and in the treatises of certain physicians, koumiss, or fermented milk, much employed in Russia, did not till recently enter into the therapeutics of France.

Koumiss is a sourish alcoholic beverage, prepared from the milk of mares, asses, reindeers and even cows; that of the three first is preferable.

To make this drink, the Tartars ordinarily choose mares of a medium age, and such as have recently foaled.

These live in herds, and are pastured, when this is possible, in meadows where the kavil grows, a kind of grass which is said to render the milk more savory and more abundant. Dr. Landowski has recently published an interesting treatise on koumiss, and he indicates the following modes of preparation.

Among the Kirghizes and the Baschkirs the milk, freshly drawn, is put into a leather bottle, of conical form, triangular, round at the base, called *saba* by some, and *toursouk* by others; these leather bottles are of horsehide, untanned, but hardened and smoked. Before pouring in the milk, a little old dried koumyss is put in the bottle, to play the part of ferment; this is called *Kora*. The liquid is stirred by means of a rod fixed in the neck of the bottle. After three

* Aran, On the Whey Cure, Bull. de Ther., t. 74, p. 143. Carrière, The Whey Treatment of Disease in Germany and Switzerland, 1860. Labat, The Whey Cure of Diseases, Anal. de la Soc. d'Hydrologie, Paris, 1874. Strauss, Dict. de Med. et de Chir. pratiques, 1874.

days' churning and exposure to a temperature of 20° or 25° C., the koumiss is made. Other tribes prepare koumiss with yeast, and keep it in stone jugs. The liquid thus obtained is bluish white, of tart alcoholic taste, and frothy when bottled. According to the degree of fermentation, three kinds of koumiss are mentioned: 1, a weak kind, of one day's fermentation; 2, a medium kind, two or three days old; 3, a strong kind older and more disagreeable to the taste. By the side of koumiss there is galyzyme, a product of the fermentation of a mixture of asses' and cows' milk. This liquor, resembling koumiss, has been recommended by Dr. Schepp (1865).

Landowski advises not to give koumiss immediately before or after meals.

When patients, and especially women, cannot acquire a liking for this drink, he advises to sweeten it with sugar or with some aromatic syrup, or to give small quantities and frequently. Landowski advises also not to give wine immediately after the koumiss.

The following analysis of koumiss is by Stalhberg of Moscow:

	Koumiss 3 Days Old.	Koumiss 5 Months Old.
Alcohol,	1.65	3.23
Fatty matters,	2.05	1.05
Sugar of milk,	2.20	0.28
Lactic acid,	1.15	2.92
Casein,	1.12	1.12
Salts,	0.28	0.28
CO_2,	0.75	1.86

The Caucasians prepare koumiss with grains of *kefir*. These grains are found in all the Russian pharmacies under the form of yellow or brown fragments. Four large spoonfuls of these bruised grains are placed in a decanter of the capacity of rather more than a quart; then a quart of milk is added. The decanter is left unstopped, at a temperature of 18° to 20° C., for eight or ten hours. The liquid is agitated every hour, then strained and poured into four little bottles, which are not quite filled. The bottles are sealed, and kept at a temperature of from 15° to 20° C. It is the custom to begin by taking two or three glasses of this beverage a day, and the quantity is increased to thirty glasses, taken during the day, a few mouthfuls at a time.

Tuchnisky gives the following table to show the modifications undergone by milk in its conversion into this kind of koumiss, called *Kefir*.

	Fresh Cow's Milk	Ordinary Kefir.
Albumins,	48	38.
Fats,	38.	20.
Sugar of milk,	41.60	20.025
Lactic acid,	0.	9.00
Alcohol,	0.	8.00
Water and salts,	873.	904.975
Density,	1028.	1026.*

* Landowsky. On Koumiss and its Therapeutic rôle, Paris, 1874. Bonneville, On Koumiss, Prog. Med., August, 1874. Labadie Lagrave, On Koumiss and its therapeutic applications, Gaz. Hebd., 1874. Polli, On Koumiss as applied to med-

You will find in our drug stores medicinal wheys containing divers substances which more or less modify their properties; for instance, there is a purgative whey, made by sweetening whey with manna, peach-flower syrup, or by adding a purgative salt. The "aperient whey" is made by adding the juices of certain bitter plants. Weiss's whey contains sudorific and purgative substances; Van-Swieten's has senna, Glauber salt and honey. Lastly, it has even been proposed to make, under the name of whey powder, an artificial whey constituted by a mixture of milk sugar and mannite.*

The quality of eggs varies somewhat—according to the food eaten by the animal; the eggs of certain insects, for instance, have an odor and savor that are disagreeable.

Besides hens' eggs, we occasionally find in the market the eggs of ducks, geese, turkeys, and even bustards.

The mean weight of the hen's egg is from 50 to 60 grammes; the shell 6 grammes; the white 36 grammes; the yolk 18 grammes.

The shell contains an albuminoid matter, and is constituted by carbonates of lime and magnesia, and by phosphate of lime; a membrane of albuminous nature separates the shell from the white. If you compare the quantity of nitrogen, carbon, fat, and water, contained in eggs and in milk, you will find that an egg weighing 50 grammes is equivalent to 100 grammes of cow's milk.

The white is formed of albumin (12 to 13 per cent, according to Payen), contained in loose cells. You find there also traces of carbonate of soda, glucose, and of urea. The yolk has, according to Gobley, the following composition:

Water,		51.486	
Vitelline,		14.760	
Extract of meat,		0.400	
Fatty matters.	Margarine and oleine,	21.304	28.968
	Oleic and margaric acids,	7.226	
	Cholesterine,	0.439	
Phospho-glyceric acid,		1.200	
Chloride of ammonium,		0.034	
Chloride of sodium, of potassium, sulphate of potash,		0.277	
Phosphate of lime and magnesia,		1.022	
Azotized and coloring matters, traces of lactic acid and iron,		0.853	
		100.00	

There is an aliment sometimes employed in France, esteemed especially in Russia, which is prepared from the eggs of certain fishes, especially those of the sturgeon; it is called *caviar*. This, according to Payen, is the composition of *caviar:*

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icine, Milan, 1874. Hasson, Milk, Cream and Butter, 1878. W. Podvysotcki, Kefir, a fermented liquid from cow's milk, Kiev, 1884, 3d Ed. (These are only a few of the bibliographical references that might be cited.)

* Vide Ann. de la Soc. Med. de Montpellier, t. xx., p. 432.

Water,		37.500
Dry substance, 62.50, formed of	Azotized matters,	29.105
	Fatty matters,	16.260
	Organic non-azotized matters,	0.825
	Mineral substances, containing 4.825 of common salt,	9.250
		100.00 *

[7] The operative procedure employed by Leven is as follows: It consists in giving to a fasting dog a certain quantity of meat, and in killing the animal by section of the bulb at an epoch more or less distant from the meal, and in examining the state of the stomach and the aspect of the alimentary bolus. This is a resumé of his experiments:

With 200 grammes of meat the stomach is distended; during the first hour the gastric juice is not secreted, the bolus is still dry, but a great quantity of peptic liquid is accumulated in the glands. During the second hour the gastric juice begins to be secreted, and the surface of the aliment begins to be moistened. During the third hour the aliment is impregnated in its entirety, and reduced to pulp and to granulations; this transformation takes place slowly, and has an average duration of twelve hours for 200 grammes. You never find but an excessively feeble quantity of peptone, and this is never in relation to the quantity of aliment which has been taken.†

[8] According to Payen, the eel, when skinned and deprived of all its uneatable substance, has the following composition:

Water,	62.07
Azotized matters having two parts of nitrogen,	13.00
Fatty matters, representing 63 per cent. of dried matter,	22.86
Mineral substances (ashes),	0.77
Non-azotized matters and loss,	0.30
	99.00

[9] Much use is made of the oyster, the mussel and the lobster, as esculents, therefore we give their analysis according to Payen.

Below is the analysis of oysters:

Water,	80.386
Azotized matters,	14.01
Fatty matters,	1.515
Salts by incineration,	2.605
Non-azotized substances and loss,	1.395

Fresh oysters are of easy digestion, when cooked, however, they are indigestible. Payen had the notion of comparing the total weights of oysters, shells included, with the quantity of esculent substances obtained from them, and he ascertained that a dozen oysters, weighing 1,402

* Gobley, Chemical Researches on the Yolk of Egg, Jour. de pharmacie, 1847.

† Leven, Traité des Maladies de l'Estomac, p. 47.

grammes, will give a nutritive value of 111 grammes, representing about 2 grammes of nitrogen, or (digestibility and nutritive quality being supposed to be equal) a little more than a tenth of the mean daily ration of a man, so that ten dozen of oysters would be required to constitute the daily rations in azotized substances.

The sea mussel, more indigestible than the cooked oyster, has the following composition:

Water,	75.74
Organic azotized substances (containing 1.804 of nitrogen),	11.72
Fatty matters,	2.42
Salts,	2.73
Organic non-azotized substances and loss,	7.29
	100.00

The esculent substance of the lobster has the following composition:

	Meat.	Soft Internal Part.	Eggs.
Water,	76.618	84.315	62.983
Azotized matters,	19.170*	12.140†	21.992‡
Fatty matters,	1.170	1.444	8.234
Mineral salts by incineration,	1.823	1.749	1.998
Non-azotized matters and loss,	2.219	0.354	4.893
	100.000	100.000	100.000

William Roberts has shown that oysters ought to be eaten raw and not cooked, in fact, the little yellowish mass which constitutes in the oyster the most dainty portion, is the liver, which is scarcely anything but a mass of glycogen. This liver contains also during life the digestive ferment which is inherent in it, namely the hepatic diastase. By the simple act of mastication, these two substances are brought in contact, in such a way that the glycogen is immediately digested by its proper diastase, without the intervention of anything else; the raw or partially cooked oyster, then, is digested of itself, but this advantage is lost in cooking, for heat, even of moderate intensity, destroys the ferment associated with glycogen. We may add that alcohol does the same harm as heat, and prevents the action of diastase on glycogen. One should not, then, drink wine with oysters, but rather milk.§

* Nitrogen = 2.92. † N = 1.87. ‡ N = 3 36.

§ Payen, Mémoires sur les matières grasses et les propriétés alimentaires de la chair des différents poissons, Comptes rendus de l'Ac. des sc., 1855). Pasquier, Essai médical sur les huitres, Thèse de Paris, 1818. Sainte-Marie, De l'huître et de son usage comme aliment et comme remède, in Lectures relatives, etc., Lyon, 1829. Allard, Du poisson considéré comme aliment dans les temps anciens et modernes, etc., Thèse de Paris, 1853. Réveillé-Parise, Considérations hyg. et philos. sur les huîtres, Gaz. méd. de Paris, 3e sèr., t. i., 1846. Ozenne (C.-M.-L.), Essai sur les mollusques considérés comme aliments, médicaments et poissons, Thèse de Paris, 1858. Ferrand (E.), Ostréonomie: huîtres toxiques et huîtres

[10] Schutz gives the following analysis of the substance of beef as compared with that of the carp:

	Beef.	Carp.
Fibrine, cellular tissue, nerves, vessels,	15.0	12.0
Albumin,	4.3	5.2
Extract (soluble in alcohol) and salts,	1.3	10.0
Extract obtained by water, and salts,	1.8	1.7
Phosphates,	traces	traces
Fat and loss,	0.1	traces
Water,	77.5	80.1
	100.0	100.0

comestibles diverses, Lyon, 1863. Dulong, Empois. par les moules, Gaz. de santé, 1812. Burrows, An account of two cases of death from eating mussels, London, 1815. Bouchardat, Note sur l'empoisonn. per les moules, Ann. d'hygiène, 1re sér., t. xvii., 1837. Duchesne, Empois. par les moules, Journ. de chimie médicale, 4e série, t. iii., 1857. Heckel, Essai sur la moule commune, Thèse, 1867. Balbaud, Étude sur l'empois. par les moules, Paris, 1870. Dechambre, Dict. encycl. des sc. médicales. Becquerel, Traité d'hygiène, 1877.

William Roberts, Les ferments digestifs, Revue internationale des sciences biologiques, 1881, t. viii., p. 89, 205 et 320.

LECTURE III.

COMPLEX ALIMENTS.

SUMMARY.—Advantages of Roasted Meats—The Appetite—Raw Meats—Their Modes of Administration—Meat Powders—Their Fabrication—Their Modes of Administration—Soup—Peptogenous Substances—Beef Tea—Meat Juice—American Bouillon—Extracts of Meat—Boiled Meat—Aliments of Vegetable Origin—Bread—The Grape Cure—Liquid Aliments—Wines and Alcoholic Liquors—Tea and Coffee—Potable Waters—Natural and Artificial Table Waters—Condiments—Tobacco.

WHICH should be preferred, raw or roasted meats? Roast meats are much better for ordinary diet, and this results not only from the conservation by roasting or broiling of the nutritive qualities of the meat, but also from the development of certain odorous and azotized principles, such as osmazome, which render these meats appetizing. In fact, gentlemen, do not forget that it is not sufficient that a substance should be simply nutritive, it must also gratify the taste.

Numerous experiments on man and on animals have well shown the importance of the taste, sight, and smell in promoting the digestion of aliments; and when, in common parlance, one's mouth is said "to water" at the perception of a kind of food which is palatable, expression is really given to an exact physiological fact. In the case of the Canadian observed by Beaumont, and of Marcelin, the subject of Charles Richet's studies, as well as of animals under experimentation, it was only necessary to place before them an appetizing kind of food, in order that under the influence of that sensation, of multiple origin, in which taste, smell and sight play a complex part, there should be immediately produced a secretion, not only of saliva in the buccal cavity, but also of gastric juice on the surface of the stomach.

When Richet introduced into the stomach of Marcelin an alimentary morsel, it was necessary besides, in order to satisfy his appetite, to present to him, and even make him chew at the same time certain appetizing substances; and yet he had complete obliteration of the œsophagus, and there consequently existed no communication between the buccal cavity and the stomach.

You see, then, how essential it is that by the happy choice of alimentary substances, meats shall be rendered as appetizing as possible. All masters of the art of good living, and Brillat-Savarin at their head, have insisted on this multiple influence of the sight, the taste, and the smell on digestion, an influence which does not stop at those particular senses, and which includes the place where one eats, the company one is with, and the thousand details which constitute the talent of the *cuisinier* and the tact of the host. If I insist, gentlemen, at such length on this point it is in order that we may be able better to pass judgment upon this very interesting question of raw and cooked meats.

Raw meat, introduced into therapeutics by Dr. Weisse,* of St. Petersburg, is now, as you know, largely used in the treatment not only of affections of the lungs, but also of the stomach and digestive tube. It has been claimed on theory, and perhaps with reason, that raw meat is more nutritive and more digestible than cooked meat; but it has been forgotten that due account should be made of the agreeable taste which roast meats afford, and the almost insurmountable disgust caused by raw meat. This very omission, gentlemen, explains why there exist in regard to this matter opinions so different.[1]

However this may be, raw meat renders us great service. Considered by the patient rather as a medicine than as an aliment, it is taken by him when he refuses to submit to an azotized regimen. You will doubtless have numerous occasions to prescribe this meat. Permit me, then, to dwell a little longer on this subject and to point out to you certain preparations which will enable you, at least in part, to obviate the inconveniences arising from the aspect and taste of the raw meat.

Ordinarily beef is the meat which is employed. To avoid an evil which sometimes results from the usage of this kind of meat, viz., the production of the unarmed tænia, Decroix has proposed to make use of horses' flesh, which does not contain the cysticercus of this tænia. Unfortunately the horse is only eaten in the large cities, and notwithstanding the nutritive and digestive value of this meat, which we had an opportunity pretty thoroughly to test during the siege of Paris, its use has not yet become general among us. You will even see certain persons, belonging especially to the inferior classes, refuse absolutely to make use of this aliment.

Yow will then take the fleshy part of beef, freed of its cellular and fatty matters, then after having hashed it as finely as possible, or passed it, as some physicians prefer, through a coarse sieve, you will give it to your patient, in its natural state if you like—and it is worthy of note that the majority thus eat it, with a spoon—or dressed up in different ways. A very eligible preparation is a kind of porridge which Laborde has denominated *medicinal tapioca porridge.* To prepare it, you incorporate with a

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* Andrieu, On the Treatment of the Diarrhœa of Infants, and especially on the Medication by Milk and Raw Meat. Thèse de Paris, 1859. No. 23.

thin and well-flavored porridge of tapioca from one to two ounces of raw beef; you have thus a mixture which resembles by its color tomato soup, and has no disagreeable taste.

Laborde recommends to make this porridge in the following manner: "You begin by preparing a tolerably thick tapioca porridge, and you let it cool sufficiently, so that it shall not exercise on the meat the influence of even a moderate cooking. Then the meat, finely scraped and in the form of a perfect pulp, is suspended in a little cold broth, the mixture having the aspect and consistence of tomato soup. Little by little now the tapioca porridge is poured upon this mixture, care being taken to stir it constantly with a spoon. You obtain in this way a perfectly homogeneous porridge, in which, when it has been properly made, the meat is found so well disguised that no one on eating it would know that it was there unless previously told. We have a habit, says Laborde, of prescribing raw meat in this way, and of serving it to the patient under the name of *medicinal tapioca porridge*, and we charge the person instructed to make it not to divulge the secret to the patient, as far as the addition of the raw meat is concerned. The plan succeeds admirably, and we have seen patients with the most delicate stomachs ask for the porridge as a luxury." (Tribune Médicale, 1875, p. 471.)

You can also, according to Vidal's method, incorporate this meat in a stew with potatoes or spinach, which will disguise the red color which seems to have so much to do with the repugnance which patients manifest to eating this raw meat; you can, finally, if you prefer, make use of the preparation recommended by my colleague, Audhoui, under the name of "*purée of beef*."

This is the way Audhoui prepares his "*beef purée*": "Remove all the fibrous parts from a certain quantity of a fillet of beef; beat the meat with the flat of a knife, then subject it to the action of a blazing fire on a gridiron, turn frequently, and salt. Place this broiled meat on a platter; cut it up into small pieces, and press out the juice by means of a large spoon or mortar pestle. The meat separated from the juice is now to be reduced to pulp by hashing, then by bruising in a mortar. It is then to be wet up with the juice previously pressed out, and the whole passed through a sieve."

You know that for children, Trousseau, who was one of the prominent advocates of this mode of treatment, prescribed, under the name of *conserve of Damas*, a mixture of raw meat and fruit jelly.[1]

You may also, for difficult patients, employ the preparations proposed by Yvon and Laillier.[2]

Lately we have seen vaunted the usage of a mixture of raw meat and whiskey, and in some of our hospitals and asylums this preparation is given. It is in my opinion one of the worst preparations of raw meat; its very appearance is repulsive, and besides, the prolonged use of the spirit associated with it may cause serious gastric disturbances; if, therefore, the mixture be economical, and have the merit of keeping well, it is not a safe aliment to prescribe.

As you are well aware, the ingestion of raw meat may be a cause of tapeworm in the human subject, and such a consequence has quite often followed the use of this aliment, therefore I am of Roger's opinion, who thinks that considering the abuse of raw meat in the dietary of children and adults, it would be well not to prescribe it, except in a case of absolute necessity, and to employ instead of beef or horses' flesh (the latter being rarely obtainable), mutton, which does not contain the cysticercus of the tænia, but rather that of the *cœnurus cerebralis* which has for its exclusive seat the brain of the sheep.

But all these preparations of raw meat tend to-day to disappear in consequence of the introduction into therapeutics of meat powder, which presents all the advantages of raw meat without any of the disadvantages.

To substitute for fresh meat, so liable to alteration, a substance quite as nourishing and capable of being kept any length of time, has long been an object of desire toward which pharmacists and humanitarians have labored. Under the name of *tasajo*, of *pemmican*, of *carne secca*, the natives of South America have from time immemorial made use of meat dried in the sun, and pulverized at the moment when it was required for food. But where this need of meat in a convenient form for keeping is especially felt, is where there is demand for the food supply of collections of men, such as armies, where every soldier is often obliged to carry with him the rations of several days. We need not, then, be surprised to find that the origin of these alimentary powders is traced to the dietary exigencies of the soldier's life. It was Louvais, Chief Minister to Louis XIV., who was the first to apply to army uses the powder of meat, and the process which he indicates for its fabrication, is almost the same as that which we employ to-day.*

In 1856, at the time of the Crimean war, a new trial was made of meat powder for army alimentation, but since then this preparation has been abandoned and it needed the more recent experiments of Debove to call anew attention to this point.

To-day this question of meat powders has not only become a subject of alimentary therapeutics, but also one that greatly concerns the dietary of the soldier, and Kirn has shown in a recent work its fundamental importance and the numerous researches to which it has given rise.[4]

To-day it is by the thousands of kilogrammes that this meat powder is made. I cannot here enter into a description of the divers industrial

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* Vide Colombier's Treatise on Military Hygiéne, 1775. We learn from this treatise that M. Louvais got his hint from an Oriental usage of drying meat in the sun, then pulverizing it. He constructed large copper furnaces for this purpose; these furnaces were large enough to contain eight whole oxen. Louvais' meat powder came into very general use. One ounce boiled in water was sufficient for a meal for four men, and a pound of fresh meat made an ounce of the dried powder.

processes instituted for the fabrication of these powders; I shall only remark that one may readily prepare at home a meat powder which has not perhaps the fineness of that found in commerce, but which is often well accepted by the patient. The process consists in taking boiled beef, hashing it as finely as possible, freeing it of fatty matters, then placing it over a sea-water bath of boiling water, and when once the meat is well dried, pulverizing it in a coffee-mill which has its gearing well tightened.

Whatever may be the mode of preparation, the powders of meat contain about the same quantity of nitrogen, (as Yvon has shown);* a proportion oscillating between 13 and 14 per cent.

CENTESIMAL COMPOSITION.

Origin.		Water.	Mineral Salts.			Dry Extract.	Fatty Matters.	Nitrogen.				Proportion Peptonized.
									Excrementitious Nitrogen.			
			Tota	Chloride of Sodium.	Phosphoric Acid.			Total of Nitrogen.	Total.	Soluble.	Utilized Nitrogen.	
Powder No. 1	Beef......	0.787 to 5.225	4.46	0.440	1.155	10.25	9.30	13.98	0.956	0.187	13.975	73.7
" 2	Beef......	10.242	1.268	0.103	0.270	1.35	3.60	13.60	0.910	0.087	13.513	54.7
" 3	Beef......	8.750	4.528	1.467	0.975	11.75	6.30	14.19	1.050	0.157	14.039	68.0
" 4	Beef......	6.584	7.313	3.666	1.019	17.50	4.10	12.36	8.400	0.163	12.199	57.2
" 5	Horse....	5.432	7.028	3.588	1.275	21.75	4.46	12.69	1.346	0.204	12.492	56.5
" 6	Horse....	6.471	2.866	0.567	0.550	18.00	4.90	13.63	1.283	0.373	13.265	59.2
" 7	Horse....	6.119	3.734	0.146	1.170	6.50	0.14	14.77	1.586	0.280	14.492	75.2
" 8	Horse....	4.471	4.121	0.953	1.305	16.25	4.70	12.68	1.318	0.246	12.436	68.8
" 9	Beef......	8.460	2.530	0.450	0.630	5.75	7.50 to 13.86	13.02	0.851	0.020	13.008	53.0
" 10	Beef......	3.750	4.354	0.464	1.185	10.75	5.58	14.03	0.910	0.163	13.869	68.2
" 11	Horse....	5.990	4.400	0.562	1.230	15.00	5.40	13.36	0.851	0.175	12.187	70.5
" 12	Beef......	8.400	1.131	0.059	0.195	1.66	3.10 to 13.20	13.53	0.758	0.017	13.513	74.9

Raw meat = 76.7.

Moreover, my pupil, Dr. Robin, of Rheims, has shown in the thesis which he wrote under my direction, that peptonization is three times more rapid with meat powders than with raw meat.† And this result is easily explicable when you think of the molecular condition to which the meat powders are reduced, a state of lessened cohesion and fineness of division, which permits ready penetration by the gastric juice. Finally,

* Yvon, On Meat Powders, Bull. de Thérap., Jan. 15, 1881.

† Robin, On Artificial Alimentation with Meat Powders. Thèse de Paris, 1882.

as these meat powders represent five times their weight of fresh meat, you at once see their superiority over the preparations of raw meat.

There is but one drawback connected with these powders, which is their relatively high price, but this can in a measure be obviated by purchasing the American powder, which is quite cheap, or by substituting horse meat for beef in the preparation of meat powder; if you choose to resort to either of these kinds, you can have very good meat powders at the low price of six francs per kilogramme.

You will frequently be called upon to test the value of these powders, which, like all other industrial products, are liable to falsification, or may become spoiled. This latter alteration is one of the obstacles to the general employment of meat powders; hence it is that we see manufacturers doing their utmost to render their products proof against change.[6]

How ought you to order these meat powders to be taken? This is a point of some importance. Formerly we were in the habit of prescribing the powder in mixture with warm broth or beef tea; to-day Debove and myself have found that the best method is to give it cold in the form of milk punch thus prepared: Place in an empty bowl a couple of tablespoonfuls of meat powder, add one or two tablespoonfuls of old rum or Bourbon (or the equivalent of some sweet wine), and half a pint of milk or water, sweetened sufficiently. In the case of patients who cannot bear alcohol in any shape, you can omit the spirit, using instead saccharated vanilla powder in quantities of one or two spoonfuls; this gives a very agreeable taste and flavor to the nutrient mixture.

It has been remarked that the animal taste of the meat powder is often heightened when it is served warm; at the same time exception should be made for chocolate and for the feculent preparation sold under the name of *racahout;* the meat powder may be taken hot or cold in combination with either of these without altering their taste. I shall return to this subject when I come to speak of "Forced Alimentation," and I shall then show you the immense advantages which may be derived from meat powder, which in all circumstances should be substituted for the preparations of raw meat.

There is another meat preparation which has given rise to interesting discussions, namely, "bouillon" or broth. Till quite recently, physicians have been divided into two parties, the one affirming, the other denying, the nutritive properties of this preparation. The experiments of Schiff enable us to decide this question.

This physiologist has in fact shown that the secretion of gastric juice is not unlimited, and that it suffices to give to a dog when fasting a considerable quantity of meat, to observe this secretion arrested under the influence of such alimentary mass in excess. The alimentary matters then constitute a veritable foreign body, and are got rid of by vomiting. It is this state which is known under the name of *indigestion à crapula,* (crapulous indigestion); but in this connection there is a very interesting observation of Schiff's, namely, that it suffices to introduce certain substances into the circulation in order to see immediately the gastric juice secreted anew on the stomachal mucous membrane.[7]

Among these substances dextrine seems to possess this property in the highest degree, and in animals that have been gorged with food, and whose stomachs have ceased to secrete gastric juice, it suffices to introduce a solution of dextrine, whether by intravenous injection or by the rectum, to cause the digestion of this mass of food to go on immediately. It is to these latter substances that Schiff has given the name of *peptogenous*, that is to say, substances which promote the secretion of gastric juice and thereby peptonization.

It is, gentlemen, a significant fact that soups and broths, whatever may be the mode of preparation, whether you follow Begiu's, Liebig's or Duval's method, contain just these peptogenous matters, and the custom, handed down for ages, which sanctions the usage of soup before the principal meal, finds striking support in this discovery of modern physiology. Of little nutritive value by itself, broth aids the digestion of foods by rapidly penetrating the circulation, and supplying the materials necessary for the secretion of gastric juice.[8]

By the side of meat broth belongs another preparation, called by the English *beef-tea*, which has a precisely similar action. To make beef-tea, you cut up into little fragments a piece of beefsteak, and macerate in water whose temperature is gradually raised to near the boiling point. You thus obtain quite a sapid albuminous liquid, possessing manifest peptogenous properties.

It is not quite the same with the preparation called American "bouillon," which is of considerable nutritive value by itself. To prepare this broth, it suffices to place in an iron kettle alternate layers of meat and of vegetables, and to subject the whole, without the addition of much water, to prolonged cooking over a hot waterbath; you thus obtain a liquid which gelatinizes on cooling, and is a true meat jelly.[9]

There has also been much commendation of meat juice got by squeezing slices of meat partly broiled on both sides over the fire. This kind of juice is not as nutritive as one might suppose. I pass in silence all the other pharmaceutical preparations in which meat is said to be dissolved in vehicles more or less complex. In these syrups or wines of beef the meat really loses its nutritive properties and cannot act as an aliment.

This leads me to speak of a product which has had a great popularity in Europe, owing to the reputation of the chemist who gave his patronage to this preparation. I allude to *Liebig's extract*. In regard to this substance, as to beef-tea, numerous discussions have been raised, and contradictory experiments have been invoked. The extract of meat by itself is not nutrient; it is a peptogenous substance which may aid in the secretion of gastric juice, but which furnishes the economy only aliments insufficient for the nutrition. Müller has in fact shown that in animals, extract of meat does not nourish, and Kimmerich has gone even further, he has shown that the animal fed exclusively with this extract, dies sooner than one subjected to a rigorous abstinence.

You will, then, use these extracts with moderation, and as far as possible employ genuine broth, which presents great advantages over these preparations.[10]

In this study of meat broth, we have examined only one of the sides of the question from an alimentary point of view, the liquid product; there remains for consideration the solid part, the meat itself, which may be utilized. The nutritive value of boiled meat is considerable, and almost equal to that of roast meat, nevertheless it is greatly inferior to it in taste, being much less relished; hence it is necessary, in my opinion, as far as possible, especially in hospital practice, to substitute roast for boiled meat in the dietary of patients.

In this respect the English are ahead of us. This is without doubt the nation that consumes the most meat, and is the most particular in regard to the way its meats are cooked. In their hospitals the English discard the use of boiled meat, and prefer those immense "chunks" of roast meat with which you are all acquainted. Here is an example which we in France ought to follow, and instead of boiled meat, the habitual ration, we ought to eat more roast meat.

Finally blood, that "flowing flesh" as Bordeau calls it, has been advised in the treatment of stomach affections, and we see at the present day great numbers of persons resorting to the slaughter houses of our great cities to drink the blood as it comes warm from the slaughtered animals. This repugnant practice has no good scientific warrant, and nothing either in the domain of physiological research or of clinical discovery goes to show that blood is superior as a food or as a medicine to the flesh of animals.[11]

Of late there have been introduced into therapeutics, alimentary powders made with dried blood, and under the name of *hæmopulvine*. Paul Bert and Regnard have given vogue to a preparation of their own. Guerder, moreover, has shown all the advantages derivable from desiccated blood in forced alimentation, and we shall return to this subject, under the head of "gavage."*

We come now to aliments of vegetal origin. Legumes and cereals, along with fruits, constitute the principal aliments of this group.

The cereals occupy the first rank, and, it must be admitted, constitute, like milk and eggs, an almost complete aliment. Wheat, in fact,

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* [See Guerder's articles, reproduced by me, in the Therapeutic Gazette, 1883, p. 452, and 1884, p. 49. Trans.]

contains azotized matters; gluten, albumen, casein and vegetable fibrin; amylaceous matters; starch and dextrine; a saccharine principle, glucose, with fatty matters and mineral matters in greater or less abundance.[12]

Legumes and certain roots have a similar composition, as you may judge by the analysis of Payen, and the differences pertain chiefly to the greater or less quantity of starchy matters and the poorness in azotized substances.

With reference to the digestion of animal food, we have seen that epithelium and its derivatives resist solution in the juices of the alimentary canal; as for vegetables, cellulose possesses the same property, and passes through the digestive tube without alteration. The aliments of vegetal origin are not digested by the gastric juice, but by the saliva and secretion of the pancreas, and if it be true that the digestion of feculents is continued in the stomach, it nevertheless borrows few of the elements therefor from the gastric juice. Hence you will recommend to persons who make use of a vegetable diet, to thoroughly chew their food, in order that the alimentary mass may be well impregnated with saliva.

On this point it is necessary to insist when beans are eaten, or fried potatoes, for if mastication is incomplete, the hulls of the one, the hard coating which forms over the other, will keep the interior of the mass from the action of the saliva, and you will find in the matters vomited or in the fæces these aliments undigested. So when you are consulted by persons who eat rapidly, recommend them to take their legumes in the form of *soups* or stews (thoroughly boiled), as in this state they are more accessible to their proper fluids, the saliva and pancreatic juice.

Apropos of these vegetable foods, I cannot too strongly protest against Leven's opinion that cabbage has a most injurious effect on the mucous membrane of the stomach, an effect resembling that produced by alcohol. It is possible that the dog may digest cabbage badly, but it is certain, on the other hand, that this vegetable, very nourishing, by the way, and of laborious digestion for certain stomachs, is ordinarily well supported, and I cannot refer you to any better examples proving the truth of what I say, than to our peasants, who make boiled cabbage so large a part of their living, and who generally have good stomachs. There is, then, little warrant for Leven's condemnation of this vegetable.[13]

Among the ordinary alimentary preparations, the one most generally in use the world over is undoubtedly bread. Hence great importance is attached to the way in which it is made. Bread possesses a nutritive value dependent on its mode of preparation and the substances which it contains. I cannot here enter into the details of this question, which you will find fully treated in so many popular works. (See especially Graham's Treatise on the Chemistry of Bread Making, London, 1880.) I shall here allude only to two points; first, to a popular opinion which needs to be combated, viz., that the whiter the bread is the less nourishing it is. The analyses of Payen and Violet show that the richness in azotized matters augments with the quality of the bread, and that breads which are the whitest, *i.e.*, those of first quality of flour, are the most nourishing. Again, (and this is the second point to which I wish to call your attention) the crust is more nourishing than the crumb or soft part.[14]

The question has been much discussed whether it is well to add bran to flour in bread-making. You well know that by repeated boltings millers succeed in depriving flour of the bran which it contains, and that meal is thus obtained which is more or less white. From an alimentary point of view the separation of the bran is a good thing; every body seems agreed that in equal weights, bread which contains bran is less nutritious than bread which is freed therefrom, and in the army bran is considered as a useless encumbrance to bread.

This exclusion of bran is perhaps a good thing as respects the dietary of healthy adults, but from a therapeutic point of view, the matter is different; analysis in fact shows that the mineral matters, and in particular the phosphates, are not uniformly distributed throughout the wheat, and that they exist in greatest abundance in the husk. So, when you deprive flour of its bran, you deprive it at the same time of its phosphates and its salts; but these latter have often an important rôle in the alimentation of wet nurses and of children. When I come to treat of the dyspepsia of early life, I shall show you that the only means of introducing phosphates into the economy is to employ those which have already undergone a natural assimilation, and to prescribe bran bread or certain legumes which, like the common bean, contain a great quantity of phosphates.*

I shall pass rapidly by the fruits, and shall only allude, from an alimentary point of view, to the advantages which may be derived from the grape cure. Ripe grapes, of good quality, taken in sufficient quantity, produce good results in certain atonic dyspepsias, and particularly in those accompanied with constipation, as in the gouty dyspepsia, for example.

These are the principal rules to follow: you will direct the patient to eat before his meals a certain quantity of grapes, which he must himself gather from the vines, and they had better be eaten while being gathered; you will, moreover, do well to choose those kinds which make the best wines, and which are the best table grapes. Those should be rejected which have tough skin and pulp, and contain but little sugar. The quantity to be eaten varies with each individual; when a sense of satiety is felt or of stomach fulness, the patient must stop, or even a little before this sensation.

This kind of treatment promotes relaxation of the bowels and does not

* In America there is a popular belief that bran bread will preserve the teeth. Kulp cites a number of instances where, as he affirms, the free use of this kind of bread has saved the teeth from falling out and from decay. Transactions of the Illinois State Dental Society, May, 1882.

impair the appetite, but rather stimulates the functions of the stomach. But here, as in the case of the whey cure, it must be confessed that a thousand circumstances foreign to the grape favor the beneficial result sought for; exercise in the open air, the pleasant surroundings, etc.[15]

This subject of grape cure will serve as intermediary between the study of solid and liquid aliments. I come now to the consideration of the latter, and shall first speak of the influence of spirituous liquors on diseases of the stomach.

The influence of the alcohols is deplorable, and in this hospital in our male wards we see, oftener than from any other cause, dyspepsias result from the abuse of ardent spirits, or even from the simple use of these intoxicating beverages, which are so generally of bad quality.

Two principal causes sufficiently explain the production of these dyspepsias; the augmentation of the acidity of the gastric juice on the one hand, and the retardation of digestion on the other. Charles Richet, by his experiments on Marcelin, has furnished us precious data respecting the first of these etiological factors. In fact, if you examine during or apart from digestion the acidity of the gastric juice, as Charles Richet has done, you will see that it is represented during fasting by 1.3 in weight of hydrochloric acid per litre, and during digestion by 1.7. But if you introduce into the stomach a little alcohol, the acidity immediately rises to 2.7, and even to 3 and 4 if Bourbon or Cognac be used.

It seems, then, to-day demonstrated that the introduction of wine or distilled spirits into the stomach has for its first effect to double and even treble the acidity of the gastric juice. If to this you join the irritant action of the alcohol, an action which makes itself especially felt on the mucous membranes, you will have an explanation of the phenomena which develop themselves in drunkards, and find expression, as far as the stomach is concerned, in a congeries of symptoms to which has been given the name of *acid dyspepsia*.

If the action of alcohol is prolonged, there is no longer simple functional disturbance, but real inflammation of the organ; you witness what the Germans describe under the name of *catarrh of the stomach*. In this case the abnormal acidity determined by the spirituous liquors too long continued, brings about, at the end of a certain time, a diminution in the secretion of the gastric juice, and an increase in the secretion of mucus, which then gives rise to those peculiar pituitous troubles which characterize the dyspepsia of drunkards.

Buchner, by his precise experiments, made by means of the stomach siphon, or by artificial digestions, has shown that alcohol always, even in small quantities, retards the peptonization of aliments.[16] *

All these alcoholic beverages taken in excess determine the same mor-

* Buchner in Deutsche Arch. f. Klin. Med., xxix., 5–6.

bid states. At the same time it is important to distinguish in this regard liquors of good quality from those that are impure or sophisticated. In our researches on the toxic action of the alcohols, Dr. Audigé and I ascertained that the empoisonment determined by the latter is the greater and the more intense the more unlike vinous alcohol the spirit is which is drank, and that the maximum of injurious results is caused by potato spirit.

The conclusion at which we arrive in that work is that from the point of view of hygiene it is desirable by successive rectifications to bring the alcohols of commerce to the state of ethyl alcohol, for vinous spirit is the least dangerous of all the intoxicants. It will not do, however, to forget that the abuse of ethyl spirit, even of the purest quality, entails gastric disasters of a deplorable kind."

As for wines, it may be safely affirmed that the stomach is the best judge of their quality, and I need only refer you to your own personal experience in confirmation. When at a dinner you have imbibed wines of bad quality resulting from fraud in their manufacture, you will often experience in the night time, under the influence of these sophisticated liquors, even when taken in moderation, cramps in the stomach, a sensation of burning in that region, and abundant acid eructations; if, on the other hand, you have drank the same quantity of wine of good quality exempt from noxious adulterations, you never suffer such symptoms.

Therefore, gentlemen, we are obliged to attribute in large part the dyspepsia of the working population of our cities, on the one hand to the shameful falsifications of the beverages served under the name of wine, and on the other, to the deplorable habit of taking these stimulating liquors, and especially white wine, while fasting, thus directly putting, and without the intermediation of food, these alcoholic beverages in contact with the mucous membrane of the stomach.

Beer and cider produce the same effect as wine, and quite recently Boens has pointed out to the Academy of Belgium the disastrous action of the abuse of the beers known as Bavarian.

You will, then, forbid your dyspeptic patient, with tendencies to acidity of the stomach to make habitual use of ardent spirits, whether in the form of distilled or fermented liquors. You will, on the contrary, permit these beverages, or at least their moderate use, to persons affected with atonic dyspepsia, a dyspepsia in which there is lack of gastric juice secretion, and the acidity of the gastric juice is below the normal. It is in such cases as these that you will do well to recommend the glass of ale or wine after each meal, and here again you will give the preference to some good vinous beverage, which is, as I have before told you, the least toxic of the alcoholic stimulants.

All the conclusions which I have just stated are in accordance with, and in fact based upon, our experimental researches on the toxic action of the alcohols, researches to-day confirmed by those which have just terminated at the piggery which we lately established in one of the abattoirs of Paris. In order to answer the objections which have been made against our former method of experimentation, which consisted, as you know, in rapidly killing dogs by injecting under their skin variable doses of alcohols, we gave the toxic agent to our hogs by mouth, a small quantity daily; thus determining in these animals chronic alcoholism. Here again we ascertained positively that the more the liquor differed from vinous spirit, the more marked were the phenomena of intoxication and poisoning.

These experiments were made with eighteen hogs, which for three years were dosed with certain daily quantities of the different alcohols; the mean dose was 1 gramme 50 per kilogramme of the weight of the animal, so that the animals were made to ingest each from 100 to 150 grammes per day.

The results at which we arrived with our eighteen subjects belonging to the two series, did not present anything like the well-nigh mathematical precision which we obtained in our first researches on acute alcoholic poisoning.

Nevertheless we have to note certain points which have a real interest. We observed in particular that in every case the crude, impure liquors (phlegms), produced results more injurious than the rectified liquors. Thus, for instance, the hog to which was given the crude grain spirit succumbed to the effects of alcoholism; the animal that got the crude beet whiskey, and which we slaughtered in the course of the experimentation, presented congestions of the digestive tube, of the liver, of the lungs, and atheroma of the aorta. The hog that was dosed with the impure potato spirit and was also killed by us, had the most marked hepatic congestions.

On the other hand, those animals to which we administered the ethyl alcohol, potato spirit ten times rectified, and other rectified alcohols, presented few lesions or none at all. These facts then authorize us to believe that the latter, viz., the rectified and purified alcohols possess a relative immunity as compared with the former, whose noxiousness common experience has everywhere recognized. And if we were to classify the alcohols according to their toxicity, we should say as the result of our researches, that the least harmful, by far, are ethyl alcohol and potato spirit ten times rectified, which is nothing more nor less than ethyl spirit, almost pure. Then come the relatively impure alcohols of beets, grain, potatoes, etc.

It will be remembered that the hog which got no alcohol, succumbed to a pulmonary affection, contracted in the rigorous winter of 1879–1880, and which proved to be a veritable sclerosis of the lungs.

The hogs to which we gave absinthe, and the tincture of absinthe, presented an interesting series of phenomena. Unlike those which were nourished on food containing alcohol, they manifested during their intoxication, a certain excitation. Trembling was not more marked in these animals than in some of the alcoholized subjects, but they presented contracture of the limbs, and a quite curious hyperæsthesia of the skin. It sufficed, in fact, to touch lightly some part of the cutaneous surface to have spasmodic contraction ensue in the muscles of the extremities. Two of the hogs of the second series had convulsive seizures, which seemed to be of an epileptiform character.

In fine, to complete the detail of experiments which have cost us so much in money, and about three years of careful observation, we observe:

1. That the alcohols, administered in a slow and continuous manner, determine in the hog, at the end of a certain time, anatomical lesions, which consist in congestions and inflammations of the digestive tube, and of the liver, without at the same time attaining to that degree of interstitial hepatitis which is noted in hard drinkers in human kind; in congestion of the pulmonary parenchyma, which may go as far as apoplectic extravasations; in atheromatous degeneration of the large vessels, and especially of the aorta, and finally, in sanguineous effusions into the substance of the muscles, and in the cellular tissue.

2. That these lesions, inappreciable at the end of thirty months in cases where ethyl alcohol was given, and alcohols having other origin than vinous fermentation, but which had been thoroughly rectified, are very conspicuous in subjects to which have been administered crude spirits, whether from beets, grain, or potatoes.

3. That preparations of absinthe are especially baneful in their effects on the nervous system.*

By the side of these spirituous liquors we must place the stimulating beverages so much employed in our day—tea and coffee.

For a long time there has been dispute respecting the real action of these two substances, which with alcohol constitute *sparing* foods (*aliments d'épargne*); some pretend they are beneficial, others that they are injurious to health. Both views are correct; everything, in fact, depends on the habits of the individual and the climate in which he lives.

Tea, in particular, is a stimulating beverage very much employed in the countries of the north, while in the warmer southern latitudes its utility is more doubtful. As for coffee, habit plays a considerable part, and many a person who has been accustomed to drinking strong coffee after each meal will find his digestion retarded or arrested if he ceases to make use of this beverage. It must be remembered, moreover, that if the use of coffee is often beneficial, its abuse may cause palpitations of the heart and insomnia, compelling its abandonment.[10]

You ought, then, before prescribing or forbidding these beverages, to

* See the articles entitled "Experimental Researches on Chronic Alcoholic Poisoning" in Therapeutic Gazette, July and August, 1884.

take into consideration the habits of the patient, and the climate in which he lives. What I can affirm is that in our farming districts the ingestion of coffee during the heat of summer and the fatigue of the harvest season renders considerable service. It is to coffee that our troops in the far East, exposed to the heat of a tropical sun, resort in order to support the vital energies, and any advantage thereby derived is attributable to the stimulation by this beverage of the central nervous system, and thence of all the functions of the economy, as has been shown by the researches of two Rio Janeiro physicians, Fort and Guimaraes.

I must here protest against a vulgar prejudice which has no real foundation, and which will sometimes occasion mothers of families to consult you. It has been held that coffee causes the whites in young women. This is not the case. Coffee of good quality, taken with milk and sugar, is an excellent beverage, of which a large part of our population partake without the least evil effects.

Water plays also an important rôle in alimentary hygiene. I cannot here treat this question in its entirety, and shall have to refer you to your treatises on Hygiene. Permit me, however, to call your attention to certain points of this subject which concern more particularly the hygiene of dyspeptics. The nature of the waters has a notable influence on certain dyspepsias, and we frequently see such affections caused solely by the usage of potable water of bad quality.

I must also point out to you the evil as well as the good effects, from an alimentary point of view, of the use of cold water and ice water. Taken in small quantities ice-cold drinks are agreeable and may stimulate the digestive functions; but the advantage thus accruing is more than counterbalanced by the disadvantages resulting from their employment. The influence of cold is to impair the tone of the gastric and intestinal mucous membrane, and the free use of ice water is often followed by dyspeptic symptoms and diarrhœa. In the United States, where great use is made of ice-water, and where it is drank to excess, there are often seen developed under its influence dyspepsias quite as serious and rebellious as those which arise from the immoderate use of alcohol.*

Mineral waters are of considerable utility in diseases of the stomach, and I shall indicate later, under the head of the different kinds of these affections, the waters which the physician may employ and which have a real medicinal value. In this connection I have a word to say about those mineral waters called *table waters*. A great part of these waters come from France, from springs in which carbonic acid abounds. The waters of St. Galmier, of Morny-Chateauneuf, of Condillac, of Couzan, etc., belong to this group. They are *sodic bicarbonate* waters and are chiefly characterized by the abundance of carbonic acid which they contain. In

* This statement is doubted.—Trans.

Germany we have the Apollinaris water, of which there is such great consumption in England and America, and the Seltzer water in the Duchy of Nassau.

The usage of all these waters is becoming more and more fashionable, and beneficial results are doubtless attained therefrom. The presence of carbonic acid stimulates the action of the gastric mucous membrane, and in this way aids digestion. It will not, however, do to abuse them, and this remark is especially applicable to the artificial Seltzer waters. Moreover, the consumption of these latter, although very great, tends to diminish from day to day by reason of the very low price at which the natural mineral waters are sold, and it must be confessed that the latter have a great advantage over the former.

The artificial waters, in fact, do not present that close union between the water and the carbonic-acid gas which characterizes the natural waters, so that the effervescent gas, instead of being set free slowly, and little by little, as in the case of the latter, is evolved quite rapidly, and determines thus, by the mere fact of its liberation in bulk, an action rather injurious than favorable to the mucous membrane of the stomach. Hence you ought, in the case of certain dyspeptics, to forbid the employ of these waters, nor should you in any event continue their use a long time, for the stomach readily becomes habituated to them, and if they are then left off, it misses its accustomed stimulation, and digestion is in consequence more or less impeded. This becomes a real inconvenience to the patient, who can no longer eat his meal without his mineral water; it is a sort of bondage that had better be avoided.[19]

I ought also, from the point of view of alimentary hygiene, to say something about condiments and tobacco. Condiments are largely used in the preparation of our food, but it will not do to forget that when too long indulged in, or too freely taken, they determine irritation or even inflammation of the mucous membrane of the stomach. Hence, while recognizing their utility, I advise you to be sparing in their use. It is especially in hot countries, where Europeans by reason of the tropical heat find their appetite declining from day to day, that the custom prevails of resorting to condiments. But instead of the state of the stomach being ameliorated thereby, it is in the end enfeebled and exhausted by these excitants.

Whenever you have occasion to treat stomachs impaired by the too prolonged usage of highly seasoned viands, be careful not to proscribe at once the employ of condiments altogether; for the stomach, habituated to its daily excitant, will no longer digest its food. The better way, therefore, will be gradually to diminish the quantity of condiments in daily use, so as little by little to accustom the stomach to aliments not seasoned.

In the atonic dyspepsias you may, on the contrary, recommend the daily use of these condiments in small quantities.

I shall finish this lecture by a few remarks on the influence of tobacco on the stomach and on digestion. I well know that the use of tobacco has but an indirect relation to alimentation, but the habit of smoking is so widely prevalent and persons addicted thereto are so wont to resort to their pipe or cigar after meals, that the subject may appropriately be alluded to here.

Already in a former course of lectures pertaining to diseases of the heart, I pointed out to you that the abuse of tobacco determines in some persons palpitations and attacks of angina; smoking may also, when made a vice, provoke dyspeptic troubles comparable in a measure to those caused by alcoholic stimulants. Hence we have the dyspepsias of smokers, analogous to the dyspepsia of hard drinkers. Revillot, who has signalized these facts, has shown that the immoderate use of tobacco produces a special atony of the digestive functions.

Such, gentlemen, are the considerations which I desired to present relative to alimentary hygiene. In the next lecture we shall study foods in their aggregate, and I shall discuss what has been called the alimentary regimen or alimentation.

NOTES TO LECTURE III.

[1] According to Payen, the composition of roast beef in slices of three centimetres in thickness, cut from a portion of the fillet free from fat, is as follows (in 100 parts):

Water,	69.89
Carbon,	16.76
Nitrogen,	3.528
Fatty matters,	5.19
Mineral matters,	1.05

Immediate Composition.	Roast Meat.	Dried Substance.
Water,	69.89	0.00
Azotized matters,	22.93	76.18
Fatty substances,	5.19	17.25
Mineral matters,	1.05	3.50
Non-azotized matters, sulphur and loss,	1.04	3.07
	100.00	100.00

Muscular flesh contains, besides, free lactic acid; the sulphur is in union with the azotized organic matter. The carbon is calculated from the 22.93 of azotized matters and the 5.19 of fatty matters. The mineral matters come from the salts found before incineration, and include the bases, potash, soda, lime, and magnesia, in union with acids, phosphoric, lactic, inosic, and hydrochloric; thus we have phosphates of lime and magnesia, lactates, and inosates of potash, chlorides of potassium and sodium.

According to Playfair, the composition of roast meat and raw meat respectively is as follows:

	Roast Beef.	Raw Beef.
Carbon,	52.59	51.82
Hydrogen,	7.89	7.57
Nitrogen,	15.21	15.00
Oxygen,	24.31	25.68
	100.00	100.00

[a] Under the name of *conserve of Damas* Trousseau gave meat reduced to pulp, and mixed with currant jelly or conserve of roses. Jaennel (Formulary), gives the following formulæ of Reveil and of Adrian:

	Grammes.
(1.) Take of fillet of raw beef,	1,000

Separate carefully and reject the aponeuroses and the fatty matter; hash finely; bruise in a wooden mortar. Add:

Powdered sugar,	20
Chloride of sodium,	15
" " potassium,	5
Powdered black pepper,	2

M. F. S. A. The fillet of beef may be replaced by veal, fish, or fowl. Take in quantities of a teaspoonful several times a day:

(2.) Meat Marmalade. (Adrian.)

	Grammes.
Take of fillet of beef,	60
Common salt,	1
Fruit jelly,	15

Reduce the fillet of beef to a pulp; add the salt, then the fruit jelly, and mix.

You may also incorporate the pulp of raw meat with syrup of gooseberries or cherries or with broth.

As intermediate between meat broth and raw meat must be placed meat jelly.

This is the formula proposed by Reveil:

	Grammes.
Take of beef muscle, freed from fat and hashed,	500
Water,	1000
Common salt,	3
Chloride of potassium,	1
Carrots, turnips, onions, of each,	30

Boil the whole over a slow fire till it is reduced one half. Strain into a mould and allow to cool.*

[a] Yvon has proposed the following pleasant combination of raw meat, gelatine, and sweet almonds:

	Grammes.
Take of raw meat (fillet),	250
Pure gelatine,	50
Sweet almonds (hulled),	75
Bitter " "	5
White sugar,	80

* Reveil, Medicaments Nouveaux, p. 65.

The almonds are first hulled, then bruised in a wedgewood mortar, with the meat and sugar, into a homogeneous paste. In order to obtain a better looking product, and at the same time remove any fibres of the meat which may have escaped the action of the mortar, this paste may be passed through a colander. The pulp thus obtained has a rosy color and a very agreeable savor, resembling in nothing raw meat. It may be preserved a long time even in summer, provided it be kept in a cool dry place.

If you wish to obtain a liquid preparation you can dilute a certain quantity of the paste with water, taking the same precautions as in the preparation of a linctus made by means of almond paste. You obtain thus an emulsion of a light rosy color whose smell and taste resemble that of almond emulsion.

Yvon gives another method of preparing the emulsion.

Take of	Grammes.
Raw meat,	50
Sweet almonds (hulled),	15
Bitter " "	1
White sugar,	16

Bruise in a mortar the meat, the sugar, and the almonds, and add the quantity of water necessary. The whole should now be pressed through a strainer. You will thus obtain an emulsion which will keep without precipitation for at least twenty-four hours, and even after that time is ready for use by simply shaking.

To render the meat more nourishing, you can add to the paste before diluting it with water, the yolks of one or more eggs, or use milk in making the emulsion.

Laillier, pharmacist-in-chief, has given the following preparation which is in use at the Insane Asylum, Saint Yon:

	Grammes.
Raw meat (scraped),	100
Pulverized sugar,	40
Wine of Bagnols,	20
Tincture of canella,	3

Incorporate the sugar with the raw meat in a marble mortar, then add the wine and canella. The mixture thus obtained has the appearance of marmalade, with an agreeable savor.*

'The question of alimentation by meat powders seems to-day to have been solved by Kirn. Under the form of *cartouches* (packages), not exceeding 5 grammes in weight, and which may be boiled in 250 grammes (about one half pint) of water, you have all the nutritive elements of a nourishing broth suitable for a meal, and two such *cartouches* suffice for the daily rations of a man. The price of the total ration is scarcely half a franc. In Germany great use is made of an American powder known under the name of *carne pura*.†

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* Rep. de Pharm. April, 1874, and Bull. de Ther. t. lxxvi., p. 556.

† Kirn. L'alimentation du soldat, (Journal des sciences militaires, juin août, 1884). Lux, De l'alimentation rationnelle et pratique des armies (broch. in 8° Paris, 1881.) Meinert, Armee- und Volks-Ernährung, 2 vol. in 8°, Berlin. 1880. Rönnberg, Versuche ueber den Nahrwerth. des Fleischmels "Carne-Pura" (Deutsche

[a] There are numerous industrial processes for the fabrication of meat powder. This is the way Hassler describes these methods:

Desiccation pure and simple.—This process, according to Adrian, consists in choosing beef of good quality, removing the fat, tendons, and aponeuroses, and cutting it into slices. These slices, about the size of the hand and a little more than a centimeter in thickness, are placed in a tightly-closed baking pan, where they cook without losing a drop of their juice, and without any alteration of the albumen of the blood which impregnates them; they are then dried in a well-ventilated oven, heated to a temperature of 80° to 90° C.

The slices of beef thus obtained are of a fine chestnut color. Their odor and savor resemble that of roast meat; their fibres on section are seen to be rose-colored. They represent 23 per cent. of the meat employed. They are lastly pulverized and sifted with care.

The powder is of a reddish gray color, slightly salty, of a decided beefy odor. From the point of view of its chemical characters, the powder and the slices of dried meat are identical; containing the same quantities of nitrogen, fatty matters, lactates, phosphates, extractive and aromatic matters, that is to say, an assemblage of varied alimentary principles of the highest nutritive value. This is the process (perfected), of the Tartars and South Americans. The one prepare their meat in this way to preserve it from the intense cold, the other from the heat of their climate. Thus made the meat serves for long journeys by land and by sea. It is, then, a method of preparation sanctioned by usage and by science.

A second made of manufacture is that by coction and desiccation. After five hours of boiling, the meat is taken from the kettle, put on the press, and then hashed; thus prepared it is placed on trays and subjected to a heat of 90° in a stove; after twelve hours of desiccation, it is pulverized to be again thoroughly dried in a stove.

This preparation, to be distinguished from *the powder of beefsteak* furnished by the first mode, should be called *the powder of boiled meat.* Its color is that of ashes, its taste is insipid and its odor faint.

It represents 20 per cent. of the meat employed, that is, 3 per cent. less than the powder of beefsteak. This 3 per cent. represents so many parts in every hundred of alimentary principles lost in the broth and in the scum, such principles as albumen, gelatine, fatty, extractive and aromatic matters, and in particular lactates and phosphates, being almost all respiratory aliments or aliments of disassimilation, so that the 20 per cent. of product obtained—azotized aliments par excellence—are found deprived of elements capable of rendering them assimilable.

The third process consists in hashing the raw meat, in soaking it in water, and washing it till it is completely decolorized; then it is put in the press and cooked after the manner of boiled meat, afterward thoroughly dried in the stove, and reduced to powder.

This preparation, even more than the powder of boiled meat, is deprived of albumen, of fatty, aromatic and extractive matters, of lactates and phosphates, in fact of elements useful in all respects, whether as

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militairartzl. Zeitsch., October, 1883. Prüfung der Fleischconserven "Carne Pura." Roth's Jahresbericht über die Leistungen und Fortschritte, etc., 1883, p. 57). Hassler, On the Employ of Meat Powders in the Dietary of the Soldier. Arch. de Med. et Pharm. Militaire, Sept., 1884.

plastic (tissue making) elements, or as adjuvants to digestion and assimilation.

This process may be called the *musculine* process, and the powder thus obtained *the powder of musculine*. This powder is almost white, nearly insipid and inodorous. It represents 17 per cent. of meat employed, *i.e.*, 3 per cent. less than the powder of boiled meat and six per cent. less than the powder of beefsteak. Although it is, taking equal weights, still richer in nitrogenous principles than the powder of beefsteak, it is inferior as an aliment to the powder of boiled meat.

In washing this meat to the point of decolorization, and in removing all the juices, it is not only rendered inodorous but indigestible, not to say unassimilable.

A fourth process is employed when the meats are very fat. The meat, freed from the surface fats, as well as from nerves and aponeuroses, is hashed fine in a hashing machine, spread out in thin layers on trays, and desiccated in a suitably ventilated stove, at a maximum temperature of 45°C. The meat is then passed on to the crusher, then placed in a lixiviating apparatus; then twice its volume of alcohol at 95° is poured upon it, and it is allowed to macerate about two hours, after which the liquid is turned off. A new and equal quantity of alcohol is then poured upon the meat, and removed after a couple of hours of contact, and this process is continued till the liquid which is drawn off from the apparatus comes out clear.

The meat thus lixiviated, is then passed to the press, and the resulting cake carried to a stove, the temperature of which is gradually raised to 110°, then is reduced to an impalpable powder.

Rousseau declares that the meat is thus deprived of all its putrid elements (not of its putrescible elements, since it is composed of nothing but these) without its nutritive value and its digestibility being at all impaired, but rather somewhat improved. The powder thus obtained is of a beautiful chamois color; it is absolutely odorless, and may be kept indefinitely.

Carne pura.—The American powder presents itself under the aspect of a fine powder of a pale brown color, and absolutely dry. Its faint odor is not disagreeable, and its savor, slightly salty, resembles that of beef. The process of manufacture is kept a secret. The volume of the meat is reduced about a sixth by the process of drying.

This meat powder keeps well in all countries and in all climates.*

Yvon's mode of testing these powders is as follows:

1. First examine microscopically. By the abundance of striated fibres, you will judge of the care which has been used in the fabrication of the powder, both from the point of view of desiccation (whether or not the heat was lower than 100° C.) or from that of the choice of material. The presence of bacteria in considerable numbers will always indicate the commencement of decomposition.

2. In determining the amount of watery extract, in meat dried at 100° C, you will be guided: by the source of the meat, that of *beef* giving

* Adrian On the Rôle of Meat Powders in Therapeutics, Paris 1884. Rousseau On Meat Powders. (Bull de Thérap., 15 Sept. 1883). Robin, On Artificial Alimentation and Meat Powders. Th. inaugural, 1882. Robin, On Artificial Alimentations and Meat Powders. Th. de Paris, 1882.

an average of 12 per cent. that of the horse, 17 per cent. of dried extract; by the mode of preparation,—the meats which have been cooked, furnishing only a feeble proportion of watery extract, not exceeding 6 per cent. and often not more than 1.5 per cent.

You should test for the fixed salts; especially to determine if the quantity of chloride of sodium be normal, and if the meat powder have been made of fresh meat, or meat cooked or washed.*

'After an excessive meal, pepsin is often wanting at an advanced period of the digestion, a period during which the stomach still contains solid aliments not transformed. In his experiments on animals, Schiff remarked that the deranged digestion rapidly undergoes restoration if the animal is made to swallow, or if there be administered to it in lavement, some broth or dextrine. "Never," says Schiff, "have I seen in the dog, indigestions caused by forced repletion of the stomach resist a sufficient dose of dextrine."

The administration of dextrine or of *bouillon* (in the form of soup or beef tea), to patients affected with dyspepsia by insufficiency of pepsin, has given Schiff the same results as were noted in his experiments on animals. He had occasion, for instance, to treat a man aged fifty years, who after each meal was taken with a sensation of fulness and distention, of general malaise, of weight in the limbs, often accompanied by cephalalgia; he had also acid eructations which did not cease till five or six hours after eating, along with the other uncomfortable sensations. During digestion the abdomen was distended, the tongue furred, the mouth pasty without nausea or vomiting; there was no fever or pain at the epigastrium. This state of malaise had produced a disgust of food, and the forces were enfeebled.

Supposing that there was insufficiency of gastric juice during the first stage of digestion, Schiff caused the patient to take two hours before meals, a small quantity of broth, in order to furnish him at the meal time a sufficiency of pepsin, to facilitate the digestive process as soon as food should be introduced.

Under the influence of this treatment the malaise disappeared, the forces were re-established, and after a short time recovery was complete.

'Begiu's recipe for broth is as follows (the quantity of 75 litres being intended):

Take of

Water, ...	75 litres.
Meat by weight, with the bones, . . .	31,245 grammes.
Legumes, and pot vegetables, . . .	6,240 "
Common salt, (chloride of sodium), . .	340 "
Roasted onions, ...	220 "

It is essential moreover: 1, that the kettle shall not contain more than 75 litres; 2, that the meat shall be boned raw, and bound by strong threads into bundles of about three kilogrammes each; 3, that the bones shall be crushed and placed in the bottom of the kettle; 4, that the meat, tied in packages, shall be placed on a perforated false bottom, above the bones; 5, the water must be poured on cold, it is then gradually brought to the

* Yvon, loc. cit., p. 27.

boiling point, and the skimming is commenced (the scum is well formed between the second and third hours); then the whole is allowed to simmer (not boil violently) till the sixth hour; then the fire is suffered to cool down, and one hour afterward the legumes, the meat, and the broth are removed from the kettle. It is necessary that the salt, as well as the vegetables and roasted onions, shall be added, the latter enveloped in a coarse cloth, after the skimming is completed.

When, at the end of seven hours, the operation is finished, the bag containing the vegetables is removed, then the false bottom containing the boiled meat; the latter is allowed for a while to drip over the kettle and the fat is skimmed off from the top. The liquid product is then fit for use to make soup of or pottage.

Payen recommends to use only the purest white salt, not to include among the pot plants, cabbages, onions and turnips, which by their sulphurous products and their fermentable juice alter the aroma of the broth, and tend to make it sour; he would rather diminish than augment the quantity of vegetables and omit the onions, whose odor and savor are unpleasant.

Liebig advises in order to obtain in less than an hour a good broth, to take a kilogramme of beef freed from fat, to cut it into small pieces or even hash it, and soak it in a quart of cold water; it is then gradually heated to the boiling point and skimmed; then salt is added, and after a few moments of slight ebullition, you have quite a strong broth, and one that may be eaten with relish. This broth, subjected to a hot water bath and evaporated down, gives a soft extract which keeps well, and may be used to prepare broth anew with.

The broth called *Liebig's strengthening broth* is made with 250 grammes of fresh beef, hashed and macerated in 560 grammes of distilled water, to which has been added four drops of strong hydrochloric acid and five grammes of salt. After one hour's maceration, it is strained through a leather sieve, or linen cloth.

Duval has adopted the following formula for making broth for certain industrial establishments:

Take of:	K.	Grammes.
Ordinary beef, ...	3	500
Water, ...	10	500
Common salt, ...		75
Legumes, carrots, leeks, parsnips, turnips,		600
Three cloves.		

Leven has made some experiments regarding the nutritive value of broth, and he has endeavored to ascertain the quantity of soluble peptones obtainable therefrom. He has shown that it is at a temperature of 40° C. that the largest amount of peptones is produced, and whenever you elevate the temperature, you diminish the quantity of the peptones; a quantity, moreover, excessively feeble, since broth contains of peptonizable material only *one thousandth* part of the weight of the meat employed, and *four one thousandths* of the organic matters and salts; hence Leven refuses broth a place in the class of aliments properly so-called. He, however, allows that it is a stimulant of the stomach and augments the secretion of gastric juice.

Beef-tea.—In making beef-tea it is well to take equal quantities by weight of lean beef and cold water. The beef should first be cut up into fine pieces, and allowed to macerate an hour in cold water, which should then be heated slowly to ebullition, boiled two minutes, then strained under pressure.

American "Bouillon."—Take of fillet of beef, 500 grammes; this should be carefully freed from cellular tissue, fat, and fibres; cut into bits no larger than a good-sized pea, and placed in a tight kettle with a sliced carrot, and covered closely; this kettle is now placed in a larger iron kettle filled with boiling water, which is kept boiling six hours. The juice thus formed is poured off and the residue is strained through a cloth, it is then allowed to settle and the clear part separated from the deposit.

Wines and syrups of meat.—In Germany and in France a great number of wines and syrups of meat are manufactured. The best formula is that given by Reveil under the name of *syrup of musculine,* and is as follows:

Take of:	Grammes.
Flesh of veal, washed, freed from fat and hashed finely,	100.
Water,	500.
Pure hydrochloric acid,	0.50
Chloride of potassium,	0.50
" " sodium,	0.50

Mix and agitate from time to time, and after twelve hours of maceration, express and filter. After having added sufficient water to make 500 grammes of liquor, add 1000 grammes of sugar, and dissolve at the temperature of 35° or 40° C.

[10] Tanret has endeavored to ascertain by analysis the nutritive value of the juice of meat and of American broth. After having for four hours subjected to heat over a boiling sea-water bath lean meat to which were added several slices of carrot, and onion, a small quantity of leeks and a pinch of salt, Tanret obtained a liquid representing about a quarter part of the meat used, viz., 125 grammes for 500 grammes of beef.

As for the juice of meat, in squeezing a slice of beefsteak after broiling it a few moments over the fire, he obtained in juice about one-fourth part of the meat employed. The American broth gave of dry extract about the fifth part of its weight; the meat juice contained mineral matters in the proportion of one-tenth of its weight, while the white of egg leaves from 10 to 12 per cent. of dry residue. If, then, we admit that the nutritive value of the residue of the juice of meat is equal to that of dried albumen, we have this easy term of comparison by which to estimate the value of a given quantity of meat juice. The white of one egg (average size) weighs 40 grammes; now 500 grammes of meat (the rump) gives 125 grammes of juice; you have therefore in this juice the value of the whites of three eggs. (Tanret.)

[11] Albertoni has studied the action of pepsin on living blood, by injecting the former into the veins; he has observed that this practice is followed by great diminution of fibrin, and retardation in the coagulation of the blood.*

* Albertoni, Action of Pepsin on Living Blood, 1878.

"The following is Gautier's table giving the comparative analysis of the cereals.

Kinds of grain.	Protein substances.	Dextrine and glucose.	Fats.	Cellulose and kindred substances.	Mineral matters.	Starch.	Water.	Names of chemists.
Wheat	14.60 to 19.50	7.60 to 6.05	1.20 to 2.12	1.70 to 3.00	1.60 to 2.75	59.70 to 60.51	14.00 to 16.00	Boussingault. Payen.
Rye	9.00	10.00	2.00	3.00	1.90	57.50	16.60	Boussingault.
Oats	11.90	7.90	5.50	4.10	3.00	53.60	14.00	"
Rice	6.43	0.60	0.43	0.50	0.68	77.75	14.40	"
Indian corn	12.80	1.50	7.00	1.50	1.10	58.40	17.70	"
Buckwheat	6.84	1.50	1.51	0.20	1.75	44.70	18.00	"
Winter barley	13.40	8.70	2.80	2.60	4.50	54.90	13.00	"

Payen's table of the principal leguminous grains:

Substances.	Legumin and kindred principles in small quantity.	Starch sugar, dextrine.	Fats.	Cellulose.	Mineral matters.	Water.
Beans, after desiccation and decortication.	28.05	55.85	2.00	1.05	2.65	8.40
Kidney beans	30.80	48.30	1.90	3.00	3.50	12.50
Peas, dried and decorticated	25.40	58.50	2.00	1.90	3.20	9.90
Lentils	25.20	56.00	2.60	2.40	2.30	11.50
Vetches	27.30	48.90	2.70	3.50	3.00	14.60

"In Leven's experiment, he gave to a fasting dog sixteen ounces of cooked cabbage mixed with nearly the same quantity of lard; the animal was killed one hour afterward; no gastric juice was found in the stomach, or its glands; nothing but an enormous quantity of water from the engorged vessels of that viscus.*

"In bread-making, the quality and quantity of the water employed, the kneading, the mode of fermentation (kind of yeast) and the manner of cooking, are all concerned in the quality of the product. The kind of flour used has a still greater influence; its source, whether pure or mixed, whether well ground and bolted, etc.

In the country the bread is generally of inferior quality to that in the city. The wheat is often of poor quality, being badly harvested, and the flour poorly ground, sometimes incompletely divested of its bran, or, it may be, mixed with the meal of other grains, such as barley or buckwheat. In the city, moreover, fresh brewer's yeast is commonly employed, in the country the yeast is often kept till it sours and spoils, and the resulting bread is sour and heavy.

Bread made from first quality of flour is more nutritious than bread

* Leven, Maladies de l'Estomac, p. 78.

made from second quality, as is seen from the analysis of Violet, showing the quantity of nitrogen per 100 parts.

Flour No. 1, N = 2.06
" " 2 " 1.05
" " 3 " 0.92

In the following table Violet shows the difference between the crust and the crumb:

	Crust.	Crumb.
Water,	17.15	44.45
Azotized matters (insoluble), gluten and the like,	7.30	5.92
Azotized matters (soluble), albumen and the like,	5.70	0.75
Non-azotized matters (soluble), dextrine, sugar, etc.,	3.88	3.79
Starch,	62.58	43.55
Fatty matters,	1.18	0.70
Mineral matters,	1.21	0.84
	100.00	100.00

Army bread in France is made exclusively of wheat from which by bolting the bran has been extracted (20 per cent.); formerly only 15 per cent. was removed by bolting. This is Poggiale's analysis of army bread:

Water,	34.17
Sugar,	1.03
Dextrine,	1.09
Starch,	44.50
Azotized matters,	8.85
Fatty matters,	0.70
Bran,	6.07
Fixed matters,	1.39
Loss,	0.20
	100.00

The following is Payen's comparative analysis of fine flour and bran, in 100 parts:

	Coarse bran.	Coarse flour.	Fine flour.
Starch and dextrine,	60.4	62.2	68.43
Azotized substances and diastase-principles in the bran,	13.0	12.5	14.45
Fatty matters,	5.6	4.3	1.25
Cellulose,	4.03	3.0	0.05
Mineral substances,	3.0	2.5	1.60
Water,	14.0	15.5	14.22
	100.00	100.00	100.00

It will be seen from this table that bran contains less starch than fine flour, and less of azotized matters, but more of fatty matters, of cellulose and of mineral matters.

"There are on the continent numerous stations renowned for the grape cure (Durkheim, Krenzuach, Grünberg, Bingen, etc.). According to Henry and Chevalier grape juice contains:

Albuminoid matters,	1.7
Sugar, gum,	12 to 20
Mineral substances,	2.
Water,	75 to 83
	100

The white grapes most employed are the Chasselas grapes and the *Pineau petit gris;* the black grapes are the *Petit noir* and the *Rough Emerald grape.* According to Rotureau, grapes from vines growing in a clayey soil and in a cold and moist country are watery, slightly sweet, and sensibly acid; they are laxative and even purgative; the effect is the contrary if the grape comes from a ferruginous soil. Grapes that grow in a basaltic, granitic, or volcanic soil are diuretic, but they are also always excitant; as for those which are grown in a new soil, they are generally little aromatic and have moreover a depressant effect.

"Buchner in his experiments on artificial digestions showed that a cubic centimetre of albumen maintained at a temperature of 40°C. in 20 cub. centimetres of water acidulated with a fixed quantity of hydrochloric acid and dosed with pepsin, underwent peptonization in six to eight hours. If to the mixture was added a small quantity of alcohol, not exceeding 10 per cent. of the entire weight, the results were not appreciably altered. Between 10 and 20 per cent., peptonization was slowed; beyond 20 per cent. it was completely arrested. In another series of experiments he made use of the tube Faucher; he gave to some patients with healthy stomachs the same kinds of food, to which he added variable quantities of alcoholic beverages, then he washed out the stomach six hours afterwards; he found that beer and wine when taken even in moderation slowed digestion, and larger quantities still more retarded it, while these beverages in still larger quantities stopped digestion altogether.

"In a work published by them five years ago, Dujardin Beaumetz, and Audigé, showed by a series of experimental researches, which consisted in determining acute poisoning in animals, that the alcohols are endowed with a toxic power which is variable. They succeeded in finding for each member of the alcohol series, the fixed toxic dose, *i.e.*, the medium quantity which in correspondence with the weight of the animal experimented on (so many grammes of the spirit for so many kilogrammes of weight), would produce death in the space of from 24 to 36 hours, with gradual and persistent lowering of the temperature. They found that the medium quantity of ethylic alcohol sure to cause death in the time indicated is eight grammes per kilogramme. In other words, if the animal weighed 30 kilogrammes (60 pounds), 240 grammes (8 ounces), of ethylic spirit would be required to produce a fatal result within 36 hours. The most toxic spirit they ascertained to be potato spirit, or fusel oil; of which, to an animal weighing 30 kilogrammes, two ounces would be a speedily fatal dose.

The following table will be of interest in summing up these results of acute alcoholic poisoning, which these experimenters have endeavored to place on a thoroughly scientific basis.

DEGREE OF TOXICITY OF THE PRIMORDIAL ALCOHOLS,

Group of alcohols.	Designation of the alcohols and their derivatives.	Medium toxic doses per kilogramme of weight.	
		In the pure state.	In the state of dilution.
		Grammes.	Grammes.
Alcohols of fermentation.	Ethylic alcohol (C_2H_6O).......	8.00	7.75
	Propylic alcohol (C_3H_8O)......	2.90	3.75
	Butylic alcohol ($C_4H_{10}O$)......	2.00	1.85
	Amylic alcohol ($C_5H_{12}O$)......	1.70	1.50
Alcohols not of fermentation.	Chemically pure methyl alcohol (CH_4O)................	....	7.00
	Ordinary wood spirit	....	5.75
	Œnanthylic alcohol ($C_7H_{16}O$).	8	
	Cetylic alcohol ($C_{16}H_{34}O$)......	7.50	
Iso-alcohols	Iso-propylic alcohol (C_3H_8O)	....	3.70 to 3.80
Poly-atomic alcohols.	Glycerine ($C_3H_8O_3$).	....	8.50 to 9.00
Derivatives of alcohols.	Acetic aldehyde (C_2H_4O)......	....	1.00 to 2.00
	Acetic ether ($C_2H_3O_2,C_2H_5$)....	....	4.00
	Acetone (C_3H_6O)..............	...	5.00

By the word pure alcohol is meant alcohol marking 100° C. with the alcoholometre of Gay Lussac at the temperature of 15°.5 C.

As for the distilled liquors of commerce these are the conclusions of the French experimenters:

All the distilled liquors (eaux de vie), and alcohols of commerce are toxic, and their deleterious action is in relation: 1, with the origin of these alcohols; 2, with their degree of purity.

1. *Origin of the Distilled Liquors.*—The origin of these liquors plays a preponderant rôle from the point of view of their toxic action, and this is the order in which we are led to class the different products on which we have experimented: 1, alcohols and spirits of wine; 2, alcohols of cider and perry; 3, alcohols obtained by distillation of the marc of grapes; 4, grain spirits (from distillation of wheat, rye, etc.); 5, beet spirit (from beet infusions and beet molasses); 6, potato spirit (proved to be the most toxic of all).

This classification is in harmony with the recent discoveries of Isidore Pierre, who has shown that the liquors of commerce contain in variable proportions a certain number of alcohols. If spirit of wine is the least noxious of all, it is because it consists almost wholly of ethyl alcohol, but the ordinary vinous spirits are generally contaminated by poisons other than ethyl alcohol, for they are a little more toxic than this spirit when chemically pure.

The existence of a certain quantity of propylic, œnanthylic, and caprylic alcohol and their products of oxidation in the spirits of grape marc, cider and perry, explains the higher toxic power of these alcoholic beverages as compared with spirits of wine.

It is particularly in grain and beet spirit that Isidore Pierre has detected the existence of propyl, butyl, and amyl alcohols; hence their great noxiousness is explained. If the spirits of potatoes have seemed the most toxic of all, it is because they contain variable but large proportions of essential oils which are, as we know, composed of butyl alcohol and fusel oil.

2. *Purity of the Spirits of Commerce.*—What we have just said is a proof that in order to render less toxic any spirit of commerce we must free

it from certain impure products which it contains, such as amyl alcohol. We have, in fact, seen in our experiments that there exist from a toxic point of view differences between the rectified spirits and those products which under the name of *phlegms* result from the simple distillation of fermented matters.

Is it possible to rectify spirituous liquors other than those of vinous origin, so that they shall contain no intoxicant but ethyl alcohol? This is a question which we cannot solve, but what we can affirm, is that it is of the highest importance to attain such a result. It would also be highly advantageous to find practical physical and chemical tests which will enable us to detect in all alcoholic beverages the presence of the divers alcohols which compose them. But till such reagents shall have been found, and science shall be in possession of some sure means of identifying all noxious impurities, we think that in cases where the consumption of ardent spirits is regarded as necessary, it will be well to employ only the spirits obtained from vinous fermentation or distillation. In countries where such spirits cannot be obtained, the endeavor should be made by successive rectifications to free the alcohols of all impure products, eliminating every spirit but the ethyl. We opine, too, that it is highly expedient to oppose by legislative and fiscal measures the adulterations and falsifications of liquors, so common everywhere, and which help to make the retailing of spirits such an abomination.

All these conclusions are an evident confirmation of statistical researches which have been undertaken to ascertain the ravages produced by alcoholic beverages. It is in the Scandinavian countries, where potato whiskey is almost exclusively used, that alcoholism attains its maximum of intensity; it is also in these countries that Magnus Huss gave the first written description of the pathological effects of intemperance. If in other parts of the North alcoholism also finds numerous victims, it is largely owing to the fact that beet spirit and grain spirit are there consumed in excess.

But this truth appears in still clearer light when we limit the inquiry, as Lunier has done, to France; he has, in fact, shown us by his remarkable charts, that the crimes and misdemeanors which result from the abuse of alcoholic stimulants are in direct relation with the usage of alcohols other than those furnished by vinous fermentation. It is in the departments where the vine does not grow, that we see alcoholism the most prevalent, and if in countries where the vine flourishes there are now and then found drunkards, this is due to the presence of large distilleries which entail the consumption of other liquors than those of the vine.

[19] Edward Smith regards tea as an excito-respiratory agent; he says, moreover, that a strong infusion, taken cold, in the dose of an ounce every hour, is the best remedy to fortify the system against the effects of excessive heat. He also considers fresh cream, like tea, as an excellent respiratory stimulant. (Foods, by Edward Smith, in International Scientific Series, pp. 328 and 347.) The physiological effects of coffee, from a hygienic point of view, have been exhaustively studied by Fort and Guimaraes of Rio Janeiro. Fort maintains that coffee acts on the organs and functions by excitation of the cerebro-spinal axis. He thinks that coffee is not a *sparing* aliment (*aliment d'épargne*), but that it augments rather than diminishes the waste of the organism, being, what he calls, an aliment of expenditure; this view is also shared by Guimaraes, who has also found that the organic combustions augment under the action of coffee.

These are the conclusions of the researches which Guimaraes undertook at the laboratory of Rio Janeiro: Coffee impresses on the organism profound modifications. It diminishes the gases of the blood, as well as the consumption of feculent and fatty hydro-carbonaceous aliments. It augments the formation of sugar and urea, and by accelerating the processes of disassimilation, it renders possible secondarily the increased consumption of mixed, and especially azotized aliments, the type of which is meat. In enabling the organism to consume and appropriate more food, and in favoring its restoration, coffee is a valuable auxiliary to hard work, and is to be recommended to all who lead an active, busy life.

[19] The water of St. Galmier contains a little bicarbonate of lime, soda, and magnesia; about one gramme to the litre. It is saturated with CO_2. The Chateauneuf water contains three grammes sodic bicarbonate to the litre, and one to two vols of CO_2; that of Chateldon has of saline ingredients scarcely half a gramme to the litre, it is well charged with CO_2. Seltzer water has in each litre twice its volume of CO_2, and about one drachm of salts. Apollinaris, popular in England and America, comes from the Valley of Ahr, near the Rhine. Its saline constitutents are chiefly carbonate of soda and chloride of sodium. The water delivered to commerce is artificially charged with CO_2 gas before being sent out; chloride of sodium is also added in the proportion of one gramme to the litre.*

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* In this country we have no natural alkaline effervescent waters which compare with those of some springs on the Continent, such as Vichy, for instance. Congress water (from Saratoga) contains per litre 3,340 milligrammes of CO_2, 184 milligrammes of sodium bicarbonate, and 6,864 milligrammes of sodium chloride. There are several other of the Saratoga springs that also contain free CO_2, and are alkaline ; many of these waters are articles of commerce ; the Hathorn especially. The Saratoga waters are much in use as table waters.—Trans.

LECTURE IV.

ALIMENTATION.

SUMMARY.—Regimen and Alimentation—Plastic and Respiratory Foods—Liebig's Theory—Basis of Alimentation—Exclusive Regimens—Vegetable Diet—Nitrogenous Diet—Evils of an Exclusive Diet—Mixed Diet—Nutritive Equivalents—Quantity of Aliments—Insufficient Alimentation—Excessive Alimentation—Peptogenous Matters—Indigestion—Dyspepsia of High Livers—Quality of Aliments—Secretion of Gastric Juice—Digestive Sense (according to Blondlot)—Falsification of Aliments—Interval between Meals—Duration of Gastric Digestion—Regularity of Meals—Indigestible Foods—Exactness in Dietetic Prescriptions.

TAKEN in its largest acceptation, the word regimen signifies not only alimentation or the alimentary régime, it comprehends also all the dietetic means which the physician can make use of to preserve the health or to combat disease. It is in this sense, gentlemen, that from the point of view of affections of the stomach, I shall interpret the word regimen.

We shall pass in review the hygienic means which have an influence on the development or cure of gastric disorders. In the first rank we must place alimentation, or the alimentary régime.

In the previous lectures I have considered digestion in its relation not only to the immediate alimentary principles, but also to aliments which when ingested constitute alimentation. The latter has for its end to supply the means of nutrition and to repair the incessant losses of the economy. These losses are of two kinds; the one pertaining to azotized, the other to hydro-carbonaceous substances.

Liebig, comparing the organism to a machine, was the first to establish this two-fold division of foods into plastic (histogenetic) foods, designed to repair muscular losses, and respiratory foods, whose function is to be burned in the economy and supply animal heat. This theory of Liebig has since been modified, and the labors of Claude Bernard, Seyler, Voit, Pettenkoffer, Traube, etc., have shown that it will not do to liken absolutely the phenomena of nutrition which take place in the organism to those which are produced in a centre of combustion. But despite all these reservations made to Liebig's classification, it is not the less true that it is to this doctrine that we are indebted for the ability to establish alimentation on scientific bases.

The incessant wastes of the economy, azotized losses by the urine and fæcal matters, carbonaceous losses by the respiration, vary according to circumstances—the state of repose or of fatigue, the amount of work done, age, sex, and even climate; you will readily understand then that the alimentary regimen intended to repair these losses should also vary according to all these circumstances. I can here only give you an average, and indicate the data which should guide you in the selection of a diet.

Here are the fundamental facts: A man loses on an average each day, 20 grammes of nitrogen, and burns 250 grammes of carbon; it is necessary, then, that the azotized and carbonaceous ingredients of his food shall furnish this amount of nitrogen and carbon. These elements may be found exclusively in the vegetable kingdom, or animal kingdom; in fact, as we have before seen, the cereals contain a certain quantity of protein substance, while the meats and azotized matters have, associated with them, a certain quantity of fat. But it must be borne in mind that a regimen purely vegetal on the one hand, or purely animal on the other, although it may suffice for nutrition, presents nevertheless serious inconveniences.[1]

In the case of an exclusively vegetable diet, a man, in order to obtain the proportion of nitrogen which he needs, ought to ingest a very large quantity of food, and for this very reason he will heavily tax certain portions of his digestive tube; while, on the other hand, if he confines himself entirely to an azotized regimen, he must, in order to obtain the quantity of carbon necessary for respiration and animal heat, consume an abnormal quantity of meat, which will also be a severe tax on his digestive organs and particularly on his stomach. A purely azotized diet, moreover, rapidly produces emaciation, and it is on this fact that Brillat-Savarin and Banting have founded the regimen which they recommend for obesity.

From the point of view of affections of the stomach, these exclusive regimens present great disadvantages; in fact, while meat eaters are liable to acid or atonic dyspepsias, those who live on a vegetal diet alone are more likely to experience grave intestinal disturbances. But I cannot too much impress upon you that habit and climate play here a preponderant rôle, and according as a man is obliged to contend against the severe cold or excessive heat, his diet ought to vary. The people of the North are obliged to live largely on azotized food and eat a great deal of fat. The people of the South, on the other hand, find a moderate diet of vegetables and cereals all that they require.[2]

For our temperate climates a mixed diet is best; that is to say, a man ought, in order to satisfy the wants of his economy, to derive from a plastic and a respiratory aliment the principles necessary for his nutrition. To this subject of mixed diet, important labors have been directed; Boussingault and Payen, basing themselves on physiological data, have established for man and for animals, a scale of nutritive equivalents, that is to say, the quantity of different foods necessary for nutrition, both during the period of rest and during that of labor. In order that you may be able better to judge and appreciate the rules which should serve as a basis for the establishment of a dietary regimen, I here place before your eyes a table which represents under a schematic form, already put in usage by a Russian physician, Dr. De Nedats,* the data furnished by Payen, and which will enable you rapidly to estimate the constitution in carbon, nitrogen, and water, of the different aliments.

In consulting this table, which I have prepared with great care, it will be easy for you, I repeat, to adjust, according to circumstances, a regimen sufficient for the daily needs. Alimentation, in fact, may be insufficient, sufficient, or excessive; this depends on two circumstances: on the quantity of the alimentary mass, and on the nutritive quality of the aliments; for, as Prof. Bouchardat has said, "it is not what one eats which gives him strength, but what one utilizes." Let us, then, study this question under these two aspects, quantity and quality.

We must take for our guide experimental physiology. You already know that, from the point of view of insufficient nourishment, it has furnished us valuable data, so I will cite here only the researches of Chossat and of Bouchardat, in order to call your attention to the effects of inanition which have been so well established by these two writers. Insufficient alimentation entails troubles which affect different parts of the economy, and end in causing death.

According to Prof. Bouchardat (Thesis on Insufficient Alimentation), alimentation is sufficient when it is so regulated that, all the functions of the economy being normally performed, the attributes of health are preserved, and no wasting is observed; the food elements being practically employed for the repair and in early life for the development and growth of the organs, by adding to their substance or by making good their losses.

It may be said *à priori* and truly, that in ordinary conditions the alimentation is insufficient when the food digested and utilized is not proportional to the expenditure.

Alimentation may be insufficient; 1, by diminution in quantity; 2, by insufficiency in quality; 3, it may be sufficient in appearance, both as respects quantity and quality, but prove insufficient for particular reasons, (morbid intolerance, disease, convalescence, age, sex, climate, season, exercise, etc.).

In a general way the effects of insufficient alimentation, so well described by Bouchardat and Chossat, are as follows: There is a diminution

* De Nedats, Comparative Table of the Composition of Foods and Drinks, Brussels, 1870.

in the weight of the body. According to Chossat, death arrives when the weight of the body is reduced by 40 per cent. of its natural standard. First the animals grow lean; the muscles lose their strength, and become pale; the secretions dry up more or less rapidly. In some cases hunger makes itself keenly felt, in others this sense is totally abolished.

At the same time, circulatory and respiratory disturbances are noticed; the beatings of the heart are enfeebled, and the respiratory movements are diminished; the temperature of the body is lowered; it may fall as low as 90° F.

The modification which the blood undergoes, according to Becquerel and Rodier, are as follows: 1, the quantity of water augments considerably, at the same time that the solid matters which the blood holds in solution diminish; 2, diminution in the quantity of globules (120 grammes, 110, 100 and even less); 3, diminution in albumen, which descends from 80 grammes to 60, and even 50; 4, fibrin rarely diminishes; 5, the inorganic salts also undergo diminution. These different modifications explain the dropsies, the hemorrhages, the anæmia, which so often follow insufficient alimentation.

Sometimes delirium, agitation, and hallucinations are observed before the individual falls into collapse, or is carried off by an intercurrent disease; an acute gastro-enteritis is often the cause of the fatal termination. The effects of insufficient alimentation make themselves felt, more or less rapidly, according to the age, sex, and habits of the patient. Thus infants succumb first, then old people, then adults.*

Insufficiency of alimentation produces disastrous results on the stomach; it frequently determines in those long deprived of food severe pain in the region of that organ, real gastralgic dyspepsias that are very distressing. I think that we are to look for the cause of these dyspepsias in a fact pointed out by Schiff. This experimenter, contrarily to the opinion held by the physiologists, who assert that the gastric juice is secreted only when the aliment penetrates the stomach, maintains that if it be true that in a fasting animal the gastric juice does not show itself during the first hours of abstinence, it is none the less certain, however, that after a certain time this secretion does appear on the surface of the mucous membrane. Now it is probably to the presence of this gastric juice when there is no food to absorb it, that are due the painful sensations experienced by the patient who is subjected to insufficient alimentation.[2]

When food is taken in too great quantity, there arise troubles of two

* Collard de Martigny, Experimental Researches on the effects of Abstinence. Jour. de Phys. de Magendie, 1828, t. viii. Hebray, The Influence of Insufficient Alimentation on the Animal Economy. (Thèse de Paris, 1829.) Piorry, On Abstinence, Insufficient Alimentation and other Dangers. (Jour. hebd.,1830.) Chossat. Experimental Researches on Inanition, Paris, 1844. Bouchardat, On Insufficient Alimentation, Paris, 1852.

kinds: first, acute symptoms constituting common indigestion or acute dyspepsia; second, disturbances of a slower order, and supervening after some time as the result of too abundant alimentation. Schiff has given a clear and precise explanation of these facts: he has shown that the flow of gastric juice is not always proportional to the quantity of aliments ingested. If it is true that the secretion of this juice augments at the moment of the repast, it is certain also that when there is too large a mass of alimentary matters in the stomach, the secretion is suspended; and in order to reproduce it, it is necessary to introduce artificially by the rectum or by the veins, certain substances called *peptogenous*, which possess the property of restoring the secretion of gastric juice.

What happens to individuals who make use of too azotized a diet? The gastric juice not being able to digest the whole, these azotized substances play the part of veritable foreign bodies, and according to the state of tolerance of the stomach, they are rejected by vomiting or else pass downwards into the intestines, provoking severe colicky pains.

A propos of this fact, viz., indigestion by reason of the introduction into the stomach of too highly azotized food, I have a remark to make by way of digression. When you eat a great quantity of meat, you need to favor as much as possible the secretion of gastric juice, and to augment in a measure its acidity. We have seen that peptogenous matters promote this secretion, and this practical consequence arises, that high livers ought, at the beginning of their repast, to take a great quantity of soup. We see here also the physiological explanation of a custom with which you are probably all familiar, viz., that of taking onion soup after a plentiful meal; also the habit, sanctioned by Continental usage, and doubtless beneficial in promoting the acidity of the gastric juice, of drinking a certain quantity of wine after a hearty meat dinner. You know, in fact, that alcoholic beverages do augment the acidity of the gastric juice; hence by a sort of physiological fatality, high livers are hard drinkers.

On the other hand, individuals who make use of a non-azotized diet, and eat moderately, may without inconvenience abstain from alcoholic stimulants; and here, gentlemen, there is justification for the ground taken by a certain American vegetarian temperance sect, which, in inculcating abstinence from ardent spirits, has also suppressed the use of animal food.

But, to return to the subject under consideration. I have given you the explanation of indigestion *à crapula;* the same explanation is applicable to the dyspepsia of high livers. This dyspepsia results from two circumstances: on the one hand excessive fatigue of the muscular and mucous coats of the stomach; on the other, irritation of the gastric and intestinal mucous membrane by the presence of substances not peptonized; all of which manifests itself by an atonic or irritative dyspepsia, so frequent in persons who are addicted to table excesses.

There is another cause—indirect it is true, nevertheless real—of dyspepsia by superabundant alimentation; namely, the presence in the blood of an excess of uric acid. In fact, the uric diathesis, which arises from eating an excess of nitrogenous food, determines, as you will see, gouty or arthritic dyspepsias in patients affected with this diathesis. Hence then, as a means for avoiding affections of the stomach, you should recommend sobriety, and without going so far as to order the severe regimen of Cornaro, it is proper nevertheless to regulate in a sage and moderate manner the quantity of aliments which one ought to take each day.[4]

After having had so much to say of the quantity of aliments, I come now to a consideration of their quality. It is not enough to introduce into the stomach a certain quantity of food-materials in order that they may serve for nutrition. It is necessary that the substances ingested shall possess nutritive qualities, and the very fact that an individual has filled his stomach with victuals and has allayed his hunger, is no proof that he has taken adequate nourishment. Now this is what unfortunately happens very often in the case of our laboring population, where we frequently see men and women (especially the latter), who, able to appropriate but a small sum to the purchase of their daily rations, endeavor to make up in the quantity of their food what it lacks in quality. Here, too, physiology gives us an explanation of these facts. Schiff has pointed out the mistake of his predecessors, and of Beaumont in particular, who thought that all that it was necessary to do, was to touch or locally irritate the mucous membrane of the stomach in order to see the secretion of the gastric juice start, and this fluid ooze forth under the influence of the irritation; he has proved that if there is a secretion in these cases, it is not gastric juice but mucus. In order to re-establish the regular secretion of gastric juice, it is necessary to give digestible aliments, and Schiff, on causing dogs to swallow innutritious boluses containing only silica, obtained no secretion of gastric juice.[5]

In explanation of the above fact it will not do to admit the opinion of Blondlot, who attributed to the stomach a particular sense, the digestive sense, enabling this organ to secrete gastric juice proportionally to the nutritive value of the food introduced, but we must fall back on the fact, before stated, of the penetration of peptogenous substances furnished by the food itself. It is, then, easy to understand how it is that individuals who ingest a great quantity of substances having little or no alimentary value, thereby determine a profound irritation of the mucous membrane, and suffer all the symptoms of irritative dyspepsia. Every day, gentlemen, you will be witnesses of cases of this kind in our hospital wards and especially among the female patients.

But it is not enough that the alimentary substance shall present a sufficient nutritive quality, it must also be of pure quality, not impaired by change or by adulterations and falsifications. I cannot here enter into the details of this question of the quality of aliments, and their falsifications, and shall have to refer you to your special treatises and works on Hygiene.

It is not enough to have determined the quantity and quality of foods, it is also necessary to regulate with precision the time for meals, and the interval between them. Let ùs examine a little this part of the question.

The duration of the gastric digestion depends on several circumstances, and especially on the nature of the aliments introduced into the stomach. We have already shown that in the digestion of meat, the alimentary bolus cannot pass the pylorus till it is reduced to the state of pulp under the influence of the chemical and mechanical action of the stomach. When, on the other hand, substances are introduced which are not attacked by the juices of the stomach, such as vegetable matters and fats, their sojourn in that viscus is longer. The pylorus, in fact, lets pass only the substances which are reduced to a semi-liquid state by the stomach. Generally these aliments remain two or three hours in the cavity of the stomach, when, at the proper moment the contractions of this organ augment in intensity, and force them into the intestine.

It is necessary, then, to allow an interval of at least three or four hours between meals. I know, however, that habit has a great deal to do in regard to this matter, and you will sometimes see persons who have never complained of their stomachs troubling them, and who nevertheless eat but one meal a day.

In this connection, gentlemen, I can but express the regret that the exigences of our modern life have obliged us to abandon the custom of our fathers, a custom followed to-day in Germany, Switzerland, and America, and which consists in having the principal meal of the day at noon.

There is another point which you cannot too much impress upon your dyspeptics, viz., the importance of regularity in meals. This is a vital matter, and one may say in truth, that in our profession the greater part of the dyspepsias from which medical men suffer result from two circumstances, irregularity of meals, and the scanty time devoted thereto. It is not enough, in fact, to have regular hours for meals, in order that digestion may go on well, but the food must also be thoroughly and slowly masticated. I have already alluded to the necessity of mastication, when speaking of the digestion of amylaceous matters, which have to undergo the action of the saliva.

Therefore, gentlemen, whenever as a result of their occupation, or for any other reason, your patients are unable to give but a limited time to their meals, recommend them to make use chiefly of azotized and fatty aliments which for their digestion have no need of salivary impregnation, urge especially the thorough mastication of food. How many dyspeptics there are, who are able to assign as the origin of their gastric troubles no other cause but insufficient mastication. In old people particularly who are deprived of their teeth, this inability to masticate is a frequent cause of disturbance of the digestive functions. It is well, then, when dealing with such patients to insist on the necessity of false teeth, which are often good substitutes for the natural teeth, but where the artificial plates cannot be worn, there is no alternative but to insist upon the food being taken minced or in a state of pulp.

If eating between meals and irregularly is often productive of dyspepsia, it must be remembered nevertheless that there are circumstances where frequent alimentation under judicious direction constitutes the best means of cure, and Brown-Séquard, in his hints as to the regulation of diet for dyspeptics, advises, as the best way of treating functional troubles of the stomach, that food shall be taken, not at the usual time, but every hour of the day in small quantities. [In diseases where the secretion of gastric juice is nil (or nearly so), the food must be liquid, such as milk and broths; here the reliance must be on the speedy absorption of alimentary principles. This is also the treatment of fevers, where the digestive function is suspended.]

Such are the rules which may be laid down with reference to the alimentary regimen, but do not forget, gentlemen, that the dietary principles which I have just formulated can never be applied in all their rigorousness, and that the stomach, as Fonssagrives says, sometimes revolts against the arbitrary fiat of the physician. The idiosyncrasies of the digestive functions are often remarkable and unaccountable; what agrees with one disagrees with another, and a kind of food reputed as indigestible, is sometimes borne with entire impunity by a very delicate stomach, so that the proverb that "the most digestible food is that which one digests best" is simply a truism.

As you pursue your profession you will continually meet with the most curious irregularities in the performance of the digestive functions, and you will need to study the whims and preferences of the stomachs of your patients, and endeavor to make your prescriptions harmonize with their individual predispositions.

All these restrictions which I have pointed out ought not, gentlemen, to prevent you from a rigorous inculcation of hygienic and dietetic principles, and I am quite of the opinion of Hamelin, who insists that everything should be fixed by rule and strictly enforced. Do not yield to the caprice of the patient; endeavor, on the contrary, by the punctiliousness and firmness with which you lay down your dietetic regulations, to make your patient understand the capital importance you assign to them. "What we take by ounces and pounds ought to affect us as much as what we take by grains and scruples" says Huxham. These words, gentlemen, the physician ought always to have in mind when laying down the principles of the alimentary regimen. We shall return to this subject when we come to the particular treatment of the different affections of the stomach.

NOTES TO LECTURE IV.

[1] During twenty-four hours an adult man loses 20.15 grammes of nitrogen, 240.68 of carbon, and 30 grammes of salts. The most simple combination of foods which enables him to repair these losses is as follows:

	Grammes.		Grammes Nitrogen.	Carbon.
Meat, . . .	300	which is equivalent to	10. +	44.
Bread, . . .	600	" " "	6.48 +	177.50
Butter and fats,	60	" " "	0.35 +	50.08
Beans, . . .	50	" " "	2.00 +	21.50

But this is only barely sufficient to supply the wants of the economy, and if hard work is to be done, this quantity must be increased, and this, according to Gautier is the "ration of work:"

	Grammes.		Nitrogen.	Carbon.
Meat	544	which is equivalent to	28.74	459.00
Bread	1190			
Fat	93			

These, according to La Porte are the alimentary rations of the French peasants:

Yearly rations of a farm laborer of Vaucluse.—Bread, 390 kilogrammes; potatoes, 90 kilogrammes; beans, 88 kilogrammes; pork, 19 kilogrammes; oil, 10 kilogrammes; wine, 123 kilogrammes; total, 720 kilogrammes. Giving per day: 1 kilogramme 972 grammes, or 22 grammes of nitrogen, 502 grammes of carbon, and 80 grammes of fat.

Yearly rations of a laborer of the North.—Rye meal, wheat and barley, 400 kilogrammes; peas, 20 kilogrammes; potatoes, 350 kilogrammes; beef, 30 kilogrammes; pork, 10 kilogrammes; milk, 160 litres; butter, 20 kilogrammes; beer, 365 kilogrammes; total, 1,367 kilogrammes. Giving per diem: 3 kilogrammes 74 grammes, or 31 grammes of nitrogen, 710 grammes of carbon, and 108 grammes of fat.

Annual rations of a French soldier.—Wheat bread, 356 kilogrammes; meat, 92 kilogrammes; farinaceous and other vegetables, 73 kilogrammes; total, 531 kilogrammes. Giving per day: 1 kilogramme 427 grammes, or 22 grammes of nitrogen, 328 grammes of carbon, and 25 grammes of fat.

Annual rations of a French sailor.—Bread or biscuit, 587 kilogrammes; meat of different kinds, 108 kilogrammes; dry legumes, 117 kilogrammes; fat or butter, 6 kilogrammes 205 grammes; wine, 91 litres, or brandy, rum or whiskey, 21 litres; coffee, 7 kilogrammes, 300 grammes; total, 916 kilogrammes 500 grammes. Giving per day: 2 kilogrammes 500 grammes, or 28 grammes of nitrogen, 409 grammes of carbon, and 41 grammes of fat.*

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* De la Porte, Hygiène of the Table, Paris, 1870. See also Dujardin-Beaumetz, Dictionnaire de Thérapeutique, Art. Aliment.

[2] Vegetable matters do not comport themselves in the same manner as animal matters in digestion and nutrition, as Voit has shown. Thus, while in the carnivorous animal the matters ingested arrive at the rectum eighteen hours or more after the meal, in the herbivora the vegetable matters remain in the intestine often for eight days, and a great part is not utilized. The carnivora void but a small amount of excrement, the herbivora void much more.

Voit has shown us that a dog fed on meat, for every kilogramme of weight, will pass an ounce of solid excrement per day; a man weighing 100 kilogrammes, with a mixed diet, will void two ounces, an ox, for every 100 kilogrammes, 20 ounces.

The investing membrane of vegetable substances—cellulose—does not easily undergo dissociation, and is but little digested; it is this, in fact, which renders vegetables so indigestible. In this connection, the following experiments of Adolph Meyer have an interest. He took a dog and gave it for nine days 1,000 grammes of bread a day, representing 536 grammes of dried matter; there were voided 70 grammes of dried excrement. The equivalent of the albumen of the bread was then given under the form of meat, and the starch was replaced by its respiratory equivalent in fat (2.4: 1); the dog's rations now consisted of 377 grammes of meat and 134 of fat; there were voided only 20 grammes of dried excrement per day.

The experiments of Meyer have thus shown that starch furnishes the greatest quantity of excrement or waste residue of the simple nutritive elements.

Franz Hoffmann has remarked that if cellulose be added to a man's food, to the meat, for instance, more excrements are voided than if meat alone be eaten. According to Meyer, bran bread, which contains all the elements of wheat, determines a more prompt evacuation by the very fact of the indigestible cellulose which is combined with it. It is not so with fine flour wheaten bread.

As one will readily see from these facts, if is quite possible by the inspection of the excrements, and by their greater or less quantity, to tell the kind of nourishment a man is fed on.

With regard to the adoption by man of a strictly vegetable diet, Barwell has observed that in individuals who rigorously abstain from animal food, and who are called vegetarians, the vitality of the tissues is very low, and surgical operations performed upon them are likely to be followed by grave results; cicatrization takes place slowly, and there often supervene abundant suppurations or even secondary hemorrhages of considerable intensity.*

[3] Schiff, as a result of numerous experiments, has ascertained that it is from nine to sixteen hours after a healthy digestion that the walls of the stomach contain their minimum of pepsin. In dogs subjected to fasting it is not till the end of 24 hours that there appears an appreciable quantity of pepsin, but after 48 hours it is possible to detect pepsin even in greater abundance, nor is it necessary to make an infusion of the stomach. Corvisart has observed that in dogs dead from starvation, the stomach was gorged with pepsin, just as if the dogs had been killed in full digestion.

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* Petit, Vegetarianism and Traumatisms, Bull. gén. de Ther., t. xcvi., 1879, p. 554.

According to Schiff, the stomach saturates itself with pepsin at the expense of the animal tissues, and when after a prolonged fast the animals enter, so to speak, into auto-digestion of themselves, the resorbed elements of the organism act after the manner of true peptogenous substances, and charge the stomach with pepsin.

'Cornaro (1462–1566) after having attained the age of forty years, and committed numerous excesses, subjected himself to a very severe hygienic regimen; he took twelve ounces of solid food per day, and fourteen ounces of wine. He lived in this way to be more than a hundred years old, and at the age of eighty-three published a book on sobriety. (*Discorsi della vita sobria, Parme*, 1558.)

This is the way he expresses himself on the state of his health:

"All those who know me will certify that the life which I lead is not a dead and languishing life, but a life as happy as one could wish for in this world. They will say that I am still vigorous enough to mount horseback alone; that I can not only ascend with firm step a long flight of stairs, but even climb a mountain; that I am always gay, always in good spirits, enjoying all the pleasures of an honest life. I take long walks, and with setters or terriers engage in the fatigues of the chase." He goes on to state that his sight and hearing are still perfect at eighty-three years, that his memory has not failed him, that his teeth are all sound, and that he sleeps as well as he ever did; his advanced life had even been blessed with numerous young children, with whose sports he loves to engage. In fine, he attributes his excellent health, his ripe old age, and his felicity to the care which for more than forty years he had taken of his diet, reducing the quantity of his food (and especially animal food), as he grew old.

'Schiff took dogs, and after etherizing them from twelve to fifteen hours after a full meal, he tied the pylorus to prevent the liquid secreted from passing into the intestine; then he introduced by the œsophagus of these animals sand or pebbles in sufficient quantity to distend the stomach more or less completely. It was sometimes possible to obtain from the stomach three or four drachms of an acid and mucous liquid, but it was not possible to cause the digestion, that is to say, the transformation into peptone by this liquid, of an appreciable quantity of albumen. Schiff admits that in certain cases he could compel gastric juice to be secreted even in an empty stomach, but it is not newly formed pepsin that is obtained but pepsin with which the walls of the stomach were charged, and which an acid secretion provoked by an external irritant, has dissolved and brought to the surface, thus forming a little gastric juice.

In making his experiments Blondlot was able to obtain by mechanical irritation of the stomach only from two to three drachms of liquid mingled with mucous matters, when he operated on the empty stomach, but he sometimes obtained as much as three ounces of gastric juice when he operated on the stomach full of food.

Corvisart has performed the same experiments and found that the liquid collected in the stomach, after the most varied mechanical irritations, presented only traces of digestive power.*

*Schiff, Physiology of Digestion, t. ii. Bidder and Schmidt, Die Verdawungssäfte und der Stoffwechsel, 1852. Tiedmann and Gmelin, Experiments on Digestion. Blondlot, Traité analytique de la digestion.

LECTURE V.

ON REGIMEN.

SUMMARY.—Exercise — Its Utility — Gymnastics — Varieties — Swedish Gymnastics—Abdominal Gymnastics—Training—Practice of Works of Charity—Influence of the Air—City Air and Country Air—Sea Air—Moral Influences—Idleness—Coitus and Masturbation—Clothing—Tight Lacing and Tight Suspenders—Hydrotherapy—Sea-Baths—Baths in general—The Excreta.

I HAVE told you that under the name of *regimen*, we understand not only alimentation, and the rules which govern it, but also all other hygienic means which may be employed in the treatment of diseases. It is the study of these means which we shall undertake in this lecture.

And first, let us inquire what is the influence of exercise? It is of capital importance, and, as Chomel rightly says, "one digests with his legs as well as with his stomach." Hence it is not altogether owing to high living, but to insufficient exercise as well, that we see so many persons possessed of ample fortunes who are sufferers from dyspepsia.

In fact a great many people while making use of an azotized diet, do too little work, or no work at all; this disproportion between excessive diet and the trifling amount of labor performed is enough to engender disease. In such cases, all that you will have to do will be to prescribe regular and methodical exercise, in order to see the dyspeptic symptoms vanish.

Recall to mind the patient who recently came to our clinic to consult us with reference to a very severe atonic dyspepsia; when we interrogated this man respecting the probable causes of his trouble, he explained to us that being employed in a railroad office, he could take no exercise during the day, and that during the evening, being obliged to balance his books, he was compelled to remain sitting. This, gentlemen, is what you will often witness in the case of clerks and book-keepers, and you should bear it in mind when you have to treat such patients.

But let us enter a little more deeply into this question, and see what physiological experimentation teaches. It brings to light this interesting fact, that absolute repose in animals, dogs for instance, immediately after a meal, diminishes the activity of digestion, without suspending it, while severe exercise appears, on the contrary, to abruptly arrest the digestive process. Thus, when after having given a dog a hearty meal, you engage him in the chase, and after some hours of excessive running you kill him and open the stomach, you will find digestion not completed. This fact has a real importance; it shows in clear light that after a meal one should neither engage in active exercise nor in absolute inaction, and in this regard, the nap which some people are in the habit of taking after their meals, is quite as injurious and dangerous as the forced labor which is exacted of a man after a copious repast.

To combat the dyspepsias caused by the want of equilibration between the quantity of food introduced and the labor habitually performed, you have divers means; in the first place, gymnastics intelligently and methodically practised render great service in the treatment of dyspepsias, especially those of young people, who, as you know, are very subject to functional troubles of the stomach.

It is not possible to enter here into the details of gymnastics; such details you will find in the special treatises of Dally, Leblond, Bouvier and Hillairet. I can only indicate the general characteristics of these exercises, which you will often have occasion to recommend.[1]

There are three great varieties of gymnastics. One kind, somewhat complicated, is performed with special appliances and constitutes *gymnastics with apparatus*, and is the kind that is practised in our schools and colleges, even down to the present time. The means consist of rope ladders, parallel bars, trapezes, etc. These exercises develop a certain agility in individuals, but they may be carried to a dangerous length, and they call into play only a limited number of muscles, so this method tends more and more to give place to a set of gymnastic exercises or "movements" which Laisné has for a long time put in practice in the Hôpital des Enfants, and which have become especially popular in Germany.

This species of gymnastics can be practised anywhere, and consists in movements methodically executed, and in a rhythmical manner, movements, moreover, which call into exercise almost all the muscular groups of the economy. This method, by far the best in my judgment, does not demand any special apparatus, and may be undertaken without inconvenience by adults as well as children. It is in use to-day in boarding schools and in the army, and will satisfy the hygienic requirements of the greater number of cases.

There is still another kind of gymnastics, called Swedish gymnastics. Sweden occupies, as you know, from a gymnastic point of view, the first place among the countries of the earth. Under the inspiration of Ling,[2] it has instituted real schools of gymnastics, in which the professors methodically demonstrate everything that pertains to the exercise of the human body. The exercises are based on the following principles: whenever you desire to effect certain movements, if the execution of those movements be opposed by any body, there is produced in the muscular group that has to overcome the obstacle, contractions more or less energetic. These Swedish gymnasts, then, make their patients perform certain movements, while at the same time opposing to some extent their execution, and it is by the multiplied and varied application of these means that they develop all the muscles of the economy.

While recognizing the great utility of this method, I think that if it is likely to give good results in muscular disorders, it is not superior, from the point of view with which we are now concerned, to the methodically practised movements constituting the kind of gymnastics of which I have before spoken. Moreover, the Swedish mode demands the presence of a master by the side of each performer, which of itself makes this method more difficult of general adoption.

But the Swedish movement cure has received a still further extension, and has been applied to the treatment of visceral affections, and a sort of *visceral gymnastics* has been devised, called by the name of *abdominal kinesotherapy*, and Nycander of Stockholm has indicated the principal movements which one should execute to combat dyspepsia and constipation.

As much, gentlemen, as I am in favor of gymnastics methodically practised in the management of dyspepsia, by so much I am shy of those abdominal gymnastics which pretend to act directly on the stomach and intestines, and I advise you to wait before adopting, as a part of your practice, those passes, those taps, and those shakings which characterize this gymnastic system, till this kind of treatment has furnished results scientifically determined.[1]

You will, then, recommend to your patients to practise moderate gymnastic exercises. You will insist on their attending to this before meals, once or twice a day; and you can, if you choose, augment the muscular exertion by adding exercise with dumb bells of various sizes, which by their weight enable one to improve and develop the power of the muscles.

There are various pastimes which conduce to the same end as gymnastics, I refer to fencing, swimming, rowing, etc. But it must be borne in mind that these physical exercises develop almost exclusively certain muscular groups to the detriment of others, hence I give the preference to gymnastics; nevertheless, as the former are often more enjoyable to the patient, you will be obliged to sanction and order them.

The English, who are far ahead of us in the physical education which they provide for their children, have long indicated the course to pursue in order to attain the regular development of the bodily forces. They have established on scientific and medical foundations quite a system of rules described under the name of *training*, having for its end to substitute for fat—a comparatively useless tissue of the economy—muscular fibre, and thus to give in the least possible volume the greatest possible muscular energy. I have not time to enter into the details of this question, which Bouchardat has so well elucidated in his treatise on the training of the pugilist. I can only trace the principal points.

The training consists in the administration in small bulk of an azotized and nutritious diet, and in certain graded and progressive exercises of the body; at the same time the functions of the skin are energized by free sweats and by hydrotherapy, and the digestive tube is acted upon by oft repeated purgations.*

It is after undergoing this training that the English feel themselves prepared for those prize contests of strength and agility for which they are so famous, from *jousts* and sports of various kinds to horse and foot races and rowing matches. Our own countrymen seem to have little fondness for these sportive exercises, and it is only occasionally that we see a few persons giving themselves with ardor to these healthful and useful games. Hence it is that you must not be astonished to meet with a rebuff, should you speak of gymnastics to your patients, and none are more reluctant to engage in these healthful practices than our young girls. This is in fact a fault in the education of the females of our country. While in England all young females in certain ranks of society engage with ardor and alacrity in horseback riding and other invigorating exercises, in France, on the contrary, these sports are held in little repute even in the country, and gymnastics are too often considered distasteful and wearisome.

We ought, then, gentlemen, to encourage with all our efforts the introduction of gymnastics into the education of our youth, and especially in the primary classes of boys and girls. The young girl has as much need of these exercises as the boy, if not more; she it is who, when she has attained to the age of womanhood, will be the mother of the coming generation, and we should as much as possible favor her physical development. Pardon me this digression, which is not so remote from our subject as you might suppose, for dyspepsia in the man as well as in the woman often depends on want of exercise.

Chomel, struck by the influence of want of muscular exercise on the development of dyspepsias, struck also by their frequency in the wealthier classes who have the most leisure, employed an ingenious method to combat these affections; he counselled the rich to works of charity, saying to them: "perform deeds of charity, but do them yourselves; go and visit the sick, interest yourselves in families that are needy, go into their garrets or cellars, and succor them, and while doing good you will by virtue of this very exertion get rid of the dyspeptic troubles that torment you." This sage advice, gentlemen, is worth remembering. Do not forget to give it when occasion offers, but remember as well the importance of bodily exercises to young people and insist on their performance.

Out-door air has an influence as important as exercise in the development and cure of indigestion, and it is a matter of common observation that dyspepsia is more frequent in the city than in the country.

You know, moreover, that for many a dyspeptic, all that is necessary to procure amelioration of the symptoms and restoration, is life in the open air, and I have already indicated to you the influence attributable to country air in the Milk and Grape Cures, so famous in the treatment of dyspepsias.

When an inhabitant of the country comes to our cities, he undergoes a veritable acclimatization, which affects especially the digestive functions, and this results not only from the atmospheric conditions in which he finds himself, but also from the modifications in the alimentary regimen to which he is subjected.

In the city, where a richer and more highly azotized diet is customary than in the country, we often witness the development of a series of dyspeptic troubles which in the country, despite an alimentation often incomplete and insufficient, the laborer almost never experiences. This difference results from the quality of the air respired, an air which is salubrious in the country, impure and unwholesome in the city; and if in the hospitals you see affections of the stomach resist our modes of treatment, although the patients are made to conform to a well-directed dietary regimen, this depends especially on the insalubrity of the air which they breathe. In the open air the appetite is increased, the digestive functions become invigorated, and if you add physical exercise, in many cases the dyspepsia will get well under this double influence.

Sea air has also a favorable effect. When the inhabitants of our large cities go to the sea-side, they find their appetite rapidly improved, and it is often the case that they then pass to the other extreme, and eat far in excess of the wants of the system. Unless proper self restraint is used, soon dyspeptic troubles supervene from ingestion of too great a quantity of food, often of an indigestible kind. Such facts as these are often observed at our watering places during the season when strangers flock thither for sea air and sea bathing.

How are we to explain this favorable action of pure air on the digestive functions? This is a question which Charles Richet has well elucidated, and which is explicable from what is known of the action of oxygen on the gastric digestion.

The production of the acidity of the gastric juice is one of the most interesting points connected with the secretion of this fluid, and physiologists have labored to grasp the mechanism of this secretion. Claude Bernard, by his ingenious experiments has shown that the acidity is produced chiefly at the surface of the stomach; analyzing more completely this phenomenon, Charles Richet has shown that this acidity is due to the general action of oxygen, being the result of a veritable oxidation of the juices secreted by the gastric glands.[5]

These glands take from the capillary network with which the stomach is so richly provided, and which is always turgid at the moment of digestion, a notable quantity of oxygen, and this oxygen, derived from the blood, serves for the oxidation of the gastric juice. We have here, you see, a fact of great importance. It shows you the direct influence of oxygen in the acidification of the gastric juice; it explains how it is that people who absorb by the lungs an atmosphere which is unwholesome and insufficiently oxygenated, experience all the evils which result from a poor quality of the gastric juice. These persons, in fact, suffer all, or nearly all, the symptoms which characterize putrid dyspepsia.

Moderate and regular exercise, walks in the open air, sojourn in the country if it is possible, sojourn at the mountains, or at the seaside:—these constitute, gentlemen, as you now see, very important elements of treatment for the cure of dyspepsias.

Certain moral influences notably predispose to the development of affections of the stomach. You are well aware how emotional and moral impressions affect the appetite and digestion, and in this regard, gentlemen, I have only to call to your remembrance your primary and final examinations, and the loss of appetite which attends these trials, and which is fortunately of transient duration.

Disappointments, griefs, violent passions, have a much greater influence, and you may be sure that in very many cases, when you cannot relieve the depression of the patient, when you cannot assuage the grief which he is experiencing, or drive away the cares which devour him, you can do nothing to benefit his stomach affection. What is wanted is a kind of moral therapeutics which shall vary with the needs of each case. It does little or no good to prescribe medicine under such circumstances, for the whole pharmaceutical arsenal is impotent; the physician must aim higher than this, and basing his counsels on considerations that tend to uplift his patient, he must endeavor to act on the mind, or moral nature; at the same time using such means as are calculated little by little to obliterate the painful remembrances, and bring peace to the troubled spirit.

In such cases as these, diversions of an agreeable kind, exercise in the open air, journeyings, entire change of scene and of habits, circumstances often so efficacious in the treatment of dyspepsias in general, will give the best results.

Chomel, who has traced with the pen of a master in his work on Dyspepsias that chapter on Moral Influences, points out a fact of which you have certainly seen instances.

He gives us a picture of a man who, after having by long and incessant application to business succeeded in amassing a considerable fortune (and the representation is applicable to many a man who has had an elevated post in the army, or at the bar or bench), finally comes to realize the repose which has been the aim of his life; he shows us, I repeat, this man who, despite his arduous labor, had always enjoyed good health, losing little by little his flesh and his spirits, becoming dyspeptic and morose, and getting well only by resuming the active life which he had relinquished.

Many times, certainly, you must have been witnesses of similar facts. The physician himself is not exempt from such a lot, and I cannot cite a better example than that of Sir Astley Cooper. This illustrious physician, after having won for himself a situation pre-eminent in English surgery, after having acquired a large fortune, fatigued with the labors imposed by an immense practice, retired to one of his estates, expecting to find there a well earned repose and a calm and tranquil life. Profound mistake! Astley Cooper became morose and melancholy, lost all enjoyment in his surroundings, and to one of his friends who congratulated him on his new mode of life, he said he was so miserable that when walking in his park, he would look around among the fine trees which adorned it to choose one on which to hang himself. He endeavored to resume his practice, but it was too late, he could not recover his health.

So you see, gentlemen, that both intellectual and physical inaction are predisposing causes of which great account should be made, and when you have dyspeptics to treat, do not forget to insist upon their performing a certain amount of work proportioned to their physical powers and mental activities.

I have spoken of the passions and of moral impressions, I must now say a few words about sexual relations. It is certain that these latter have a notable influence in the development of dyspepsias, and almost every day we see young people become dyspeptics because they give themselves to excesses in coitus. But apart from the evil of excess, there is also the practice of coitus immediately after a meal, which should be condemned as dangerous. There is in this case a sudden arrest of digestion in the period of its activity, and grave troubles in the functions of the stomach are likely to ensue. Masturbation produces the same effect as coitus, and many young men owe their dyspepsias to this cause alone. In such cases you are likely to observe a peculiar sort of dyspepsia of gastralgic form, accompanied with cramps in the stomach.

What hygiene comprehends under the name of *applicata*—garments, baths, hydrotherapy, play also an important part in the genesis of dyspepsia.

In regard to wearing apparel, I have two points on which to animadvert; viz., the use by females of the *corset* on the one hand, and the disuse by men of suspenders on the other. Excuse me for entering into these details, which may seem to you perhaps to be trivial, but which have a real importance.

As for tight lacing, it suffices to recall to mind what takes place during digestion to understand the injurious influence which a tight corset around the waist may have. In the normal state after a hearty meal, the stomach, which is the seat of an extremely active congestion, and the volume of which is augmented by the alimentary matters which it contains, slightly expands the epigastric region, and if by brute pressure you oppose this expansion, you disturb profoundly the gastric digestion, and this is just what the corset does when it is too closely laced. Hence it is, gentlemen, that if you will take note of what happens at great dinners, where it is the custom for ladies to appear in low-necked dresses, you will see the ladies by your side eating little, scarcely tasting the dishes; this is certainly not for want of appetite, but for the reason that if they were to eat too abundantly you would soon see them turn red, and suffer intense discomfort—almost suffocation—under the influence of a digestion disturbed by the constriction of the corset.

If possible then, require of your female clientèle that their corsets (since it is fashionable to wear them, and they cannot oppose the prevalent fashion), shall not exercise too much constriction, and if they are to be guests at a public dinner, that they shall so arrange their toilet that it shall not interfere with their digestion.

In the case of the other sex, the subject presents itself somewhat differently. Young men find it inconvenient to wear suspenders, and so wear a tight strap around their waist. This is a wretched habit, and has the same ill consequences as have been before mentioned in connection with tight lacing. In order to hold up their trousers, a belt is required which shall compress the upper part of the abdomen and the epigastric region. During meals the belt does not yield and the stomach, squeezed out of shape, cannot perform its normal functions; therefore this is a frequent cause of dyspepsia, and you should recommend to your patients always to wear suspenders.

Baths have also a notable influence, not in the development but in the treatment of dyspepsias. You will find that hydrotherapy methodically employed, and cold baths, are powerful auxiliaries in the cure of these affections, especially when associated with gymnastics.[6]

Sea baths have also a beneficial influence, but I must make here a reservation. It has now become quite fashionable in our large cities to send dyspeptics to the sea-side for a part of the summer; this practice, rendered easy by the railroad, is undoubtedly beneficial to the majority of invalids, whether children or adults, but in its application to nervous patients it is injurious. However much benefit feeble and scrofulous children, and the debilitated in general, of both sexes, may derive from a sojourn at these watering places, our neuropathic and hysterical females, whose dyspeptic troubles are apt to take on the gastralgic form, seldom get anything but harm from sea-bathing. I have seen many a nervous affection aggravated by this treatment. The excitant action of sea baths overpasses the end in view, and children who before were simply fretful, become unendurable. But it is especially in the case of nervous females that this excitation is the most pronounced. On a former occasion when lecturing on Diseases of the Heart I pointed out to you the injurious influence of sea-bathing on these diseases; bear in mind then that these two pathological conditions, exaggerated neuropathy and cardiac affections, contra-indicate the use of sea-baths.

There is a point pertaining to this question which ought to engage our attention for a moment. What is the influence of baths taken immediately after meals? Are they likely to be attended with grave or even fatal accidents, as some maintain?

This is a question difficult to answer. It is easy to understand that after a hearty meal, and at the moment when digestion commences, immersion in cold water may determine a perturbation on the part of the stomach, and provoke an indigestion which may itself have grave consequences. It is also quite possible that a congestive process going on in the stomach and suddenly arrested, may determine in other organs, and in particular in the encephalon, congestions more or less serious. Therefore I think that it is prudent never to take a cold plunge immediately after eating.

It has been said also that two hours after meals a cold bath can have no bad influence on digestion. Nevertheless at this period digestion is not finished, and moreover it has been shown that one may without inconvenience eat when in the water; the restaurants in the great bathing establishments are vouchers for the harmlessness of this practice. As you see, gentlemen, on this obscure and difficult question contradictory views are held, and I am unable positively to decide: I think, however, that it would be always safer to wait two or three hours after meals before indulging in cold bathing.

Finally the *excreta* have a certain influence in the production of dyspepsia.

We shall return to this question more at length when we take up the subject of symptomatic dyspepsias. I shall show you, then, that perturbations in the secretion of urine and perspiration may be a cause of dyspepsia. I shall also show you how inactivity of the intestine, and accumulation of fæcal matters, may react on the stomach, embarrassing the function of that organ.

Such, gentlemen, are the general considerations which I desired to set forth relative to the hygienic therapeutics of diseases of the stomach. You will, I hope, excuse the great length of this exposition, in view of the capital importance of dietetics and hygiene in the treatment of these affections. You know that I consider as one of the most useful points in clinical therapeutics, the possibility of grouping together in the treatment of disease therapeutic and hygienic means, and you see here how great value I attach to the latter.

I have, perhaps, entered rather minutely into details which may seem to you to be trivial, but when you are in active practice you will see the influence which these little things have in the treatment of affections of the stomach. Nothing, in fact, ought to be considered as trivial to the physician which has to do with the welfare of his patient, and he should be as particular in inculcating the little hygienic rules as in ordering active medicinal substances.

But before beginning the study of the dyspepsias properly so called, it is necessary to say a few words concerning the mechanical methods of treatment which are applicable to a large number of gastric affections, I refer to "lavage and gavage" (or stomach washing and forced feeding.) This subject I shall take up in the next lecture.

NOTES TO LECTURE V.

[1] Gymnastic exercises are divided into three groups: 1, active exercises, in which the movements are voluntary; 2, passive exercises; 3, mixed exercises, in which are concerned both volition and an external force.

Active exercises may be divided into free movements and restrained movements.

Free movements, which are made under the influence of the will without the aid of apparatus, may be executed by one person alone or by several persons in concert; in the latter case they constitute general gymnastics.

They consist in movements of the head, (flexion, extension, rotation and lateral inclination); movements of the trunk, (flexion, forward and backward rotation); movements of the upper limbs; arms, (adduction, abduction, rotation, projection forwards and backwards); forearm and hand, (pronation, supination, etc.); movements of the lower limbs; thigh, (flexion, extension, adduction, abduction, rotation inwards, rotation outwards); leg, (flexion and extension); foot, (flexion, extension and abduction); finally, divers general movements; walking, running, leaping, dancing, swimming, wrestling, boxing, etc. The restrained movements are executed with the aid of movable apparatus, which may be of a portable kind, such as dumb bells, clubs, iron balls with rope sling, leaping poles, etc., or non-portable, such as the "portico," rope ladders, trapezes, the arm swing, the windlass. Other movements, still more restricted in their range, are made by means of fixed apparatus, such as parallel bars, fixed ladders, wooden horses, etc.

Among the passive exercises, we should class carriage riding, yachting, massage, and faradization.

Lastly, the mixed exercises consist in movements which are both voluntary and involuntary; horseback riding, swimming, the velocipede, and the Swedish gymnastics.

It depends on circumstances whether these movements shall be hygienic or not; in fact, if it is useful to take moderate exercise after meals, all severe exertion should be interdicted, and everything which greatly taxes the muscular powers should be reserved for the morning or evening, when active digestion is not going on.

The usage of gymnastics as a kind of treatment for nervous diseases, such as chorea, hysteria, epilepsy, and in the treatment of scrofula, was long since introduced into the hospitals, and it was in 1847 that Laisné instituted his first medical gymnasium at the Hôpital des Enfants, then at the Salpêtrière.

The clinical attendant causes the nervous patient, whether child or adult, to perform marches, racing, and the various manœuvres and movements indicated by the professor, and during their execution all sing a song whose rhythm corresponds with the prescribed movements. By these means the general health is rapidly improved, and certain nervous affections even cured; chorea, for instance, as the report of Blache on this mode of treatment has demonstrated.

These are the conclusions of this report (Mém de l'Acad de Méd., vol. xix):

1. None of the modes of treatment applied to St. Guy's dance (chorea) has given so great a number of cures as gymnastics, whether used alone or associated with sulphur baths.

2. Gymnastics may be employed in almost all cases without the liability to interruption by the contra-indications which at each step present themselves in the usage of other modes of treatment.

3. Cure is obtained in about the same number of days as that demanded by the employ of sulphur baths; but it seems more permanent, and the sedation shows itself from the first days.

4. At the same time that the disorder of movements disappears, the general health of the children improves in a remarkable manner, and the little patients go out, not only cured of their chorea, but also of the anæmia which so often acçompanies it.

5. Gymnastic exercises which one might at first thought regard as perilous, especially in regard to the state of the children who engage in them, offer no real danger, and may be practised in in any season, an advantage which cannot be claimed for the baths.

6. It is very important to divide the exercises into two categories: 1, passive exercises, which may be employed alone in the period of the affection when the will has no control of the muscular powers; 2, active exercises which the children execute of themselves, with or without the aid of apparatus.

[2] Pierre Henry Ling was born November, 1776, and died in May, 1839. He has had followers in all parts of Europe.

According to Ling, muscular movement energizes the arterial or centrifugal circulation, at the same time that it promotes the nutrition of the parts which execute the movements, and this in a proportion determined by the amount of the exercise. One may by regulated exercises improve the nutrition in any muscular groups he chooses. Every organ which is put into action, acts upon all the other functions of the economy. Muscular effort, for instance, fixes the chest in inspiration, slows the circulation of the pulmonary artery, and consequently that of the large veins which empty into the right heart, augments the venous tension, congests the cerebrum, etc. Strong inspirations followed by expiration have the opposite effect. The muscles in compressing the arterial branches during their contraction, cause a reflux of blood to remoter regions in quantity proportioned to the capacity of their capillary system. Hence the vertigines, the cerebral congestions, the palpitations which after each active exertion are experienced by persons subject to these sorts of affections. When the contraction ceases, the blood flows back into the capillary network of the muscles.

To obtain these effects, Ling has instituted three orders of exercises. In the first, the movements are simply active; they are movements executed by the patient himself; standing, walking, leaping, the ordinary gymnastic exercises, and the partial movements of the body. In the second order, which Ling calls *order of active passive movements*, the patient makes a movement which the gymnast resists; in the third order, that of *passive active movements*, the gymnast compels certain displacements of the members against which the patient struggles in causing his muscles to contract.*

'These are the divers manipulations which Nicander of Stockholm borrows from the Swedish *kinesotherapy* to combat the affections of the digestive passages, and in particular, constipation and dyspepsia:

(*a*) Passes along the colon, either its whole extent, or a part. These passes are made with the palmar surface of the hand, in a direction corresponding to the course of digestion. The subject occupies a position which allows the abdominal muscles to be relaxed.

(*b*) Passes in the transverse direction.—Both hands of the operator are employed; these are made to meet in the middle line of the abdomen, being laid flatwise. They are then made to pass back and forth in opposite directions, pressure being used according to the case. The abdomen is similarly stroked longitudinally from the ensiform cartilage to the pubes.

(*c*) Cyclical passes.—These are made after the same principles.

(*d*) Pressures in a transverse direction.—In these manœuvres the outspread hands of the operator are made to thrust back and forth the patient's intestines, *i.e.*, from left to right and from right to left.

(*e*). Circular pressures.—These are made in a direction corresponding to that of the digestion.

(*f*) Shocks of the abdomen.—The hand of the operator being placed on the abdomen impresses on the intestinal mass energetic and regular shocks.

(*g*) Pressure over the solar and sacral plexuses is also recommended.

These are the manœuvres which M. Nicander employs against constipation, and which, he says, have the same effect as rectal douches.

The subject stands with his arms extended in front of him, and fixed to a support; four operators surround him, and push his pelvis now backwards, now forwards, so that the anterior abdominal muscles are sometimes on the stretch, sometimes relaxed, while the assistants exercise a slight degree of pressure on the abdomen at regular intervals.†

'"Six weeks is ordinarily the time requisite to prepare a person for a wrestling or boxing match, or a race. Begin by taking a blue pill at bed time, and a 'black draught' in the morning, and repeat this medicinal regimen twice the first week. After suitable purging take up your training quarters. Choose a convenient habitation some distance from a populous city; let your exercises be moderate at first, to be gradually in-

* Trousseau and Pidoux, Traité de Thérapeutique (Constantin Paul's edition), t. ii., p. 125.

† Soc. de Hydrologie, Séance of December 22, 1878.

creased from day to day as your forces increase. The subject who is under training must rise early (at 6 o'clock A.M.), wash himself with care, then take a raw egg in half a glass of good sherry, then walk two miles before breakfasting (at 10 o'clock). The exercise must always be proportioned to the individual's condition. The more fleshy he is, the more severe must be his tasks. After breakfast he will walk two miles, intercalating now and then little runs of three hundred yards at the top of his speed, and ending in a race of a mile to bring on profuse sweating, when he will dry himself by brisk rubbing with a towel. Then he will resume his clothing and walk leisurely a little while. If thirsty he will drink a little pale sherry and water. About 11 o'clock he will take a few swallows of good port, or half a pint of old ale. He ought constantly to have in his pocket a hard biscuit to prevent hunger. He will often avert thirst by chewing a piece of dried biscuit; this is better than drinking much liquid, which leads to perspiration and makes him 'short winded.' He will dine at 1 or 2 P.M., and take a moderate exercise, such as sparring, pitching quoits, or swinging dumb bells (4 lbs. weight). He must then take another walk of a mile in length. If the fatigue induces sleepiness, he may nap one hour. The last meal must be at 4 o'clock, five hours before bed time. He must abstain from smoking. All spirituous liquors (except the small quantities permitted as before mentioned) must be proscribed, also soups, milk, stewed meat, and seasoned food. Lean meat must be eaten with plain bread and only enough in quantity to supply the bare necessities. The bowels must be kept regular once a day, (after breakfast). If there be more than one stool a day, too much exercise is being taken, and the amount must be diminished, or there must be a slight change in diet. The party must weigh himself every day, and when he shall have attained the desired weight, he must limit his exercises to walks of little length, without neglecting the short runs to keep him in wind. He must take care not to wear damp flannel, must rub himself thoroughly after severe exertion, and change his clothes after perspiring freely. All dangerous kinds of exercise should be interdicted."*

[a] Notwithstanding the contrary results obtained by Frerichs, the experiment of Claude Bernard is considered as scientifically exact; it consists in the injection into the veins of a hare of lactate of iron and ferrocyanide of potassium; these two salts when put in contact, will produce Prussian blue only in an acid medium. In the stomachs of animals under experimentation, the blue coloration of the mucous membrane was only apparent on the surface; the tubular glands presented no change of color.

Charles Richet having taken the mucous membrane of the stomach of a conger eel, reduced it to a pulp, and treated it with water, separated the infusion into two parts, which he placed in flasks in a stove at a temperature of 40°C. Into one flask he passed oxygen gas for two hours; at the end of this time having measured the acidity of both liquids, he remarked that the liquid which had been treated with oxygen had a total acidity of 0.49, while the other indicated only 0.28.

With the gastric juice of other animals the result was the same.

Moreover, according to Mathieu, the quantity of oxygen contained in the blood diminishes at the moment of digestion.†

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* G. Boisson, Treatise on Training, (Thèse de Paris, 1877).

† Mathieu and Urban, The Gases of the Blood, (Arch. de Phys., 1874, p. 712); Charles Richet, On the Gastric Juice, p. 76.

[a] Hydrotherapy may have an important rôle in the treatment of dyspepsias, but as Bene-Bardi remarks, it must be employed methodically, and the methods put in use must be conformed to the lesion which it is desired to combat. Therefore in dyspepsias due to gout, to rheumatism, to scrofula, you must associate heat and cold, and in these cases, dry or wet heat is indicated before the cold applications. In the symptomatic dyspepsias, it is against the primary affection that the hydropathic treatment should be directed. Is the dyspepsia accompanied with phenomena of excitability, you should employ tempered immersions, lotions, affusions, and warm douches, wet wrappings of short duration. Does the dyspepsia present itself with signs which denote exhaustion of the forces of the entire organism? you have an indication for tonifying applications, such as cold affusions, frictions with a wet cloth, shower baths, jet douches etc., which constitute, according to Bene-Bardi, the most efficacious procedure when it can be borne by the patient. In certain cases of painful dyspepsia, you will derive advantage from the application over the epigastrium of Chapman's hot-water bags.

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LECTURE VI.

ON LAVAGE AND GAVAGE OF THE STOMACH.

(STOMACH WASHING AND FORCED FEEDING).

SUMMARY.—Lavage of the Stomach—History—Operative Procedure—The Stomach Syphon—Its Introduction—Liquids to Employ in Lavage of the Stomach—Topical Applications to the Gastric Membrane—Quantity of the Liquid—Stomach-pump—Gavage or Forced Feeding—Alimentary Powders—Meat Powders—Farinaceous Powders—Œsophageal Tube of the Author.

GENTLEMEN: Lavage of the stomach is a method which gives astonishing results in many gastric affections, and I am to-day one of the most earnest advocates of this practice. In the wards of my hospital you may daily see beneficial results, and sometimes indeed veritable resurrections obtained thereby. If I express to-day my opinion on this subject with so much positiveness, it is because my first tentatives made subsequently to the labors of Kussmaul were not satisfactory, but now, thanks to the discovery of Faucher, all inconveniences have been removed, and we are enabled to utilize the method to the greatest advantage.

I have been reproached for changing my mind, but there is, as yet, nothing pertaining to therapeutics so absolutely settled as to exclude all future progress, and I have always been ready to welcome any improvement in modes of treatment, especially when they are the result of thorough experimentation, and if I have had occasion to alter my views respecting lavage of the stomach, it is because I have tried the new methods and found them practical and advantageous.

The idea of removing liquids from the stomach is of French origin, and must be credited to Casimir Renault. Another Frenchman, Blatin, in 1832, taught the utility of washings of the stomach. It must be admitted, however, that it was Küssmaul who first systematized this practice and gave it a definite place among the resources of our profession.[1]

It was in 1867, before the Congress of German physicians held at Frankfort on the Main, that Küssmaul first made known the results of his clinical experiments with the stomach tube. He employed the œsophageal sound, to which he adapted a suction and force syringe, and it was by virtue of this apparatus, called stomach-pump, that liquids were injected into or drawn from the stomach. The inconveniences of this instrument were these: the introduction of a rigid tube was painful, moreover the extremity of the sound irritated the walls of the stomach, so after several trials of Küssmaul's pump, I abandoned this method. But the discovery which Faucher made in 1879, and almost at the same time, Oser, in Germany, removed these difficulties.

This discovery consisted in the passage of a soft and flexible tube into the cavity of the stomach, and in the application of the physical theory of the syphon to the introduction into and removal of liquids from this organ. From this date I have multiplied the applications of the stomach-syphon, and one of my pupils, Dr. Joseph Lafage, has comprised in his excellent thesis on the treatment of dilatation of the stomach by "lavage," a great number of observations, and for ten years past I have so frequently practised stomach-washing, and with so much success, that I have had reason to felicitate myself for the part which I have taken.

How is lavage of the stomach performed? The answer to this question involves a description of the instrument used, the manner of using it, and the liquids employed for cleansing the stomach.

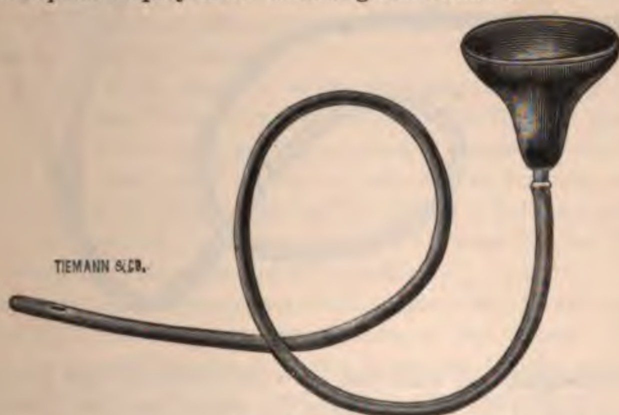

FIG. 1.

The tube Faucher is of flexible caoutchouc, one metre and a half long with an index on one side, so that you may know the depth in centimetres to which the tube has penetrated. The tubes are of three sizes, No. 1, 2 and 3, the diameter of the first being eight millimetres, the second, ten millimetres, the third, twelve millimetres; to these tubes is attached a funnel.

In purchasing a tube Faucher, you should select one as smooth as possible and with some degree of stiffness, so that you may easily be able to make it enter the stomach by successive pushes (such tubes as Debove has recently caused to be made); as for the funnel, it should be of glass, so that you may watch the descent of the liquid.[2]

These tubes have lately undergone great improvements, without yet fully attaining the ideal of a hollow and resisting, yet quite supple tube.

One of my colleagues, Audhoui, has constructed a stomach tube on the principle of the double catheter, (two flexible syphons glued together), while my friend Debove makes two parts of the syphon, and introduces the œsophageal part by the aid of a stylet, which gives stiffness and resistance to it. These improvements have not come into general use, in fact the simple tube may, by skillful management, give you all the results which you desire.

I advise you, when you attempt for the first time to introduce the syphon, to use tube No. 1 (taking care to select one with the requisite degree of stiffness); then, when your patient is used to a tube of this size, you can easily succeed with a larger one.

The introduction of this instrument can readily be effected in this manner: Place yourself in front of your patient. Make him open widely the mouth and protrude the tongue. Pass in the tube over the

FIG. 2.

back of the tongue, and when you have the extremity well in the throat, as far as the base of the tongue, make the patient swallow, and while the movements of deglutition are being performed, push on your instrument into the œsophagus. When once you have gained the first part of the œsophagus, you can easily carry onward the tube, by a succession of pushes, and with considerable rapidity.

Some have proposed to render the introduction of the tube easier by greasing it with oil, vaseline, or glycerine. Fatty substances leave a disagreeable taste in the mouth; I am myself in the habit of simply dipping the tube in Vichy water, or what is better still, in milk.

As soon as you have made the tube penetrate to the proper depth, as indicated by the salient index on the outside of the syphon, you annex the funnel, fill it rapidly with liquid; then, as soon as you see the liquid disappear in the inferior portion of the funnel, you lower it instantly, converting the tube into a syphon, and causing the liquid contents of the stomach to flow into the pail which you have placed between the feet of the patient.

During the introduction of the tube some dyspnœa is manifested on the part of the patient. The eyes are injected, the face turns red, and the patient pretends that he cannot breathe. Insist, then, on the patient making full respirations during the operation.

To the dyspnœa we must add nausea and vomiting among the unpleasant accompaniments of the operation; this nausea is manifested as soon as the tube enters the œsophagus, or when it reaches the stomach. In some very sensitive individuals it is impossible to penetrate to the back of the throat without inducing vomiting. You can readily calm these reflexes by bromide of potassium; in fact, it is my custom to give bromide internally, and apply it locally three or four days before attempting the first lavage of the stomach.

It is more difficult to avoid the irritation provoked by the presence of the tube in the stomach. The vomiting, however, which ensues from this cause, is more infrequent and can generally be prevented by introducing immediately into the gastric cavity a little water. In this way you will separate the walls of the stomach from the end of the tube and will avoid irritating the organ.

The tolerance of the pharynx, of the œsophagus, and of the stomach is readily obtained, and I can affirm that always after three or four sittings, patients support without any inconvenience the presence of the tube. In a very short time they can effect the introduction of the tube themselves, and in the case of the greater part of my patients, both in private practice and in the hospital, I leave to the patient himself, after the fourth sitting, the entire performance of the operation.

At the same time there are two circumstances which often present an insurmountable obstacle to the introduction of the syphon. These are, first of all, œsophageal spasms in certain hysterical females, spasms which it is often difficult to overcome, even with a rigid instrument; secondly, ulcerations of the epiglottis and the posterior part of the larynx, which frequently render the passage of the tube very painful. With the exception of cases of this sort and such mechanical obstacles as cancer of the œsophagus, I have never found patients rebellious to the introduction of the Faucher tube.

What kind of liquids and what quantities is it advisable to introduce? Ordinarily we make use of some alkaline water, such as Vichy, or Vals; or it may be plain water, with one half drachm to the quart of bicarb. soda. I sometimes use, after the German practice, water containing one and one half drachms, to the quart of Glauber's salt.

In certain cases it is necessary not only to wash out the stomach, but also to disinfect it. In other cases it is necessary to alleviate cramps and pain seated in the stomach; in still other cases there are hemorrhagic tendencies to combat; hence different medicated solutions are indicated.

Among the antiseptic liquids I particularize resorcin and boracic acid.

Andeer is very fond of resorcine, and I have myself made numerous trials of this medicinal agent in chronic gastritis. Solutions of resorcin, as dilute as 1 per cent., are irritating, but they procure a complete disinfection of the contents of the stomach; therefore in using this medicament I take care to make the solution very weak (*i.e.*, not more than five grammes to the quart). Boracic acid in the same proportion is also an excellent disinfectant.[2]

For the pain in the stomach the best solution to employ is the milk of bismuth. To a pint of water add five drachms of the sub-nitrate of bismuth; stir constantly before introducing this mixture into the stomach, and when you have caused it to enter the gastric cavity, let it remain there for several minutes, that the bismuth may have time to become deposited in thin layers over the mucous membrane. To the milk of bismuth you may add chloroform water and the carbon bisulphide water, solutions which are markedly anæsthetic to the gastric mucous membrane. As for the hemorrhages, the best remedy with which to combat them is a weak solution of perchloride of iron; a tablespoonful of the liquor fer. perchlorid. to the quart of water. All these constitute the topical applications or "dressings" on which you can best rely.

As for the quantity of liquid to use, this depends on the degree of dilatation and on the tolerance of the stomach. Some patients will bear two, three, four, and even five quarts; in the case of others a pint even will induce efforts at vomiting. You will then have to determine by trial the quantity which the patient will tolerate. However sensitive may be the patient's stomach, it is a good rule to continue the washing process, till the liquid which issues from the buccal end of the syphon is perfectly limpid and clear.

There is generally little difficulty attending the removal of liquid by the syphon; it is possible, however, that some solid particles of food in the stomach may get impacted in the eyes of the instrument so as to stop them up. You can generally clear these out by letting a little more liquid run through the tube into the stomach. In other cases (especially where there is great dilatation) your tube may bend on itself so that its lower extremity is applied to the upper part of the stomach; this may happen in ordinary practice from having introduced the sound too deeply. In these circumstances the syphon fails to work, for obvious reasons. You have only to withdraw the tube a few inches to overcome the bend and bring the open end in contact with the liquid. You can aid the evacuation of the stomach by pressure over the abdomen, and by making the patient cough, thus obtaining the expulsory contractions of the diaphragm.

Is the syphon sufficient in all cases of dilatation of the stomach? Yes, in the immense majority of cases. When, however, the dilatation is enormous, and the stomach is full of putrid liquids, as sometimes happens in cancer of the pylorus, it is necessary, in order to effect thorough cleansing, to employ the stomach pump, which injects the detergent solution with more force, and enables it better to reach all parts of the stomach. I am in the habit of using the Collin pump in these circumstances, which is a good aspirating and force syringe, and is easy of adjustment.

To wash out the stomach and disinfect its contents, to apply suitable medicated dressings—such are the results which you may obtain from the syphon. But this is not all. You can by this method feed the patient, and practise what Debove calls superalimentation, what Mesnet has denominated artificial alimentation, and what I designate under the commonplace term, "*gavage*" (forced-feeding).

It was Debove who first conceived the happy idea of applying the tube of Faucher to the alimentation of patients. The results which we have together obtained have stimulated us to continue our first essays, and since the first communication of Debove, in November, 1881, to the Medical Society of the Hospitals, this method has continued to undergo improvements.[4]

Debove was the first one, moreover, to make use of meat in the form of powder in this forced alimentation, and to obtain good results from this practice. Formerly we employed a mixture of raw meat and eggs, beat up in milk, but despite all the care that was taken in mincing this raw meat, the mixture was far from being homogeneous, and quite often particles of meat in suspension would stop up the tube, and prevent the further descent of the liquid food; and it was found necessary in these cases to use tubes of pretty large diameter. At the present day we get rid of these inconveniences by using alimentary powders.

Of what do these powders consist? They are of two kinds: powdered meat and farinaceous substances cooked and reduced to a fine powder. The powder of meat is obtained by drying the minced fibre of meat and raising the temperature to 120° C.; then reducing it to an extremely fine powder. At the present time, since our communications on the subject, a great number of manufacturers fabricate these meat powders, and you will find them in commerce under the denominations of powders of pure meat and powders of the fillet of beef. The first, which are composed of horse flesh (a kind of meat, by the way, very nourishing), are of gray color, and their odor recalls that of duck's liver; these are the least expensive. The second, whose price is much higher, for it takes six kilogrammes of fresh meat to obtain one of the powder, are of reddish color, and have the odor of roast beef. Both are reduced to an almost impalpable powder, and it is this very finely pulverized condition which, by enabling each molecule of meat to be attacked on all sides by the gastric juice, explains to us how it has been possible with this method to cause such enormous quantities of these powders to be absorbed. We find in this fact a direct illustration of what I said to you in one of my previous chapters, in reference to the influence of the molecular state of bodies on their digestibility. We find also here another confirmation of the experiments of Schiff, which go to show that meat is one of the best peptogenous substances; in fact, under the influence of these powders of meat, you will see stomachs the most inactive and feeble recover their functions and the appetite return.

The farinaceous powder consists of lentils, which furnish a flour of a very nourishing and highly azotized character. These farinas were originally used in their raw state, then Debove, having found that cooking augments their digestive properties, caused them to be cooked before being reduced to powder, and it is under this form of farina of cooked lentils that we generally administer it.

Tanret has advised to cause the lentils to germinate before using them, and Perret has made the powder out of malted lentils. Germination, in fact, favors in part the transformation of feculent matters, and in this way aids their digestion. You can in the same way utilize the farina of Indian corn, which is very rich in fatty materials, and the mixture of this powder with the powder of meat, either in equal proportions or as two parts of meat to one of farina, constitutes an alimentary product very acceptable to even the most difficult patients.

These powders may be mixed in a variety of ways, as may be seen by consulting the thesis of my pupil Robin.

In practicing forced feeding these alimentary powders are incorporated with water or milk, in the proportion of about 200 grammes (between six and seven ounces) to a quart of the vehicle. In mixing the ingredients, be careful to add the milk little by little, so as to make first of all a homogeneous paste with the powder, which slowly undergoes solution in the milk as it is added, and you get in this way a liquid having the consistence and the aspect of chocolate, and which is ready for use.

You see, then, the advantages which these meat powders have over the older preparations made from raw meat; they are much more nourishing in a smaller volume, and much more digestible, and there is no danger of conveying tænia through them to your patient. They are useful dietetic agents when stirred in thin tapioca gruel, or broth; one or two spoonfuls of powder of cooked beef, and a spoonful of farina of lentils, cooked or malted, or if you please torrefied corn meal. Gruels made in this way are very agreeable to the taste, and are well borne.

These are not the only advantages of these powders. They have enabled me to simplify very much the operative procedure when it is desired only to practice artificial feeding, and when washing out the stomach may be omitted. We see, in fact, that while in the case of patients affected with severe gastric disorders, little or no opposition is made to the introduction of the tube Faucher, it is not so with persons not suffering from profound troubles of the digestion, but in whose case forced alimentation is deemed necessary. They are apt to be frightened at the size and length of the syphon, and to such an extent, that thus far the method of Debove has not been popular in the private practice of physicians, however successfully it has been employed in the hospitals.

I have therefore attempted to render the operation less painful, and this is the result of my endeavor. After having verified the fact first taught by Ortille, that in order to introduce liquid substances into the stomach all that is necessary is to place them in the upper part of the œsophagus, I have considerably shortened the tube Faucher, and I have given it a length of only twenty centimetres. Then since the alimentary mixture made with meat and farina is thin and diffluent enough to traverse quite narrow tubes, I have diminished considerably the diameter of the tube, which is now only about the size of a large sized urethral

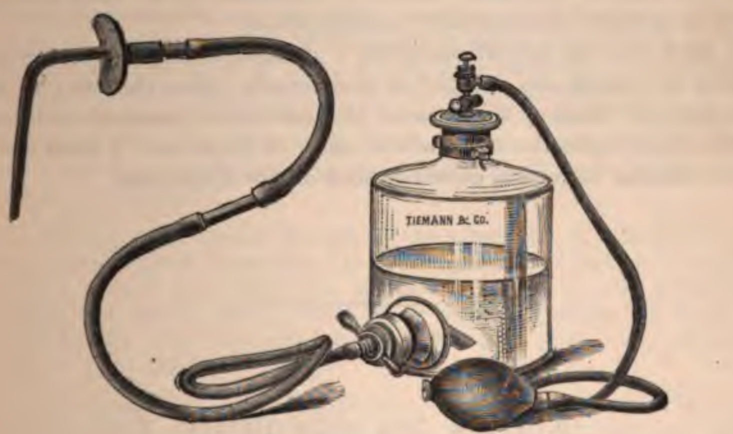

FIG. 3.

sound. Lastly, I have flattened the pharyngeal extremity of the tube so as to render its introduction easier. A whalebone stylet keeps the tube curved, and a large disk placed at the buccal orifice (to keep the patient from swallowing the tube) completes the first part of the apparatus. The second part consists of a glass jar, in which I place the alimentary mixture, in the upper part of which reservoir air may be compressed by means of an India-rubber ball; a long India-rubber tube connects the œsophageal part of the instrument with the glass jar.

You proceed in this manner: With the œsophageal sound, furnished with its stylet, in your hand, you make your patient open widely his mouth, putting out his tongue, as if for a laryngoscopic examination; with the right hand you introduce the tube into the back part of the throat, and cause your patient to execute movements of deglutition, and you withdraw the stylet, taking care that the disk which terminates the tube shall come in front of the mouth; you then place the extremity of the free tube which is attached to the glass jar, into the pharyngeal sound. Then you compress the rubber ball and the alimentary mixture passes from the reservoir into the œsophagus of the patient; you ask him to make efforts to swallow, and slowly and progressively you cause the liquid in the glass reservoir to penetrate the stomach.

You have often seen me perform this operation in our hospital; you have seen the readiness with which patients consent to be fed in this way, and how much they prefer this method to the former, in which the longer and larger tube is used.

Thanks to gavage we see the appetite return, the bodily weight increase, the strength come back, and the facts which Debove has published, and those which I have noted, indicate the great future in reserve for this kind of treatment, which is applicable to all cases where nutrition is at fault, and especially to tuberculosis.

Such are the indications which I deemed it important to present relative to "lavage and gavage" of the stomach. Now that we have studied together the basis of the general therapeutics of stomach affections, we shall enter upon the treatment of each of these, and I shall devote my next chapter to general considerations on the dyspepsias.

NOTES TO LECTURE VI.

[1] Boerhaave was the first to counsel the injection into the stomach of liquids by means of an œsophageal tube; he, however, said nothing of the removal of those liquids. Casmir Renault in 1802 first recommended mechanical emptying of the stomach in cases of poisoning.

In 1810, Dupuytren made a large number of experiments of this kind, and showed the harmlessness and the advantage of mechanical depletion of the stomach. Edward Jukes in England repeated these experiments, and performed one on himself that was of great interest; he took a poisonous dose of opium, and then cleared his stomach by means of a stomach-pump, which he had invented. The instruments used on these occasions were all nearly alike, consisting of a syringe and long œsophageal tube. One of the first stomach-pumps was that invented by Physick of Philadelphia; Read of London also devised an instrument which Sir Astley Cooper adopted; Lafargue in France, used a pipette resembling somewhat the syphon.

Arnold in 1829, Somerville about the same time, then Plosz constructed soft flexible tubes and applied the theory of the syphon to the removal of liquids from the stomach; all these had fallen into oblivion, and it was not till the experimental essays of Oser and of Faucher in 1868, that syphoning out the stomach became current practice.

In 1832, Blatin recommended the employ of an œsophageal sound to whose upper extremity was adapted the canula of a suction pump; he advised washing out the stomach by means of this tube in inflamed states of that viscus. This operation was not, however, put in practice at that time.

In 1867, at the fourth reunion of German Naturalists and Physicians at Frankfort on the Main, Kussmaul made known the results of his method, and it was at once adopted by Wiemeyer, Bartels, Reich, and Liebermeister.

Accidents determined by the suction and force pump of Kussmaul, which was adapted to a rigid œsophageal tube, have often been observed. Thus Ziemssen has seen the mucous membrane sucked into the eyes of the tube and lacerated; hemorrhages have also been noted, and Wiesner records cases of the kind.

[1] Galante has constructed, according to Debove's directions, a tube Faucher which does not present throughout its entire length walls of the same thickness. The inferior part, which is to penetrate the stomach, presents a considerable thickness, and an extremely smooth surface, which permits its easy introduction into the stomach, thanks to the relative rigidity of this tube. The upper part, which remains outside of the buccal cavity, and which is connected with the syphon, is of much thinner and more supple caoutchouc.

[2] Paul Schliep employs for lavage of the stomach: 1, bicarbonate of soda when there is acid dyspepsia; 2, permanganate of potash in putrid dyspepsia; 3, phenic acid when the stomach contains vegetal parasites; 4, boric acid as a disinfectant; 5, tincture of myrrh in atonic dyspepsia.

J. Andeer has used resorcin for disinfectant lavages. He employs two per cent. solutions.*

[3] It was November 11, 1881, that Debove communicated to the Medical Society of the Hospitals the first results of his practice. At the beginning of his experiments he made use of a mixture of 200 grammes of meat incorporated with two litres of milk, to which were added ten fresh raw eggs. He has since then substituted meat powder for this mixture, and by this means in phthisical patients he has obtained a notable improvement in nutrition, as has been manifested by an increase in weight, and in the quantity of urea excreted during the twenty-four hours.

Identical results have been obtained by Dujardin-Beaumetz, and his interne Pinel has recorded these results in the Bulletin Général de Thérapeutique.

This forced feeding has never produced in the hands of Dujardin-Beaumetz and Debove any bad effects. In one solitary instance, however, Desnos had the misfortune to penetrate the larynx and trachea with the tube, and before he was aware of it, a part of the alimentary mixture had entered the bronchi.

* Schliep, Deutsches Archiv. f. Klin. Med., vol. xiii., p. 455. Andeer, Die Anwendung des Resorcins bei Magendben, etc., Bd. II., Heft 2. Dujardin-Beaumetz and Callias, On Resorcin and its Therapeutic Employ, Bull. de Therap., 1881, t. ci., p. 59.)

Broca and Wins have of late given an excellent resumé of the results of forced feeding in phthisis, and various other cachectic states.*

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* Dujardin-Beaumetz, De l'alimentation forcée chez les phthisiques, Bull. gén. de Thérap., 15 Novembre, 1881. Debove, Du traitement de la phthisie pulmonaire par l'alimentation forcée, Bull. gén. de Thérap., 30 Novembre, 1881. Desnos, De quelques inconvénients ou accidents de l'alimentation forcée chez les phthisiques et des moyens de les conjurer, Bull. gén. de Thérap., 15 Janvier, 1882. Pennel, De l'alimentation artificielle chez les phthisiques, Bull. de Thérap., 15 Mars, 1882. Dujardin-Beaumetz, Sur un nouveau procédé de gavage, Bull. gén. de Thérap., 15 July, 1881. Read also the discussions of the Medical Society of the Hospitals of Paris, Sessions of October 28th, December 23d, and April 14th, 1882, also those of the Society of Therapeutics of Paris, Sessions of November 9th, December 14th, 1881, and January 25th, 1882. Mœller, De l'alimentation artificielle des phthisiques, Revue médicale de Louvain, Août et Septembre, 1882, p. 382. Debove et Broca, Du lavage de l'estomac et de l'alimentation artificielle dans quelques affections chroniques de l'estomac, Progrès Médical, 30 Septembre, 1882. Quinquaud, L'alimentation artificielle, Revue Scientifique, 1882, p. 526. Broca et Wins, Recherchés sur la suralimentation, Bull. gén. de Thérap., 1883, t. cv., p. 289, 350, 363, 441, 495, 541. Broca et Wins, Recherchés sur la suralimentation, Bull. de Thérap., 1883, t. cv., p. 289, 350, 363, 441, 495, 541.

LECTURE VII.

DIVISION OF DYSPEPSIAS.

SUMMARY.—The Diseases of the Stomach—The Dyspepsias—Definition—Classification of the Dyspepsias—Buccal Dyspepsia—Stomachal Dyspepsia—Intestinal Dyspepsia—Varieties of Stomachal Dyspepsia—Basis of the Classification—Disorders of the Muscular Coat—Atonic or Flatulent Dyspepsia—Vomiting—Disorders of the Mucous Coat—Putrid, Acid, Pituitous Dyspepsia—Disorders of the Nervous System—Sense of Hunger and Thirst—Gastralgic Dyspepsia—Anorexia—Dysorexia—Heterophagia—Varieties according to the march of the Symptoms—Accidental Dyspepsia—Varieties according to the Age—Dyspepsias of Infancy and Old Age—Symptomatic Dyspepsias—Affections consecutive to the Dyspepsias.

GENTLEMEN: Now that we know the hygiene and the general therapeutics applicable to the treatment of affections of the stomach, we may, in continuing our course, go more deeply into the subject, and take up in their order the divers diseases of the gastric ventricle. I shall, therefore, in the following chapters set forth the treatment of the dyspepsias, of ulcer and of cancer of the stomach.

By far the largest space must be devoted to dyspepsia. I well know how vague and indefinite is this word, and the inconveniences which it presents; and I am quite of the opinion of Brinton, who thinks that in the advances made by clinical medicine and pathological physiology this word dyspepsia is destined to disappear from nosology.

Nothing is in fact more curious than, on surveying the histories of the dyspepsias, to see how this term has served to cover doctrines widely different and opposite; but I must insist that I am not here to give a course on internal pathology, and in the department which I have chosen, namely that of clinical therapeutics, this word may still render us great service. It embraces, it is true, after too confused a manner, all the functional troubles of the stomach, but it enables us, in return, to characterize by a single word a complex symptomatic state which it would be difficult for us to designate otherwise. I shall keep the term, then, despite its inconveniences, and shall endeavor by as methodical a division as possible to clearly define the divers indications and therapeutic applications.

Do not expect great exactness from me in the limits which I shall impose upon my subject; it will often happen that I shall overstep the obscure bounds which separate the functional troubles from real inflammations of the organ; and you will see me include in the same chapter, irritative dyspepsia with inflammation of the gastric mucous membrane; you will hear me speak of gastralgia in the same connection with painful dyspepsia, and you will pardon these seeming lapses from exact nosology, for I shall show you that these distinctions, which are perhaps justified by internal pathology, disappear before the most essential part of clinical medicine, namely the treatment.

Comprehending a great number of different affections, dyspepsia requires division into several heads, and you will see in the various works which have been devoted to this subject, divisions that are more or less complex.[1]

I shall first of all give the basis of the classification which I propose to adopt and I shall endeavor to determine on what physiological data we can establish a methodical arrangement of the different functional disturbances described under the generic name of dyspepsia. You will see, then, as we go on, that the details into which I shall enter are not without practical utility, and that they will enable us to deduce consequences important to therapeutics.

The plan which I am about to trace may perhaps seem theoretical, for it is difficult to find a case which corresponds absolutely to each variety of dyspepsia; generally, in fact, you observe a mingling of types; modifications supervene during the course of the disease, and a patient that at the onset presented one form of dyspepsia presents another a few months later. But I must insist that these divisions have their advantages, and this is why I devote more time to these preliminary considerations than is my wont, for they will facilitate the exposition of the therapeutic means of which the physician may make use in the treatment of the functional troubles of the stomach.

As in the case of every symptomatic aggregate, we ought to study several points in connection with dyspepsia: the seat of the functional disorder; the march of the disease; the state of the patient and the causes that have determined the affection.

Let us examine these different points.

The digestive act is not simple, it is, on the contrary, very complex, while dyspepsia connotes the pathological modifications pertaining to digestion in its entirety, and as this latter comprises three principal parts, the buccal act, the gastric act, and the intestinal act—you see that to each part may correspond a functional disorder to which we have the right to give the name of dyspepsia.

We have, then, buccal, gastric, and intestinal dyspepsias. The first, or buccal dyspepsia, is little amenable to divisions; the latter (intestinal dyspepsia) may be subdivided into *duodenal*, *ileal*, and *ileo-cæcal dyspepsia*.

The functional disorder of the stomach to which the word dyspepsia is most generally applied, is susceptible of numerous subdivisions, and I am obliged here to enter into minute explanations.

In order methodically to classify the various perturbations which the stomach may present, we shall have to take for basis the different constituent parts of the organ and the modifications which the disease imposes on the regular functional performance of the several tissues.

The stomach, for the purposes which now concern us, may be regarded as possessing two coats, the muscular and the mucous; it receives, moreover, blood-vessels and nerves. The functions of these constituent parts may be modified in three different ways; there is either *exaggeration*, *diminution*, or *perversion*. It is on these physiological bases that I shall establish the varieties which stomach dyspepsias present.

Let us commence by the muscular coat, concerning whose office I shall have more to say when I come to the treatment of the atonic dyspepsias. This coat forms, as you know, a complete investment of the stomach, and if we may believe certain physiologists, and especially Leven, it has a preponderant rôle in the functions of that viscus. The muscular tunic has in fact for its office to cause the alimentary bolus to be soaked with gastric juice, and to bring it successively in contact with all parts of the stomach by means of those regular movements called *peristaltic*. We may observe in the functions of this muscular envelope the modifications which we have just mentioned: diminution, exaggeration, and perversion.

The stomach muscle may lose its activity; then the digestion becomes slow, torpid, and little by little the stomach allows itself to become distended under the influence of the paretic condition of its muscular coat; this is the type that I shall describe under the name of *atonic* and *flatulent dyspepsia*.

In other cases the muscular function is exaggerated, the contractions augment in energy, there is a real perversion; sometimes the peristaltic movements are reversed and the stomach rejects its food, this is vomiting; sometimes it is simply a regurgitation of food into the buccal cavity, a sort of rumination called *merycism*. You see, then, that in the functional troubles of the muscular layer modifications may be produced, and that these enable us to establish two varieties of dyspepsia.

Let us now, from the same point of view, study the mucous coat. It is to this that the stomach owes its particular digestive action, by virtue of the gastric juice secretion which has the property of transforming albuminoid substances into peptones.

From the point of view of our classification, we remark that the mucous coat may be considered under two aspects; it contains in fact pepsin glands and mucous glands. The glands of the stomach you know line the internal wall of the ventricle, but if you make an attentive examination you will see that on the level of the great cul-de-sac of the stomach are seated the tubular glands which contain in their interior the corpuscles called pepsin corpuscles, while, on the other hand, in the region of the pylorus the glands are deprived of these particular corpuscles; the first secrete gastric juice, the second mucus. We may, then, establish still another division, according as the disorders have to do with these different glands.

As for the gastric juice, cases are observed in which there is diminution in the secretion, and consequently more or less diminution in the activity of the stomachal digestion. As the gastric juice has the property not only of converting albuminoid matters into peptones, but also, as Spallanzani has shown, of preventing the putrefaction of these substances, you will understand that one of the first signs of this functional trouble will be a putrid odor in the breath, such as is observed in certain cases of dyspepsia. Therefore I shall give to this particular form of dyspepsia, which corresponds to a diminution of gastric juice, the name of putrid dyspepsia.

In other cases it is not diminution that causes the trouble, but excess of gastric juice secretion, which then acquires an exaggerated acidity; the patients experience eructations of alimentary matters, accompanied by a peculiar sensation of burning and heat along the œsophagus. It is this symptom to which has been given the name of *pyrosis*. I shall describe this variety under the name of *acid dyspepsia.*

As for the troubles due to perversion in the secretion, our chemical and clinical knowledge of the gastric juice is not far enough advanced to enable us actually to determine the special and intimate modifications which diseases effect in the nature of this liquid. We refer to the two preceding varieties, putrid and acid dyspepsia, the modifications produced in the constitution of this secretion.

From the point of view of the secretion of the mucous glands, we are at present acquainted with but one modification to which this secretion is subject, and which consists in an exaggerated mucous flux; this excess manifests itself by glairy and pituitous vomiting, so often observed in the course of alcoholic dyspepsia. We may give to this special form the name of pituitous dyspepsia.

I have alluded to the blood-vessels and nerves; the former are so intimately connected with the secretion of gastric juice that we cannot separate the modifications produced in the circulation of the stomach from the disorders which take place in the functions of the mucosa; therefore we shall only concern ourselves with the nerves.

From the point of view of its nervous system, the stomach presents itself under two aspects: first, as an organ receiving important nerves, secondly, as the seat of a special sense, that of hunger and thirst. With regard to the last point, I am well aware that Schiff has furnished serious arguments against this doctrine, and that he has endeavored in his Lessons on Digestion to show by cleverly managed experiments that this sensation ought not to be referred exclusively to the stomach, but to the entire economy.[2]

Despite the opinion of this learned physiologist, I am not yet convinced, and I continue to think (without entering farther into the difficulties of the subject) that the stomach has a predominant rôle in the production of this particular sensation called the sense of hunger and of thirst, and from the point of view of the study of the dyspepsias, I shall refer the disorders which concern this particular sensation to a functional modification of the stomach.

In its relation to the nervous system, digestion presents this notable characteristic, that it is not accompanied with pain, and that for this function to be normal, it must be unconscious. Lasègue, who has lengthily insisted on this fact, has rightly said that from a clinical point of view it is not enough to constitute dyspepsia that there shall be functional troubles of the stomach, the patient must also be conscious of these troubles. This has led Pidoux to say that dyspepsia is a neurosis. But in certain circumstances this neurosis acquires a special acuteness; the patient experiences during digestion pains more or less severe, and cramps. It is to this form that the name of *gastralgic dyspepsia* has been given.

As for the sense of hunger, it may be augmented, diminished or perverted. The diminution of the sense of appetite is a frequent phenomenon; you observe it in most acute and chronic diseases; it is called *anorexia*.

In other cases there is morbid exaggeration of the sense of hunger, which is never satisfied; the patient is always eating; this is what Lebert has described under the name of *dysorexia*, and which is known as *boulimia*.

Finally, perversion of this sense, or *heterophagia*, manifests itself in different ways, described under the names of *pica* and *malacia*. *Geophagia*, which Heusinger has noticed in anæmic negroes who eat clay, enters into this group.[3]

Such are the different varieties into which dyspepsias of the stomach may conveniently be classified, and which in the coming chapters we shall take up in their order.

I have said that the dyspepsias may also be divided according to the march of the affection, and you will, in fact, see certain writers, Chomel and Nonat in particular, range in the group of dyspepsias an acute affection which by its symptoms resembles them, namely *accidental dyspepsia*, or *indigestion*, while they reserve the name of *ordinary dyspepsia* for the digestive disorders which we shall study more particularly in this course of lectures.

Age has also a notable influence on the development of the dyspepsias;

we shall find here also a basis of classification, and we shall have to study the *dyspepsia of early life*, and *the dyspepsia of old age*. I shall devote an entire chapter to the dyspepsia of new-born infants, which you will often be called upon to treat, and concerning which you will want very precise indications.

Finally, the causes of the dyspepsias play a considerable rôle from the point of view of treatment, and we shall see that in many cases if you direct your efforts toward removal of the cause, you effect disappearance of the disease. You will not, then, be surprised if I insist so lengthily on this particular branch of therapeutics, which Professor Bouchardat has so well characterized by the word *etiological therapeutics*. Functional digestive troubles result in fact from a thousand causes; sometimes they take their origin in lesions of the abdominal organs; the liver, the bladder, and the uterus have here a preponderant part, and you will often meet with certain forms described as *hepatic dyspepsia, urinous dyspepsia*, or *uterine dyspepsia;* sometimes the disorders come from an alteration of the blood: the general diseases, the diatheses, gout, anæmia, chlorosis, provoke dyspepsias—these are the *dyscrasic* or *dyshæmic dyspepsias* of Spring. I shall be obliged to return to all these points when I take up the study of the different kinds of dyspepsia.*

Lastly we shall have to consider the accidents consecutive to the dyspepsias, and which Beau described under the name of *secondary and tertiary troubles of dyspepsia.*†

I shall now enter upon the study of each of the varieties of dyspepsia which I have enumerated, and shall begin my next chapter with the treatment of putrid dyspepsia.

NOTES TO LECTURE VII.

[1] Dyspepsia (medical term so vague at the present day) has stood for many different maladies, and has had divers significations according to the times and the writers. Under the names *apepsia, bradypepsia, imbecillitas ventriculi, intemperies ventriculi, concoctio læsa, concoctio debilis, debilitas stomachi, cruditas ventriculi, fermentatio læsa, chyleficatio læsa, gastralgia, gastro-enteralgia, neurosis of the stomach, gastro-intestinal neurosis,* dyspepsia has been studied from remote times. Hippocrates considers it as the consequence of a want of equilibrium between alimentation and exercise; Aretæus, Celsus, Galen, describe certain mal-temperaments of the stomach, dividing them into varieties, such as dry, humid, cold, and warm; J. de Goris speaks of dyspepsia along with the bradypepsia and the apepsia of Galen; Sauvages and Vogel admit numerous subdivisions, (ac-

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* Spring, Symptomatology, vol. i., p. 120.

† Beau, Treatise on Dyspepsia, Paris, 1886.

cording to them anorexia and cardialgia are distinct diseases,; while Cullen regards dyspepsia as caused by atony of the muscular coat of the stomach. Still later Broussais, referring all these diseases to irritation of the digestive canal, substituted gastro-enteritis for dyspepsia. At the same epoch Barras, Dalmas, and Andral, considered dyspepsia as a neurosis. Numerous works, memoirs, and theses have since been published on this subject; among these we may specify the treatises of Valleix, Beau, Chomel, Nonat, Guipon, Willieme, Brinton, Chambers, Fox, Luton, etc., and recently the *thèse d'agrégation* of Raymond and the work of Professor Germain Sée.

Since Sauvages, who admitted so many kinds of dyspepsia, numerous divisions of the disease have been proposed; we shall only give a few of them.

Chomel studies only one kind of dyspepsia, what he calls essential dyspepsia, and he limits his subject to the digestive troubles of the stomach and intestines (stomachal and intestinal dyspepsias). He divides dyspepsias into accidental, temporary (indigestions) and habitual. Among the latter he gives the following varieties: 1, flatulent dyspepsia; 2, gastralgic and enteralgic dyspepsia; 3, boulimic dyspepsia· 4, acid dyspepsia; 5, alkaline dyspepsia and the dyspepsia of liquids.

Nonat, like Chomel, divides dyspepsias into accidental (or indigestion), and chronic or habitual (the dyspepsias properly so called). Under the name of chronic dyspepsia, he describes gastric dyspepsias as: 1, simple gastric or atonic dyspepsia; 2, gastralgic or nervous dyspepsia; 3, flatulent gastric dyspepsia; 4, acid dyspepsia; 5, dyspepsia by irritation.

In the intestinal dyspepsias, he recognizes the following varieties: 1, simple intestinal dyspepsia; 2, flatulent intestinal dyspepsia; 3, intestinal dyspepsia by irritation; 4, duodenal dyspepsia.

Professor German Sée, in his work on the dyspepsias, proposes the following division: 1, glandular dyspepsias; 2, mucous dyspepsias; 3, neuro-vascular dyspepsias; 4, dyspepsias *ab ingestis;* 5, dyspepsias mixed or complex arising from various mechanisms.

According to Professor Gubler (clinical course of 1875), the various forms which dyspepsias present ought, from an etiologial and therapeutic point of view, to be classed in the following way: 1, painful and spasmodic dyspepsia; 2, atonic dyspepsia; 3, catarrhal and saburral dyspepsia; 4, inflammatory dyspepsia.

This is the division which Raymond adopts in his thesis.

According to Leven, dyspepsia is not a functional trouble, but results from irritation of the mucous membrane, an irritation which may spread and affect the divers membranes of the stomach. Germain Sée has aimed to restrict the dyspepsias to simple chemical disorders occurring in the gastro-intestinal secretions. According to him, these affections are *defective chemical operations;* the chemical alteration is the primordial lesion; the other symptoms, such as pain, distention, vomiting, are only epiphenomena of dyspepsia. Lastly, the nervous troubles which ensue are only secondary effects.*

* Rivinus (A.-Q.), De dyspepsia, Erfodia, 1669. Schelhammer (G.-C.), De dyspepsia, Iéna, 1694. Sauvage, Nosiolodia methodica, Amsterdam, 1768. Vogel, Apparatus ad nosologium methodicam, Amsterdam, 1775. Cullen, Éléments de médecine pratique, trad. par Bosquillon, Paris, 1816. Broussais, Examen des doctrines médicales, Paris, 1847. Barras, Traité sur les gastralgies et

[a]According to Longet, hunger is the expression of a general state which manifests itself by a special impression which we refer to the place where it makes itself felt, although in reality it has not its sole seat in this place. In his view, hunger is produced by a modification in the sensibility of the stomach, and it is supposable that this sensation takes its origin in the mucous membrane of that organ, since the introduction of inert bodies into the gastric cavity suffices to appease it.

In his Lessons on Digestion, Schiff passes in review and refutes the various opinions put forth respecting the sense of hunger, and the divers manifestations of this phenomenon. According to this physiologist, hunger does not depend on the state of vacuity of the stomach, since we see daily animals, such as guinea pigs and hares, feel the desire for eating when their stomachs are far from being empty; nor does it depend on the contractions of the empty stomach, for such contractions are impossible in the empty state of that organ, since it lacks the alimentary mass on which to act; and, moreover, the movements of the empty stomach are infrequent and much less energetic than during digestion. Schiff, also, does not admit the hypothesis which attributes hunger to compression of the sensory nerves of the walls of the ventricle, produced by the retraction of the empty stomach; he denies also that the rubbing against each other of the walls of the stomach when void of food, can be the cause of the phenomenon of hunger; and he cites in this connection the instance of certain animals in whose stomachs have been found pebbles and other foreign bodies which seemed to cause no uncomfortable sensations. Beaumont thought that in the stomach during fasting, the glands not being able to evacuate the products of their secretion, the mucous membrane became turgid in consequence and that from this came the sensation of hunger. Schiff rejects this explanation, which does not seem to him to be defensible, since by a mechanical irritation of the mucosa, one can cause the glands to secrete an abundant liquid, and yet hunger does not cease.

The experiments of Sedillot—cutting the pneumogastrics in the horse and tempting the animal to eat immediately after the operation, prove that division of the vagi nerves does not abolish hunger. Moreover one ought not to consider the ganglia of the great sympathetic as the pathway

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les entéralgies ou maladies nerveuses de l'estomac et des intestins, Paris, 1829, 3e édit. Dalmas, Dict. méd. en 30 vol., 1826. Andral, Clinique médicale ou choix d'observations recueillies à l'hôpital de la Charité, 4e edit., Paris, 1869. Beau, Leçons cliniques sur la dyspepsie (Gaz. des hôp., 1859). Beau, Traité de la dyspepsie, Paris, 1866. Chomel, Des dyspepsies, 1857. Nonat, Traité des dyspepsies, 1862. Guipon, Traité de la dyspepsie fondé sur l'étude physiologique et clinique, Paris, 1864. Durand-Fardel, Traité thérapeutique des eaux minérales; Traité des maladies chroniques, t. II., Paris, 1868. Willième (F.-J.), Des dyspepsies dites essentielles, leurs natures et leurs transformations, Paris, 1868. Habershon (S.-O.), Pathological and Practical Observations on Diseases of the Abdomen, etc., 2d edit., London, 1862. Brinton (W.), Lectures on the Diseases of the Stomach, 2d edit., London, 1862. Chambers, Sur le régime alimentaire de la dyspepsie, etc. (Braithwaite's Retrosp., V., 36, 1859). Fox (W.), On the Diagnosis and Treatment of the varieties of Dyspepsia, London, 1867. Luton, Dict. de méd. et de chir. pratiques, 1870. Raymond, Des dyspepsies (Thèse d'agrégation, Paris, 1878). Leven, Traité des maladies de l'estomac, 1879, p. 206. Germain Sée, Des dyspepsies gastro-intestinales (Introduction, Paris, 1881).

of transmission of the sensation of hunger to the nerve centres, since Brunner and Henson have divided the splanchnic nerves, and found that this did not prevent the animals operated on from continuing to eat with an appetite. The same was the case with the hares on which Schiff practiced section of the two pneumogastrics, of the two sympathetics, and extirpation of the cœliac ganglia. Anencephalous fœtuses have lived several days while giving indubitable signs of hunger; we cannot, then, place the centre of the sensation of hunger in a determined part of the convolutions of the hemispheres (despite the well known views of the phrenologists).

From his experiments Schiff concludes that the sensation of hunger is independent of the local state of the stomach. The normal accomplishment of the stomachal and intestinal digestion does not suffice to make it disappear, and it yields only to absorption of digested matters. This explains why the sensation of hunger was so acute and persistent in certain cases, cited by Cabiol, Dionis, Pozzio, and Albin, where the intestine was of abnormally insufficient length; the normal work of digestion was not interrupted, but the digested matters not having time to be absorbed in sufficient quantity, were hurried through the alimentary canal too rapidly, and a certain part was lost with the excrements. Moreover, Schiff has shown that if in famished animals you inject nutrient liquids into their veins, you assuage the hunger of these animals, which are thus nourished without there being any food in their stomachs.

It is the same with respect to thirst. The sense of thirst is not seated in the back of the throat, for complete anæsthesia of the pharynx does not annihilate it in animals. The section of the glosso-pharyngeal and lingual nerves, practiced on each side by Longet, did not prevent the dogs on which he operated from drinking as wont, and resection of the pneumogastrics in the cervical regions in dogs did not provoke the cessation of thirst.

Thirst, therefore, like hunger, according to Schiff, is a general sensation. It is only alleviated by the absorption of water, and Dupuytren has shown that by injecting water into the veins of dogs parched with thirst after long racing in the heat of the day, their thirst was completely quenched.

[1] During times of famine, or sometimes even in the course of long journeys, certain Indian tribes eat an argillaceous earth, containing oxide of iron; they incorporate in this clay, made up into cakes, a little flour and fry it in palm oil. It is not of this kind of heterophagia that we are now speaking, but of that disease observed in negroes, and which Heusinger attributes to the effluvia of marshes, while Hirsch, denying this paludal (malarial) influence, finds its principal cause in bad hygiene, in insufficient alimentation, in progressive inanition.

The geophagism which has been observed chiefly in the West Indies, in Brazil, and in Egypt, little by little, in the course of a few weeks or a few months, reduces the subject to a state of fatal marasmus and prostration; rarely the disease lasts more than a year, and it is rarely cured. The disease is preceded by a period of general enfeeblement, lassitude, and anæmia. The mucous membranes lose their color and the face becomes ashy pale; palpitations ensue on the least effort; the patient complains of pains in the stomach and has an intense longing for clay, which he devours with avidity. With this unnatural regimen there are vomitings and gastro-intestinal troubles; the enfeeblement and anæmia make rapid progress; death is generally preceded by general dropsy.

The autopsy shows an anæmic state of all the organs with serous infiltration; the gastro-intestinal mucosa is pale; the mesenteric glands are ordinarily tumefied; the spleen is shrunken and small, the liver and heart enlarged.

LECTURE VIII.

ON PUTRID DYSPEPSIA.

SUMMARY.—Putrid Dyspepsia—Its Symptoms—Putrid Gastric Fermentations—Organic Alkaloids—Leucomaines and Ptomaines—Their Toxic Action—Clinical Processes to Determine the State of the Secretion of the Gastric Juice—Stomach Explorers—Sponges—Lavages—Tests of the Acidity of the Gastric Juice—Reagents—Tests of the Digestive Power—Method of Leube—Therapeutic Indications—Pepsin—Mode of Preparation—Amylaceous Pepsin—Elixir of Pepsin—Glycerole of Pepsin—Peptogenous Substances—Acid Medication—Ptisans—Carnivorous Plants—Dietetic Rules of Alimentation—Regimen—Hydrothermal Treatment.

IN the previous lecture I based my division of the dyspepsias on the disturbances provoked in the different functions of the stomach, and I showed you that the mucous membrane, as well as the muscular coat, might be pathologically modified in three different ways: there may be abolition, exaggeration, or perversion of function.

Without stopping to give you a description of the structure of the mucous membrane of the stomach, which has been a part of your anatomy course, I will pass immediately to the study of the functional troubles which this mucous coat, considered as the secretory organ of the gastric juice, may present. These disorders are of two kinds: diminution or exaggeration of the function; as for the troubles that are characterized by perversion of this secretion, although such perversion doubtless exists, we are not warranted in constituting thereof a special group, our chemical and clinical knowledge of the gastric juice being so imperfect.[1]

I give the name of putrid dyspepsia to the functional disorder arising from the putrefaction of substances introduced into the stomach. This putrefaction has two sources: either it results from the diminution of the secretion or digestive power of the gastric juice, or else from too prolonged a sojourn of food in the stomach in certain dilatations of that organ.

Let us examine the first of these causes.

The diminution of the secretion of gastric juice manifests itself by symptoms naturally dependent on absence of this liquid, and consequent non-peptonization of azotized aliments introduced into the stomach, which readily undergo putrid fermentation. Whether it be the acid of the gastric juice, rather than the pepsin, as Charles Richet thinks, which opposes putrefaction, it is not the less true that the fact signalized by Spallanzani is correct, and that the gastric juice prevents albuminoid substances from becoming putrescent. The principal symptoms of this putrid dyspepsia are as follows:[2]

After having eaten, especially if the meal be composed of azotized substances, the patient experiences a sensation of oppression, of a load in the epigastric region; his meal does not digest, in a word, he suffers the discomfort of a foreign body in the stomach. Several hours after the ingestion of aliments, colicky pains are felt, of greater or less intensity, which indicate that the alimentary matters have at last passed the pylorus and entered the intestine. During the entire period of stomach digestion, the breath exhales a more or less fetid odor, and eructations of sulphuretted hydrogen ensue, whence comes the name of *sulphuretted dyspepsia*, which Bouchardat has given to functional stomach troubles of this kind.

You have, moreover, lately seen in our wards a patient who presented in a high degree this special symptom; it was the case of a man affected with atonic and putrid dyspepsia with dilatation of the stomach. We gave him raw meat to eat, and some time after the repast his breath exhibited in a striking manner the cadaveric odor of meat undergoing putrefaction.

With these symptoms are sometimes associated energetic contractions of the stomach, which produce vomiting; in other cases there is muscular paresis, and to the sum of the symptoms to which I have given the name of putrid dyspepsia, are joined those which characterize diminution of the contractility of the muscular layer. It is this paretic condition which distinguishes the second group of putrid dyspepsias, and in which we see enormous dilatations of the stomach—from whatever cause—resulting in the fermentation of substances too long contained in that viscus; I shall describe these cases at some length when I come to the chapter on Atonic Dyspepsia.

Whether it be determined by the non-secretion of gastric juice, or by the abnormal fermentations which aliments undergo that accumulate in these dilated stomachs, this form of dyspepsia has acquired of late a considerable importance, and you will see as we go on that Bouchard has based on these putrid transformations of foods a new medical doctrine.

Since Selmi showed us in 1876 that there exist cadaveric alkaloids, to which he gave the name of ptomaines, and especially since Armand Gautier, by his brilliant researches penetrating more deeply into the question, established the important fact that the living animal cell as well as the vegetal cell produces alkaloids; since, moreover, the labors of Bouchard have proved that the economy incessantly generates alkaloids which are eliminated by the divers emunctories, and the toxic action of these divers alkaloids has become known, it has seemed more and more necessary to antagonize these processes of putridity, and you will see that *we are able* to do this by special therapeutic agents.[3]

But let us return to our subject and study that form of putrid dyspepsia determined by the non-secretion of gastric juice. The symptoms which characterize it are familiar to you all, and result, as you know, from the presence of azotized substances which, not being transformed into peptones, act after the manner of foreign bodies, and produce that sensation of oppression and of weight of which dyspeptics complain. As for the colics and intestinal troubles, they are explained by the irritation occasioned by these undigested substances which pass into the intestine, to be later digested by the pancreatic and intestinal juice, or to be finally expelled without having undergone any modification.

By the side of this putrid dyspepsia, characterized by non-secretion of gastric juice, we must place the functional disturbances due to modifications effected in the gastric juice itself.

In the foregoing lectures, I have insisted on the necessity of the union of the acid with pepsin in order to effect peptonization, and I have pointed out to you the part played by these two agents, acid and pepsin, in the digestion of proteinous matters. The gastric juice may lose a part of its acidity, and this entails diminution of the activity of the digestive process. It is this state that Chomel would designate by the rather strange appellation of *alkaline dyspepsia*, and which we might more fitly describe as *dyspepsia due to insufficiency of gastric juice*. It has the same symptoms as putrid dyspepsia, the odor of the breath is less fetid, however, and commonly the local or direct symptoms, as Luton observes, amount simply to a sensation of weight and discomfort in the stomach during digestion.

This diminution of the acidity of the gastric juice depends on several causes. Bouchardat attributes it largely to insufficiency of the excretion of urea by the kidneys; and elimination of this excrementitious principle by the mucous membrane of the stomach and its transformation into carbonate of ammonia, which at once neutralizes the acidity of the gastric juice.*

Gallard assigns the dominant rôle to excess of the sudoral secretion; in his view, too abundant acid sweats cause a diminution of the acidity of the gastric juice, and as proof, he alleges this fact, that dyspepsia from lack of acidity of the gastric juice, affects, as a rule, individuals who are obliged to live in an atmosphere of high temperature. This writer has applied this conception to the explanation of other dyspepsias, such as those occurring in persons who take too violent exercise after meals, or who live in places that are overheated, and those who are subjected to forced marches, like soldiers, or to exhausting labor, like farmers in harvest time.

But you will ask how can we recognize this diminution in the acidity of the gastric juice? Thanks to the researches of the German physicians,

* Bouchardat, Hygienic Treatment of Dyspepsias, Bull. de Thér. t. xcvi., p. 152.

and in particular, to those of Leube, we can to-day ascertain by clinical processes both the diminution of the acidity of the gastric juice and its digestive activity, and these processes are now so well known and so much in vogue that at the Carlsbad stations, all the patients affected with stomach disorders undergo these examinations before taking a course of the waters. To ascertain the acidity or digestive power of the gastric juice, you may make use of three means: lavage of the stomach, the sponge method, and the stomach explorer.

A few words about each of these procedures.

In the application of the test of lavage, you introduce into the stomach about a quart of water at the ordinary temperature; you let this water remain a few minutes, then draw it off and use it for the tests which I am about to describe.

The sponge method is the most employed, it is also the most simple. A small sponge, to which is attached a long silk thread, is coated over with gelatine or gum; the patient swallows this sponge while fasting; it is allowed to remain half an hour in the stomach, then withdrawn quickly by means of the thread, which the patient keeps between his teeth. You can conveniently replace the sponge capsules such as are employed in Germany by the gelatine capsules of Lehuby, which are found in all our pharmacies; into these capsules a little piece of sponge with a long silk thread sewed to it is squeezed, and the gelatine cover smoothed over it. The gelatine capsule soon dissolves in the stomach.

It has been objected to this method that we cannot be sure that the sponge ever penetrates deeply into the interior of the stomach; moreover, these little sponges bring up but a minute quantity of the gastric juice; hence it is that I have substituted the stomach explorer for the sponge mode. This explorer, which I here place before your eyes, is fabricated by Galante. It comprehends, as you see (Fig. 4), a stomach sound precisely similar to the tube Debove, having a length of half a metre; in the interior of this tube is a little glass bulb perforated at both ends, to whose lower extremity is attached a little rubber tube to put the bulb in communication with the mucous membrane of the stomach; the narrow upper extremity of the glass bulb is adapted to another rubber tube which is much longer, and ends in a flask-shaped rubber ball similar to that which makes a part of an ordinary spray producer; finally a stout string enables us easily to withdraw the glass reservoir. The mechanism of this apparatus is easily understood. You introduce the tube into the interior of the stomach, then by means of the rubber ball you exhaust the air in the glass bulb, which then admits gastric juice; then you withdraw the sound; when once the tube is out of the stomach, you remove the glass bulb by means of the string, and empty the gastric juice which you have extracted into a watch glass by means of pressure made on the rubber ball. The apparatus is one of the most simple, and its introduction and removal is exceedingly easy, especially in individuals who are used to the stomach tube.

Having obtained from the stomach of your patient, whether by the sponge, the stomach explorer, or by lavage, a certain amount of liquid secretion, you proceed to test it in the following manner:

To ascertain its acidity, clinicians in Germany make use of a full strength solution of tropœoline double zero; the name *tropœoline zero, double zero, triple zero* has been given to certain coloring materials obtained by the distillation of coal tar. In this country you can substitute for tropœoline a substance fabricated by the firm of Poirier and to which is given the name of Orange No. 4.

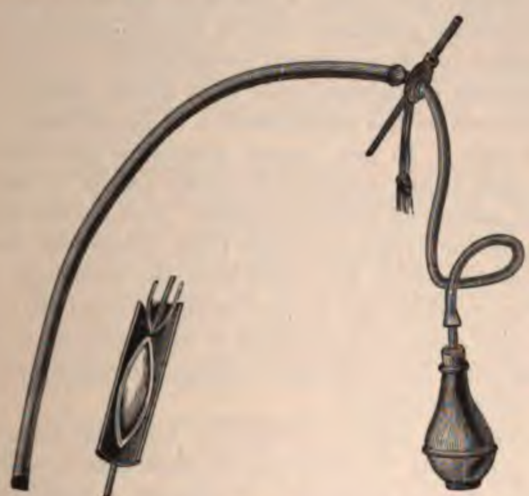

FIG. 4.

Under the influence of acids, and particularly of hydrochloric acid, these solutions, which are yellow, take on a bright red tint. In the case of lactic acid, the tint is orange red. It suffices, then, to compare the tint obtained with that of standard solutions to know the degree of acidity of the gastric juice. The other portion of the liquid serves for practising artificial digestions with little cubes of cooked albumen of a given weight; and here, too, it will be enough to compare the result gained with that which is obtained by means of a standard solution of pepsin, in order to judge of the digestive value of the liquids secreted by the stomach. I need only refer those interested in this subject to the excellent thesis of my pupil, Dr. Deschamps, in which all the details pertaining to these researches are given.*

What is the true value of all these new clinical methods? It is very

* Deschamps, Du Diagnostic du Cancer de l'Estomac, Thèse de Paris, 1885.

difficult as yet to decide positively, the researches are so recent, and their practical utility is still under discussion; I have, however, deemed it necessary to allude to them that you might be informed as to all the modern improvements in the diagnosis of the dyspepsias, and be ready to avail yourself of them when the opportunity presents itself.

Let us now return to the treatment of putrid dyspepsia. The indications to fulfill are to remedy artificially the non-secretion of gastric juice, and to increase the acidity of this juice. We will study successively the means furnished by therapeutics, properly so called, and those which hygienic therapeutics give us. Let us begin with medicaments.

The first indication is fulfilled by the employment of pepsin internally. This is a medicament, gentlemen, whose value has been long under discussion, and while certain physicians extol it without measure in the treatment of dyspepsias, others are utterly sceptical as to its utility.

These differences of opinion result from several causes; and first, because the indications for the administration of pepsin have not been fixed with sufficient care.[4] In fact, pepsin cannot be prescribed indiscriminately in all cases; it can only give favorable results in one special and particular form, namely in putrid dyspepsia. You see now the importance of the divisions of the dyspepsias which I have given you, divisions which may seem to be theoretical, but which have the advantage of indicating the special forms in which this or that medicament may be employed with success. The other cause of uncertainty in the administration of digestive ferments is that these ferments easily undergo alteration, and thus rapidly lose their digestive properties.

But let us return to pepsin. From the time that Schwann in 1836, discovered the possibility of extracting, by maceration in acidulated water, from the gastric mucous membrane of animals a liquid possessing the digestive properties of the stomach, and since Wasmann and Papenheim in 1839 were enabled by precipitating this substance by alcohol to obtain it in a state of purity, the modes of fabrication of medicinal pepsin have been perfected, and to-day there are numerous processes in usage.

I shall not enter into the details of the fabrication of pepsin, I shall mention only the French and English methods. The French method is the most complicated. It consists in taking the inner lining membrane of a sheep's rennet, thoroughly scraping it, and macerating the detritus in water; the solution is then precipitated with a salt of lead which is then decomposed by sulphuretted hydrogen, then the liquid is evaporated to dryness at a temperature of less than 112°F. and the residue consists of pepsin more or less pure.

The English process is more rapid; the mucous membrane of the stomach of a hog is taken, scraped, and the detritus digested in water acidulated with a little muriatic acid, strained and dried on a plate. From the point of view of the animal chosen it seems to me that we should give preference to the English process. The hog in fact is omnivorous and its stomach resembles man in its digestive capabilities; therefore the last French Codex (that of 1884) in conformity with this view, directs employment of hogs' stomachs in the fabrication of pepsin

Besides these kinds of pepsin extracted from the stomachs of sheep and of hogs, another pepsin is in use which is obtained by Perret from calves' rennets.[5] Dannecy has even counselled to make use of fowls' gizzards, which have been dried and cut into small pieces or pulverized, and what is stranger still, the stomachs of ostriches have been utilized for this purpose; pepsin from this source would I think be rather scarce and rather costly.

The purified pepsin obtained from any of these sources, seems to present the characters of albuminoid substances, although its exact composition is unknown, and what shows our want of definite knowledge, is to see physiologists like Schiff deny to this product the properties of azotized substances. What is, however, certain is that this pepsin acts the part of a true ferment, and in the presence of an acid transforms albuminoid matters into peptones.

Do not think that the pepsin employed in medicine is that substance in a state of purity, which has been described under the name of pepsin extractive. The name of *medicinal pepsin*, or *pepsin of Corvisart* has in fact been given to a mixture of pure pepsin and starch, in pulverulent form, in which starch is introduced in variable proportions, and has for its object to give to the mixture a certain digestive value so that fifteen grains of this amylaceous pepsin shall digest ninety grains of fibrin. It is this mixture which is sold under the names of Corvisart's, Boudault's and Hottot's pepsins. In commerce this amylaceous pepsin is sold under three different states: acid, neutral, and alkaline. I need not tell you that the last two ought to be discarded from therapeutics, because peptonization is effected only in presence of an acid. It is only the amylaceous acid pepsin, which you should prescribe; this may be given in the dose of from seven to fifteen grains just before each meal.

If this mixture of pepsin and starch has its advantages, it has also its disadvantages. In the first place it encourages sophistications, and to such an extent is this the case, that certain manufacturers have put on the market pepsin preparations consisting entirely of starch; moreover, pepsin is a protein substance which readily changes when exposed to the air, and thus loses its digestive properties. Attempts have therefore been made to obviate these evils. Ellis has proposed to use rennet wine, made by macerating in sherry wine the pulped mucous membrane of a calf; Perret advises to substitute sugar of milk for starch in the manufacture of pepsin, and with this combination to make granules, which may be kept from the action of the air by a coating of benzoin. But much the best process is that of Wittich, (adopted also by Catillon), which consists in the use of glycerine as the solvent of pepsin. The mucous membrane of a calf's stomach reduced to pulp is macerated in glycerine which dissolves the pepsin and albuminoid matters; the latter are then coagulated by heat and the coagulum being separated, a liquid endowed with an energetic digestive power is obtained. Catillon's preparation, made after the same process, digests its own weight of fibrine, and according to comparative experiments, the glycerite of pepsin would seem to be more active than the pepsin made after the formula of the Codex.[6]

You know, gentlemen, that according to the results of Berthelotz' investigations, glycerine, this sweetish principle of oils, ought to be ranged in the class of triatomic alcohols. You know also that Audigè and I, in our researches on the alcohols, showed that this substance, taken in large quantity and massive doses, possesses toxic properties, comparable in a certain measure to those of the alcohols. Glycerine in small doses may, however, possess reconstituent properties, and Constantin Paul has suggested that these effects may be due to its faculty of dissolving pepsin. Sidney Ringer and W. Murrell have pretended that glycerine has the power to prevent undue acidity of the stomach, pyrosis and flatulence, by opposing or retarding the gastric fermentations.

Other preparations of pepsin have also been recommended, and I ought to mention two elixirs, which have a great popularity, those of Corvisart and Mialhe.[7] These elixirs should be prescribed in doses of a tablespoon ful, or dessert spoonful at meal time. Alcohol appears to retard the action of pepsin, as Vulpian and Mourrut[8] have shown; this diminishes somewhat the real therapeutic value of these elixirs.

By the side of pepsin we should place the artificial peptones, whose favorable action has been remarked by Plotz, Maly, Giergyai, and Adamkervicz. These products have heretofore been little known in France, and Holland, owing to the labors of Sanders, for a time had the monopoly of their fabrication. Since I called attention to the utility of these products, our pharmacists have found out how to fabricate peptones of excellent quality which equal if they do not excel those of foreign origin.

These peptones are now offered in commerce under two forms, liquid and solid, the latter being preferable. Catillon has studied the nutritive equivalent of these different peptones, and has shown that in the case of an adult man, nutrition may be well maintained by taking daily, eight tablespoonfuls of a saturated solution of peptones, corresponding to three times the weight of meat.[9]

You may administer these peptones in the following manner. Into a cup of nicely flavored broth, pour a tablespoonful of liquid peptone, or a teaspoonful of solid peptone, and repeat this nutritive potion three times a day. But it must be remembered that the acidity of these products and their disagreeable taste render them often poorly supported by the stomach, and the result is that at the end of a short time one is obliged to cease using them. I think then that these peptones ought not to be recommended in the treatment of affections of the stomach, at least when it is necessary to administer them by mouth, but on the other hand, they are admirably adapted for rectal feeding, and ought to serve exclusively, as I shall hereafter show you, for nutritive lavements.

By the side of pepsin and peptones of animal origin, we must place certain curious products quite recently studied by Wurtz and Bouchut, and which are described under the name of *vegetal pepsin.*[10]

The *Carica papaya* is the principal member of this group; its stem, leaves, and fruit, furnish a juice which has the curious property of transforming, with extreme rapidity and energy, animal substances into peptones. Wurtz has extracted from this juice a substance which possesses all its digestive properties, and to which the name *papaine* has been given. With this digestive ferment, there have been made elixirs and wines absolutely like the elixirs and wines of pepsin.

What is the real therapeutic value of these pepsins, whether of animal or vegetable origin? It is very much less than one might suppose after witnessing the experiments of the laboratory, where we see these pepsins so readily and rapidly transform into peptones the albuminoid substances with which they are brought into contact. In the dyspepsias and in particular in putrid dyspepsia, these properties seem considerably weakened, and for my part I am convinced that the best means of remedying want of secretion of gastric juice, is not to introduce soluble digestive ferments into the stomach, but rather to address one's self directly to the pepsin glands, in stimulating anew their secretion by peptogenous substances; this end you will attain not by medicaments, but by an alimentary regimen, well understood and well ordered. But before entering upon this subject, I must say a few words about acid medication.

You know the important rôle which belongs to the acidity of the gastric juice in the peptonization of albuminoid substances; you will not then be astonished to see acid medicaments prescribed in putrid dyspepsia. The question so long debated of the nature of the acid of the gastric juice has a great influence on the acid medications proposed, and you will see physicians in accordance with the dominant opinion, prescribe sometimes hydrochloric, sometimes lactic acid. Thus it is that Trousseau and Caron have formulated antidyspeptic potions with hydrochloric acid for their basis, and some physicians have proposed lactic lemonade to combat this want of acidity of the gastric juice.[11] You will also find in your old formularies, under the name of *vitriolic elixir* of Mysnicht,[12] of *Eau de Théden*, (Theden water,) and *Elixir of Paracelsus*, acid mixtures which have been recommended in like cases.[13]

Thus far we have been concerned with only the more important standard preparations. Certain ptisans, and especially the bitter infusions, are of considerable efficacy in putrid dyspepsia. Although we do not exactly know how these bitter substances act, they are nevertheless regarded as excitants of the gastric juice secretion, and as promotive of digestion. It is true that this opinion does not rest on any very solid basis; experience, however, seems to declare the utility in some cases of these ptisans and infusions, and their administration is attended with no evils. I shall have more to say of them when I come to treat of atonic dyspepsia.

But by the side of these bitter infusions whose intimate action escapes us, it is proper to place other preparations whose favorable effect in putrid dyspepsia is now perfectly understood I allude to ptisans containing peptogenous substances such as the *white decoction* of Sydenham[14] and infusions of grain in the process of germination. Van Tieghem in fact maintains that at this period the cotyledon leaves have the power of dissolving the azotized substances contained in the grain. Seeds of vetch, of Indian hemp, of germinating barley, have in his belief, peptonizing properties.

We have just passed in review the pharmaceutical preparations used in putrid dyspepsia; these preparations have a certain value, but they claim the second rank in efficiency as compared with the dietetic means which may be advantageously employed. Here, as in the treatment of dyspepsias generally, the first place belongs to hygienic therapeutics.

What hygiene, what regimen, will you prescribe for a patient suffering from putrid dyspepsia due to deficiency of gastric juice?

Let us begin with diet. There is a curious fact which the experiments made by us in forced feeding (gavage), have brought to light, namely, that when you put in direct contact with the mucous membrane of the stomach albuminoid substances suitably prepared, you see re-appear the secretion of gastric juice; this is what takes place with the meat powders, and it seems to be shown by these experiments that the best stimulants of the secretion of the pepsin glands are the peptones which result from the intimate action of the gastric juice upon the azotized molecules of these alimentary powders. The fact ought to be utilized in the treatment of putrid dyspepsia, and you will do well to order meat powder or raw meat to be taken in small quantity with each repast, and it is here that we witness the triumph of the method recommended by Brown-Sequard, who proposes to treat these dyspepsias by making the patient eat a little food every hour. A little malt flour, by reason of its peptonizing properties may be advantageously added to the meat powder; you can also add bread crust which contains dextrine, the latter being, as Schiff has pointed out, powerfully peptogenous.

You will also prescribe a small glass of wine at the end of every meal. [The same quantity of old cider may be substituted for the wine in certain cases]. These fermented liquors augment the acidity of the gastric juice, and you know that this particular form of dyspepsia is characterized by absence of acidity of this secretion. As for the stronger liquors, you should allow only old whiskey or brandy, of good quality, and to lessen its local irritant action, the beverage should be sweetened; sugar in fact minimizes the irritation that results from the action of alcohol on the mucous membrane.

Finally, do not forget that milk plays here an important rôle. When I spoke of the digestion of milk, I pointed out that this liquid is a real regulator of the acidity of the stomach, and that it needs but a little quantity of gastric juice to provoke the lactic fermentation of a great quantity of milk. The presence of this lactic ferment augments the normal acidity of the gastric juice, and also its digestive properties.

You will order active exercise, moreover, in order to increase the activity of the general circulation, and you will also advise the patient to be much in the open air, and if possible, to live in the country. According to Charles Richet, these rules find their physiological explanation in this fact that the acidity of the gastric juice results from its oxidation; now this oxidation is effected at the expense of the oxygen of the blood; therefore the more highly charged the blood is with oxygen, the more is the acidity of the gastric juice augmented. Finally, you may also derive advantages from cold baths; hydrotherapy in rendering more active the general circulation, energizes also the circulation of the stomach, and has an influence on the secretion of gastric juice.

Out-door air, hydrotherapy—these constitute most powerful curative means, and you may obtain the advantages of both at certain thermal stations, such as Divonne. Sea-baths have also been counselled in these cases, as being stimulants of the entire organism.

To what spas shall you send your patients affected with putrid dyspepsia?

The hydrothermal cure plays so important a part in the treatment of dyspepsia, that in order to give you the most useful indications in this regard, I have drawn from the experience of my friend Dr. Durand Fardel, whose wide knowledge of all that pertains to this subject is everywhere recognized.

In general, waters charged with carbonic acid seem to exercise a favorable stimulation on the secretion of gastric juice, and are indicated in these dyspepsias; hence it is that the table waters St. Galmier, Condillac, Chapetout, etc., give good results. You may add the waters of St. Alban, Boulou, Hontalade at St. Sauveur; Mahourat at Cauterets. You may also employ alkaline waters, the sodic bicarbonated, such as those of Vichy and Vals, but in small quantity, a tumblerful at each meal, taking care to choose the springs which are least alkaline.

I shall, however, defer till I come to speak of acid dyspepsia, the further consideration of these alkaline waters, which deserve particular mention by reason of the important part which belongs to them in the treatment of dyspepsias.

These, gentlemen, are the dietetic and pharmaceutical rules to follow in the treatment of putrid dyspepsia by non-secretion of gastric juice. You will pardon me for having dwelt at such great length on this form of dyspepsia, but it is one of the most frequent, and from the point of view of treatment, it demands the greatest attention. It remains for me now to say a few words concerning putrid dyspepsia by vicious fermentation of substances introduced into the stomach. I shall be brief on this point, for I intend taking it up more fully when I come to speak of dilatation of the stomach.

It is in fact in dilatations of the stomach that we find these putrid dyspepsias especially common. Resulting from the prolonged sojourn of alimentary substances in the dilated stomachal cavity, these forms of putrid dyspepsia require to be treated by washing out the stomach with antiputrefactive solutions. At the same time, in some cases, one may without practising gavage, have recourse to certain pharmaceutical preparations, and in particular to Belloc's charcoal powder, or to weak solutions of boracic acid (one or two per cent.) or better still to a solution which gives me excellent results under such circumstances, and which I have described under the designation of *carbon bisulphide water*. This solution is obtained, like chloroform water, by agitating pure sulphide of carbon with water, then by carefully decanting the mixture.[18]

This aqueous solution, as has been shown by Ckiandi-Bey and Pelegot,* contains from three to four grammes of sulphide of carbon per litre. It is eminently antiseptic.

My excellent interne, Dr. Sapelier, in his remarkable thesis has shown the benefits which may be derived from this precious medicament which has none of the toxic properties which have been attributed to it by Delpech. It is especially in the treatment of gastro-intestinal affections, that we experience the usefulness of this powerful antiseptic. We give the carbon bisulphide water in milk, or with wine and water, and thus administer *per diem* five or six tablespoonfuls of the saturated solution. Here is a good formula for its preparation:

Take of:

Pure carbon bisulphide,	25 grammes.
Water,	500 "
M. Essence of peppermint,	gtt. xxv. "

Place in a flask of the capacity of 700 cubic centimetres. Agitate and allow the precipitate to deposit; decant off the clear solution when needed. When you have poured off nearly all the clear liquid, add more water, and shake as before. It is well always to leave a little undissolved carbon bisulphide in the bottom of the flask, as the aqueous solution,

* This is according to Fausto Cestini, Remmier and Livache. The proportion soluble in water is much less, according to Ckiandi Bey. (Vide Pelegot, Acad. des Sciences, t. xcix., p. 387, 1884.)

when decanted off from the precipitate, speedily weakens from volatilization of the sulphide which it holds in suspension; this is prevented by always leaving an excess of the antiseptic in the flask. I shall have more to say about this subject when I come to speak of antiseptic intestinal medication.

In the next lecture I shall consider acid and pituitous dyspepsia.

NOTES TO LECTURE VIII.

[1] The mucous membrane of the stomach possesses a thickness of six millimetres and a half; it is quite firm in the healthy state, but readily undergoes softening after death; it has an ashy white color when the individual is fasting, but is of a lively red hue during digestion. This color is due to the active congestion which precedes the secretion of gastric juice. On the surface of the mucous membrane of the empty stomach are observed numerous folds or rugæ, due to shrinkage of the organ, which disappear when the organ is distended with food; little shallow depressions are also seen and pointed processes or papillæ (état mamelonné), also small round apertures, the orifices of glands.

The mucous membrane is composed of three layers: epithelial, glandular and muscular.

The epithelium, but slightly adherent to the underlying layer, is formed of juxtaposited cylindrical cells with round nuclei and granules. The muscular coat thin, resistant, formed of bundles of fasciculi adheres to the cellular tissue of the stomach and to the glandular layer; it is traversed by the vessels which are distributed to the mucous membrane.

The glandular layer, thicker than the two others, is formed of two sorts of glands; pepsin glands and mucous glands. These glands adhere to the muscular coat, and are a millimetre and a half long, and are extremely numerous, attaining, according to Sappey, to nearly the figure of five millions. The mucous glands surround the pylorus, and are also found in the cul-de-sac of the lesser curvature; the pepsin glands occupy the rest of the organ. The latter are racemose, presenting themselves under the aspect of a hair root. The mucous glands, of about the same length, have the appearance of clusters of grapes; they differ from the pepsin glands: 1, by the number of their divisions, which is considerably less; 2, by the situation of the glandular cæca, which in the pepsin glands occupy the terminal extremity of the gland, while in the mucous glands these cæca are irregularly ranged on the respective divisions.

The pepsin glands contain polyhedral cells more or less voluminous, pepsin cells, which do not exist in the other glands. The excretory duct of these stomach glands is of variable length, and lined on the interior by a cylindrical epithelium, which is a prolongation of the epithelium of the mucosa.

[2] Albertini had already shown that on heating gastric juice to 100° C., (212° F.) which destroys the pepsin, you do not deprive the juice of its antiputrefactive properties. Charles Richet has shown that pepsin does not possess any antiseptic property, and that this resides in the acid of that secretion.

He placed some fibrin from fresh blood in two flasks; to the one he added pepsin, to the other hydrochloric acid. The flasks were then exposed to suitable conditions of heat and moisture, and at the end of from 15 to 20 hours it was remarked that the fibrin which was not acidified had become quite putrid, while that which had been acidified was free from all odor or other trace of putrescence.*

[3] In 1876, Selmi, in searching for arsenic in a corpse which had been buried thirty days, found a crystallized alkaloid to which he gave the name *ptomaine.*

Armand Gautier had before pointed out the modifications which albumen while putrefying undergoes, since then he has shown that all animal substances of albuminous nature may give origin to alkaloids to which he has applied the name of *leucomaines.* These alkaloids are precisely similar, from the point of view of their chemical reactions, to those produced by the vegetable world, hence Gautier thinks that the production of leucomaines is not the exclusive property of the vegetal cell, but of every living cell, animal as well as vegetal, and that the human organism makes alkaloids just as the plant does. While Selmi considered the ptomaine alkaloids as a product of putrefaction, Gautier, on the contrary, generalizes the fact, and makes them a function of the living cell.

Brouardel and Boutmy had pretended that the ferric ferro-cyanide enabled them to distinguish the cadaveric from the vegetable alkaloids, the ptomaines alone transforming the ferric ferro-cyanides into ferrous ferro-cyanides. Gautier has shown that this reaction is not as absolute a criterion as has been affirmed, and that the similarity between the vegetal and the animal alkaloids is complete.

As for the action of these leucomaines, it is very similar to that of strychnine. Introduced into the circulation of animals, they produce dilatation, then contraction of the pupils, stupor, tetanic convulsions, irregularities in the cardiac pulsations, and death by arrest of the heart in systole.

According to Gautier, the leucomaines have the same physiological action as muscarine, and this is confirmed by the researches of Brieger, who has transformed neurine, a substance not toxic, into muscarine, a very toxic substance, by leaving the former exposed to the air in aqueous solution.

Maas has, on the contrary, assimilated the action of the ptomaines to that of strychnine and morphine, while Tanret showed in 1881, that animal alkaloids might be obtained by putting alkaline salts in contact with peptones. Brieger in 1883, obtained alkaloids by simply digesting fibrin in gastric juice.†

* Albertini, Lo Sperimentate, June, 1874. Charles Richet, On the Gastric Juice, p. 112.

† Selmi, On a Virulent Crystallizable Alkaloid Extracted from the Viscera of two Exhumed Bodies, Jour. de Pharm. et de Clin., t. xxix., p. 156, 1879. Brouardel and Boutmy, On a Reagent capable of Distinguishing the Ptomaines from Vegetal Alkaloids, Bull. Acad. de Méd., 2d series, t. x., no. 19. Gautier, Can we Distinguish the Cadaveric Alkaloids from those of Natural or Artificial Origin? Bull. Acad. de Méd., t. xx., no. 20. Brieger, On the Venomous Matters Produced by Man and the Higher Animals, Zeitschrift für physiologische Chemie, t. vii., p. 274, 1883. Maas, On the Human Alkaloids, Verhand. der deutschen Gesell-

[4] Discovered in 1836 by Schwann, isolated in 1839 by Wasmann and by Papenheim, pepsin, called *chymosin* by Deschamps, and *gasterase* by Payen, had been the subject of many labors, but it did not fairly enter into the domain of therapeutics till the publication of the important researches of L. Corvisart.

Pepsin is an azotized quaternary substance. In its greatest state of purity it presents itself under the form of a grayish powder, soluble, though with difficulty, in distilled water; heated with potash or nitric acid it reacts like other proteinous matters. It is precipitated by the metallic sulphates, acetates and chlorides, by alcohol and by tannin.

Divers processes have been proposed for the extraction of pepsin. That of Jeannel is as follows: "Take the stomach of a newly killed hog, open and wash in a full stream of water; spread on a table, the mucous membrane being uppermost; scrape with some force the mucous membrane with a dull knife. You thus obtain about an ounce of a semi-solid matter, which is then agitated with five ounces of distilled water; digest fifteen minutes at 35°C., add two drops of hydrochloric acid, filter through a linen strainer, and allow the filtrate to settle; decant and dry on plates at a temperature of 45°C." The semi-fluid substance obtained by scraping, and taken up by water at 30°, then acidulated by HCl, and filtered, gives a very active solution.

The process of the French Codex is as follows: The rennet bags of sheep quite fresh are opened, turned inside out, and washed by a gentle stream of water; the mucous membrane is then scraped off, bruised in a mortar so as to rupture the cells and digested for twelve hours in pure water. The infusion thus obtained is precipitated by acetate of lead, and the precipitate, consisting of pepsin and oxide of lead, is mixed with water and decomposed by sulphuretted hydrogen, which throws down the lead, leaving the pepsin in solution. The liquid having been filtered is evaporated at about 100°F. to a syrupy consistence, after which sufficient perfectly dry starch is added to absorb the semi-liquid matter, and bring it to a state of dry powder. Lactic acid is sometimes added to the liquid in small proportion before evaporation, and doubtless adds to its efficiency. An attempt to evaporate to dryness might injure the preparation, and an easily putrefiable substance would be obtained. Starch is chosen for the solidification of the syrupy mass on account of its absorbent property and because it is not affected by the digestive power of the pepsin. If properly prepared, fifteen grains of this pepsin (which is the same as Boudault's), with the aid of a little lactic or muriatic acid, will cause the solution in water of four times its weight of fibrin at the temperature of the human body. Much care is requisite to use fresh rennet bags, and not to allow the temperature used in evaporation to exceed 100°F. It is asserted of the above pepsin, that it has the reactions of the gastric juice and is fully capable of replacing that liquid for the purpose of digestion. It may be given with or without lactic or muriatic acid, the addition being unnecessary when there is already sufficient acid in the stomach.

[5] According to Perret, calves' rennets constitute (next to the dog's stomach) the very best source of pepsin. These are taken in a perfectly fresh state, carefully washed, then spread out on a chopping block and whipped

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schaft f. Chir. Tanret, Peptones and Alkaloids, Comptes Rend. de l' Acad. des Sciences, 1881.

with a sharp knife till they are reduced to a pulp. This pulp is treated with four times its volume of distilled water containing 4.50 parts of citric acid for every 100 parts by weight of the pulp, which is equivalent to about 10 grammes of citric acid for every rennet used. The mixture thus obtained is allowed to stand for twenty four hours in the cold, then expressed through a strainer; what remains in the filter is again treated with its own volume of distilled water containing 15 grammes of citric acid to the quart and again expressed. The two liquids are then mixed and allowed to stand for twelve hours in the cold and settle; the clear liquid is then strained off from the residue which consists of shreds of membranes, fatty matters, etc. Perret charges this clear liquid with fresh quantities of pulp, till its final density marks six to seven degrees Baumè. If now to this product a tenth of its volume of alcohol at 95° be added, a precipitate is obtained which can no longer be dissolved.

By successive manipulations the pepsin is completely freed of peptones; it is submitted to concentration in boilers heated by a sea bath at 28° or 30°C., and when it has acquired the consistency of syrup, an equal weight of sugar of milk is added, and the whole is divided into globules. These globules are dried at a low temperature and covered with a coating of benzoin which preserves them. (Perret, Bulletin de Ther. t. xciv., p. 264.)

'According to the new French Codex, medicinal pepsin, in powder, ought to respond to the following test:

Introduce into a wide mouthed flask,—

Medicinal Pepsin, ...	gr. vijss. (0.50)
Distilled water	℥ ij. (60.00)
Acid Hydrochloric officinalis, . .	gtt. xv. (0.60)
M. Pork fibrin, washed and dried, . .	ʒ ijss. (10.00).

Place the flask in a warm water bath, at 50°C. (122°F.), and digest for six hours, taking care to agitate frequently till all the fibrin is dissolved, and the liquid, when cooled and filtered, ought not to become turbid by the addition of a few drops of nitric acid.

Boudaults' pepsin, or the *nutrimental powder of Corvisart* has the following composition: neutral pepsin, 50 centigrams, lactic acid gtt. iij., starch, 50 centigrams.

[The following article by the translator is reproduced from the Boston Medical and Surgical Journal, and has a practical utility in this connection.]

THE CODEX COMMISSION'S REPORT ON PEPSIN.—Probably no medicinal agent is more extensively prescribed than pepsin, and there is, perhaps, none concerning whose real efficacy more doubt exists in the professional mind. The indications for its administration are not clearly established, nor is it certain that this substance, even with the addition of a dilute mineral acid, has precisely the same action in the human stomach on the ingredients of a meal as it has out of the body on albumen in a test tube. However this may be, there is a real interest in knowing the best means for determining the purity of this now standard medicament, for inert preparations abound.

It has been shown that it is not enough that the sample which is the subject of experiment shall dissolve a certain quantity of coagulated white of egg; this result may be obtained with pepsins of feeble digestive power, and simple solution is not peptonization.

Dr. Pierre Vigier, of Paris, appointed recently member of the Codex Commission to revise the pharmaceutical methods in use for the assay of pepsin, has published the results of a long series of experimental researches. He gives the following formula, which has been adopted by the Codex. A pepsin which will respond to this test is regarded as of good quality.

FORMULA A.

Take of:

Medicinal pepsin in powder,	0.50
Or pepsin extractive,	0.20
Distilled water,	60.00
Hydrochloric acid,	0.60
Fibrin of sheep, calf, hog, washed and dried in the air,	10.00

This mixture is subjected in a wide-mouthed flask, to a temperature of 122° F. for six hours. At the end of this time, the filtered liquid ought not to show a precipitate, or become cloudy by the addition of a few drops of pure nitric acid, which is an indication that all the fibrin has been peptonized.

Vigier finds that the greater part of the pepsins of commerce have a digestive power greatly inferior to that required by the above standard. They may, indeed, dissolve fibrin in quantity very greatly in excess of their weight, but a copious precipitate will follow the addition of the nitric acid, which shows that the fibrin has not been peptonized, and, as is well known, the albumen is not assimilable except under the form of peptones. The only re-agent which enables one to estimate the peptonizing power of a pepsin is nitric acid, introduced drop by drop; and, after numerous trials, Vigier has ascertained that it is best to employ for this test a fixed quantity of ten grammes of filtered liquid to which is slowly added, *guttatim*, nitric acid up to forty drops; above that quantity, the acid redissolves the precipitate formed.

The same experiments have shown that although the temperature of 122° F. (50° C.) is higher than that of the stomach, yet the maintenance of this temperature is necessary for a perfect result.

The Commission of the new Codex has, in accordance with these experiments, adopted the following criteria: "Pepsin in powder, or medicinal pepsin, obtained from pepsin extractive by the admixture of a certain quantity of dextrine, or starch, ought, in a quantity not exceeding fifty centigrams, to peptonize ten grammes of fibrin.

"The pepsin extractive (officinal pepsin of the Codex of 1866), which is found in commerce under the form of a brown extract, ought, in the dose of twenty centigrams, to peptonize ten grammes of fibrin."

The report of Vigier adds that these figures are not exaggerated; there are pepsins in the market, and among them that of Boudault, whose digestive power is twice as great as that indicated above. The fibrin employed is obtained by whipping the blood of a sheep, a hog, or a calf; that obtained from the blood of the ox is found, practically, not so good for the purpose.

Pepsin acts only in an acid medium; the hydrochloric acid, which is the acid of the gastric juice, is that to which the preference should be given. The quantities of acid and water given in the above formula have been fixed upon after numerous tentatives, as those certain to give the best results.

An interesting experiment is given illustrative of the power of a limited quantity of pepsin to peptonize an indefinite quantity of fibrin, provided new supplies of acid are added at the same time. A complete artificial digestion having been obtained, in accordance with the conditions of the above formula, to the contents of the flask, still unmolested, a fresh quantity of fibrin was added, with a proportion of acidulated water equal to that already employed; at the end of six hours the digestion was perfect. This operation was repeated three or four times with the same result, only after the fourth digestion, the filtered liquid became slightly cloudy on the addition of a few drops of nitric acid. This experiment shows that the encumbering action of the peptones in artificial digestions diminishes in proportion as they are further diluted, and that the digestive power of the pepsin is augmented in the same ratio. It also shows that pepsin acts after the manner of living ferments; "from this," says M. Vigier, "we obtain a hint as to the beneficial effects of drinking freely during meals." *

The formulæ for the Wine and Elixir of Pepsin adopted by the Commission of the New Codex are as follows:

WINE OF PEPSIN.

Medicinal pepsin, ...	5 parts.
Muscadel wine, ...	100 "

ELIXIR OF PEPSIN.

Medicinal pepsin in powder, ...	1 part.
Alcohol at 80, ...	3 parts.
Syrup, ...	8 "
Distilled water, ...	9 "
Flavor *ad libitum.*	

Twenty grammes of the Elixir or Wine of pepsin are equivalent to one gramme of pepsin in powder, and this quantity is necessary to digest ten grammes of fibrin.

As the strong alcohols precipitate pepsin from its solutions, it is only in a very dilute state that they can be used in conjunction with this medicinal agent; hence, for the preservation of pepsin, menstrua are chosen, as in the formulæ above given, which contain only ten to fifteen per cent. of alcohol. The amylaceous pepsins (like Boudault's), give better preparations with dilute alcohol than the saccharated pepsins.

The glycerites of pepsin, according to the Codex Commission, have little activity, and it is the same with respect to other preparations which contain, associated with pepsin, other ferments, such as pancreatine, or pharmaceutical products, such as hydrochloric acid, coca, quinine, bismuth, iron, etc.

The Commission, in concluding, emphasize the importance of the physician or pharmacist testing every preparation of pepsin of which he is the prescriber or vendor, in order that he may know the quality thereof, and if it be a faulty article, avoid its use or delivery. For such purpose, the very best criterion is the formula A, given on preceding page.

* Bulletin Gen. de Thér. Nov. 30th, 1885.

[1] Mialhe's elixir of pepsin is as follows:

Take of:

Amylaceous pepsin,	6 parts.
Distilled water,	24 "
White wine (Lunel),	34 "
White sugar,	50 "
M. Alcohol at 80°,	12 "

[2] Mourrut, in a memoir on the Artificial Digestions, and Prof. Vulpian in his course, have studied the action of the digestive ferments employed in the treatment of dyspepsia. They have shown that the presence of an acid (as in the stomachal digestion) prevents the action of diastase and of pancreatine. Thus Mourrut has ascertained that one centigramme of diastase saccharifies completely in six hours, at the temperature of 37° to 40° C., 40 grammes of a starchy solution containing five per cent. of its weight of starch; he remarks that if you add to the starch water two drops of hydrochloric acid the transformation is not effected till at the end of thirty hours. The result is very nearly the same with both artificial and natural gastric juice.

In a second series, Mourrut made the same experiments with pancreatine, putting 20 centigrammes of this substance in contact with 50 grammes of starch water containing only 3.5 of starch. The saccharine transformation of all the starch water demanded eighteen hours. After the addition of two drops of muriatic acid to a similar mixture, there was no transformation at the end of 48 hours. Both artificial and natural gastric juice behaved in the same way; at the same time with natural gastric juice there was liquefaction of the starch paste but without saccharification.

Mourrut dissolved 20 centigrammes of pancreatine in 50 cubic centimetres of water; then he put into this solution six grammes of cooked albumen of egg divided into little cubes; at the end of eighteen hours of exposure to the moderate heat of an oven there was a partial transformation of the albumin into peptone.

The same experiment repeated after the addition of two drops of muriatic acid to a mixture in every respect similar, gave a result absolutely nil as far as the formation of albuminose or peptone was concerned.

As for alcohol, it does not destroy the action of pepsin on azotized substances but only retards it; and if the Elixir of Pepsin has no such retarding action on digestion it is because this elixir contains but little alcohol. Alcohol retards also the digestive action of diastase and pancreatine.

Catillon's peptones are thus made:

A kilogramme of beef, freed from its fatty and tendinous parts, and finely hashed, is digested at the temperature of 113° F. for twelve hours in five litres of water acidulated with twenty grammes of pure muriatic acid (density 1.18), and with pepsin in slight excess. The proportion of pepsin can only be determined by its standard of strength. It will take, for instance, 35 grammes of the pepsin of the Codex which digests 30 to 40 times its weight of fibrin (I refer to the *pepsin extractive*, which comes in a pasty form, and not to the amylaceous pepsin which digests only six times its weight of fibrin); the mixture is agitated from time to time and kept at a constant temperature. Below 104° F. the digestion of the fibrin

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is retarded; if the temperature of 122° F. is exceeded, the risk is incurred of destroying the pepsin, and this is sure to happen at 158° F. The mixture, at first in a state of pulp, becomes fluid by degrees, and after a time, which varies from two to six hours or more, according to the strength of the pepsin, it attains a complete transparency. It consists then of a mixture of peptones and syntonin, and is not coagulated by heat and nitric acid.

After twelve hours of digestion, the mixture is filtered to separate the insoluble parts. Rapidity of filtration is an indication that the transformation is complete.

The filtered liquid ought not to become cloudy by boiling; treated by nitric acid, as above said, it ought not to give rise to any precipitate.

This liquid is then saturated with bicarbonate of soda, and evaporated in a sea-bath. When concentration is advanced, a pellicle forms on the surface; the solution has arrived at the state of saturation.

It is better for therapeutic uses to keep the peptone in a state of syrupy consistence, and therefore the evaporation is not usually pushed to desiccation.

The saturated solution of peptones ought to mark 19 degrees on the areometer of Baumè, (density 1.15); it contains the half of its weight of solid peptones; prepared with meat, it has a deep yellow color, a disagreeable odor, and a slightly acid taste, resembling concentrated broth.

Catillon has solved the following problem: What is the quantity of peptone necessary to produce the same proportion of urea as the quantity of meat essential for the regular daily rations. He has seen that in an adult weighing 144 pounds (72 kilos), a ration of 350 grammes of bread, 351 grammes of potatoes, and 30 grammes of butter, to which are added 160 grammes of the saturated solution of peptones, suffices for nutrition, and induces even an augmentation of weight; this is equivalent to 2.22 grammes of the solution, or 1.11 grammes of solid peptone for each kilogramme of the weight of the body.

In the case of the dog, the proportion of peptone necessary for nutrition is larger. There is needed, for an animal weighing 11.2 kilogrammes, 75 grammes of solution of peptones *i.e.*, 7 grammes per kilogramme of the weight of the body. Plotz and Maly had previously performed similar experiments. Plotz fed a dog for ten weeks with a mixture of fibrin peptone, of glucose, of butter and of salt. The animal consumed 567 grammes of peptones, 309 grammes of butter, 422 grammes of glucose, and gained 501 grammes. Maly performed a like experiment with a pigeon.*

[10] Wurtz has shown that papaine, the soluble ferment of Caraca papaya, dissolves a thousand times its weight of moist fibrin, the greater part of which is transformed into peptone not precipitable by nitric acid. The papaine begins by attaching itself to the fibrin, and it gives rise to a product which, under the action of water, brings about a solution of the fibrin, while at the same time, the ferment becoming free, may exert its action on a new portion of fibrin. According to Wurtz, papaine possesses the composition of albuminoid matters, and resembles the pancreatic ferment called trypsin. Caraca papaya is not the only plant which furnishes a vegetable pepsin, and certain species of *ficus* possess the same property. Bouchut gives the name of *ficoine* to this special ferment.†

* Catillon, Des Peptones. Bull. Gen. de Thérapeutique, 1880, t. xcviii., p. 116–169.

† Wurtz and Bouchut, on Papaine. (Acad. des Sciences, June and Nov., 1880, and Bull. de Thér., t. 99 (1880), p. 132.

[11] *Antidyspeptic potion of Trousseau.*

Acid muriatic, ...	gtt. iv.
Mistura acaciae, 125 grammes, ...	(℥ iv.)

M. Dose.—A tablespoonful after each meal.

Caron's dyspeptic potion.

	Grammes.	
Cinchona wine, ...	100	(℥ iij. ʒ iij.)
Syrup of poppies, ...	30	(℥ i.)
Hydrochloric acid, ...	1	(gr. xv.)

M. Sig. 1 or 2 tablespoonfuls before each meal.

[12] The formula for the *vitriolic elixir of Mynsicht* is as follows:

Take of:

Sweet flag, . . . Maranta galangal, . .	ā ā	8 parts.
Wormwood, . . Peppermint, . . Sage, . . .	ā ā	4 "
Camomile flowers, . Canella, . . . Cubebs, . . . Ginger, . . . Cloves, . . . Nutmeg, . . .	ā ā	3 "
Chips of aloes, . . Lemon peel, . .	ā ā	1 "
Sugar, ...		32 "
Alcohol (at 60°), ...		192 "
Dilute sulphuric acid, ...		32 "

Mix the sulphuric acid and the alcohol, and pour upon the other ingredients pulverized and placed in a retort; macerate a fortnight at a moderate heat and filter.

Dose.—Two to forty drops well diluted.

[13] *Eau de Théden* is made as follows:

Take of:

Pure sulphuric acid, ...		1 part.
Alcohol at 90°, Currant juice, ...	ā ā	48 "
Distilled water, ...		1 "
Sugar, in fine powder, ...		24 "

Dissolve the sugar in the water by the aid of heat, adding the currant juice, then mix with the alcohol and sulphuric acid in a flask. (The mixture of alcohol and acid should be made with caution.) Macerate eight days and filter. Dose, 20 to 30 drops in a little peppermint water.

[Less complicated acid mixtures may be readily extemporized by the physician Thus the following formulæ will sometimes serve a good purpose:

℞. Acid Hydrochloric dilute, ...	m. xx.
Infus. Aurantii, ...	f. ʒ ix.
Syrup Zingiberis, ...	f. ʒ j.

Make a draught to be taken after meals.

℞.	Acid hydrochloric dil.,	
	Acid nitric dil. ana.,	f. ʒ i.
	Ext. taraxaci,	℥ i.
	Infus. gentian,	f. ℥ vii.
M.	Take two tablespoonfuls twice daily before meals.	

	Acid hydrochloric dil.,	f. ʒ iij.
	Syrup zingiberis,	f. ℥ ss.
	Tinct. aurantii corticis,	f. ʒ ix.
M.	Take a teaspoonful well diluted after each meal.	

The dilute HCl is often given to advantage in doses of ten to fifteen drops in a mixture with a scruple of saccharated pepsin just after meals.]

[14] The "white decoction" is thus made, according to the Codex:

Take of:

Stag's horns, calcined and reduced to powder,	1 part.
Wheaten bread crumbs,	2 "
Gum arabic,	1 "
White sugar,	6 "
Distilled water of orange flowers,	1 "
Pure water q.s. to make,	100 "

Triturate together the horn powder and the gum; add the bread crumbs and the sugar; triturate anew; boil in water fifteen minutes, strain, express gently and add the orange water. [Burnt hartshorn consists of bone phosphate of lime, with a little free lime. Its medicinal effects are inconsiderable.]

[15] These are Ckiandi-Bey's conclusions:

1. Carbon bi-sulphide is to some extent soluble in water, (though certain works on Chemistry have disputed this). Its solubility varies between 2 and 3 milligrams per 1,000 grammes of water at the temperature of 18 or 20° C. In agitating the pure carbon bi-sulphide in a flask full of water, I have seen as much as 50 centigrams per litre taken up.

2. This solution *arrests all fermentations; it kills the microbes; it is one of the most energetic antiseptics; it is besides endowed with a considerable power of penetration.*

3. Pure sulphide of carbon in solution in pure alcohol, (at 96°) is slowly decomposed and gives rise to various products notably to H_2S, (sulphuretted hydrogen). The alcoholic solution dissolves caoutchouc.

4. Contrarily to the opinion advanced by several writers, I have never for twenty years observed any case of paralysis of any of the limbs among workingmen constantly exposed to emanations of sulphide of carbon, nor any loss of virility from this cause. (My observations concern about two thousand workingmen.)

5. The vapors of carbon bi-sulphide when respired in a certain proportion, determine phenomena resembling those of etherization with no other discomfort than a heaviness of the head of short duration.

6. The solution has a warm sweetish taste, followed by a sensation of heat in the stomach, and at the end of three quarters of an hour, pricklings or tinglings in the mucous membrane of the nose, similar to those produced by sulphurous acid, with some cerebral heaviness or torpor which soon passes off.

7. Pure sulphide of carbon applied to the skin (as on a wad of cotton)

is one of the most energetic revulsives; its action is almost instantaneous, and the pain is like that of boiling water, but it ceases immediately on exposure to a whiff of air which vaporizes the remaining sulphuret.

It is by reason of all these facts that I have advised carbon bisulphide to combat cholera and all the microbiotic diseases (typhoid fever, diphtheria, phthisis, etc.). It will be of great value given internally; the solution may be used for this purpose to advantage; it may be employed also as a cutaneous revulsive, and as a disinfectant for the dejections, bed clothes, garments of cholera patients, etc.

The aqueous solution may be used for watering streets and for washing houses, as it may be furnished at an extraordinarily cheap rate.

Sulphide of carbon for medicinal use ought to be purified by beating it up with metallic mercury, till there is no longer any black precipitate; to prepare the aqueous solution all you have to do is to agitate a certain quantity of the pure bisulphide with water and decant off the clear solution.

Pure carbon bisulphide has an odor resembling that of chloroform. The aqueous solutions constitute the cheapest medicament known; (one centime ($\frac{1}{100}$ franc) for 10 litres.*)

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* Ckiandi Bey, On the Antiseptic Properties of Bisulphide of Carbon. (Bull. de l'Acad. des Sc., Sept. 22, 1884.)

LECTURE XI.

ON ACID AND PITUITOUS DYSPEPSIA.

SUMMARY.—Acid Dyspepsia—Pituitous Dyspepsia—Treatment of Acid Dyspepsia—Alkalies—Vichy Water—Vals Water—Influence of Sudation on the Acidity of the Gastric Juice—Employ of Inert Powders—Patterson's Powder—Powders and Pills of Trousseau, Radius and Gendrin—Hygienic Treatment—Wines—Treatment of Pituitous Dyspepsia—Milk Diet—Koumiss—Lavage of the Stomach—Thermal Treatment.

GENTLEMEN: I intend in this lecture to include in the same description acid dyspepsia and pituitous dyspepsia. The one in fact is often the consequence of the other, and if you interrogate patients affected with the pituitous form, you will find that their gastrorrhœa was preceded for a period of greater or less length by acid dyspepsia.

What are the symptoms of these two states? At the onset, acid dyspepsia is characterized simply by a feeling of oppression in the stomach during digestion; the patient complains of heat in that organ whereas in dyspepsia from deficiency of gastric juice the stomach, often feels *cold;* the victim of acid dyspepsia cannot commit any excess of diet or imbibe freely of wine, without rapidly experiencing an aggravation of the usual symptoms. The sensation of heat in the region of the stomach increases; during the night there is regurgitation of acid matters which come up into the throat or mouth, leaving a burning and smarting impression along the œsophagus; this is PYROSIS.

If the table excesses continue, to these symptoms is added an ill-defined spasmodic pain, seated about the cardiac region; this is CARDIALGIA. In other cases a severe pain is felt in the dorsal region, similar to that resulting from the passage down the œsophagus of too large a morsel of food.

Sweet victuals, as well as wines and spirits, augment these symptoms, and the patient has continually a peculiar sour taste in his mouth. At a more advanced period there ensue vomitings of glairy mucus. Then these vomitings become habitual, and every morning the patient throws up a certain quantity of mucus or phlegmy matter; he has now *pituitous dyspepsia.* All persons addicted to the abuse of alcoholic stimulants will complain to you of this characteristic symptom.

The disease has now changed its character. At the beginning, the stomach irritated by substances introduced into its interior, secretes too acid a gastric juice; then under the influence of this exaggerated secretion, the pepsin corpuscles cease to be reproduced, and the greater part of the glands are transformed into veritable mucous-glands, and no longer secrete real gastric juice, but mucus instead, in greater or less quantity. It is the expulsion of this mucus which constitutes the pituitous vomiting of drunkards.[1]

One may also liken putrid dyspepsia by vicious fermentation, to certain forms of acid dyspepsia. In fact, as Bouchardat has shown, the presence of the lactic, butyric, propionic ferments in the stomach causes transformation of glycogenic aliments into lactic, butyric, and propionic acids. This variety of acid dyspepsia should be combated by anti-fermentative medicines.

To return to ordinary acid dyspepsia: how are we to treat it? Here we must establish a distinction between pharmaceutical and dietetic means. Pharmacy offers us, on the one hand alkalies, on the other inert powders.

The use of alkalies is perfectly indicated, and is in conformity with the experiments of Charles Richet, who showed that alkalies introduced into the stomach in large doses neutralize the acidity of the gastric juice.[2]

The inert powders produce another effect; they attenuate the secretion of gastric juice. By referring to the experiments of Claude Bernard, of Blondlot, and of Schiff, you will see that by their presence these powers provoke a secretion of gastric juice which is non-acid, or but slightly acid, and generally a secretion of mucus.

These two means are then logically indicated. Hence they are generally used in combination, the inert powders and alkaline powders being associated in the same formula.

Let us commence with the alkaline preparations. It is the bicarbonate of soda which is generally employed; this is given in pulverulent form in the dose of fifteen to thirty grains about meal time, or the salt is dissolved in water in the proportion of one drachm to the quart, constituting an artificial Vichy water, and given at the proper time. But it must be understood that such extemporized Vichy waters are far inferior to the natural alkaline waters, as far as both taste and quality are concerned. With regard to the latter, there are, as you are well aware, several sources of the Vichy water: the thermal waters, properly so-called, are of high temperature, 31°, 35° and 43° C., these are the Hospital Springs, Chomel Well, and Grande Grille; the others are cold, viz, 12°, 14°, 15° C. (50° to 59° F.); such are the Celestin, Hauterive and Saint Yorre Springs.

All these waters contain about the same quantity of sodic bicarbonate, that is to say, from 4 to 5 grams per litre. If you are far from the source, choose always the cold waters, which may be transported to great distances without undergoing change. You will order them to be taken at the moment of the repast, and if the patient supports them well, you will instruct him to drink his water not with wine, but pure, in quantities of one or two tumblersful a day and even more.[3]

If you prescribe Vals water, there is less difficulty of choice. Vals has a great number of springs, but it is not properly a thermal station, for the waters are all cold; they have over Vichy the advantage that they present a gradation in their alkalinity; and you will find among these Vals waters, some which contain only 1 and others which have as much as 9 grams per litre of bicarbonate of soda, so that you can choose among these springs those whose waters are the best adapted to meet the indications of your case.

In our large cities there have been established drinking booths where the public can obtain these waters on draught; these mineral water saloons ought to be encouraged. Thither the physician may send his dyspeptic to obtain his glass of mineral water an hour before his usual meal; the patient thus gets a certain amount of exercise in obtaining his potion of Vichy or Vals water.[4]

As for the so-called inert powders, there are numerous preparations of this kind which are administered in connection with meals, and have for their basis subnitrate of bismuth, phosphate or carbonate of lime. The latter may be given separately in the dose of from ten to fifteen grains.

All these powders act as alkalies; they are in fact tri-basic salts which may yield up a part of their base to the acid of the gastric juice. The subnitrate of bismuth is much the most frequently employed. Odier of Geneva, and Carminati, then Trousseau in 1833, were the first to extol its benefits in dyspepsia.*

Generally the formula for the administration of these inert powders is somewhat complex, and they are given in conjunction with alkalies. There is first of all the combination of subnitrate of bismuth and magnesia, known as the *American* powder, or Patterson's powder.[5]

You may employ Patterson's formula, or the following preparation, which has given me good results:

Take of:
Subnitrate of bismuth,
Carbonate of magnesia,
M. Bicarbonate of soda, ... ā ā ʒ ijss.

Make into thirty powders. One powder at meal time may be taken suspended in water, or in capsules or wafers.

Trousseau made with these mineral substances, powders and pills; in the latter he combined subnitrate of bismuth with chalk, in the former he associated magnesia and bicarbonate of soda. Gendrin preferred the

* Odier in 1786, Carminati in 1788, and Trousseau in 1833, pointed out the good effects of subnitrate of bismuth in dyspepsias. Trousseau advised it especially in spasmodic vomiting and in gastralgia; he gave from 15 to 48 grains a day. (Bull. de Thérap., t. v,, p. 43.)

combination of bicarbonate of soda and bismuth; Radius a mixture of magnesia, syrup of orange, and peppermint water.[6]

Such are the bases of the most of those preparations which render the best service in these forms of dyspepsia. You can join to these powders and potions the usage of antifermentative medicaments and such as prevent the too prompt and energetic action of the gastric juice. For instance the sulphite of soda, counselled by Pinalli of Padoue, has a favorable action in dyspepsia. This medicament is given in daily quantities of five grams (75 grains) in one hundred and fifty grams (℥ v.) of water.

But here too, as in the other forms of dyspepsia, the first place must be given to the hygienic treatment. Therefore we ought to insist on attention to regimen.

Let us first examine the principles of the alimentary regimen. The first duty is the suppression or diminution of alcoholic beverages. The experiments of Richet on Marcelin, are most instructive in this respect, and I referred to this point when I spoke of alcoholic stimulants; wine and spirits may even increase two-fold the acidity of the gastric juice. Recommend then to patients suffering from acid dyspepsia not to drink wine, and if they cannot altogether abstain from this beverage, to drink only the mildest, purest, and least intoxicant kinds. It is in this malady that the sophistications, which unfortunately are so prevalent that it is a difficult matter to obtain good table wines, do the greatest harm. You will in fact see persons who cannot dine at a restaurant without suffering immediately from the symptoms of acid dyspepsia.

Choose then a native wine weak in alcohol; here certain wines of central France, and some of the Bordeaux wines may be used with safety. It seems to me too, that the light white wines are well borne, and as you will be likely to prescribe Vichy water with the meals, the mixture of Vichy water and white wine constitutes an agreeable drink, and superior to the mixture of these waters with the red wines. Permit then a moderate quantity of light wines with Vichy, but proscribe altogether distilled liquors whether before, during, or after meals, and especially forbid white wine to be taken on an empty stomach.[7]

As for the diet, you may allow articles of food which are largely azotized, and which are easily digested by the abundant secretion of gastric juice. Recommend also to these patients not to take their meats too highly seasoned; they had better in fact be very sparing in the use of condiments, for, as you well know, acid dyspepsia often results from the too free use of these relishes.

By these means you will generally be enabled successfully to combat the acid dyspepsias. You should always insist on out-door exercise, and sometimes you may usefully conjoin the use of vapor baths, such as the Turkish baths, which produce a powerful sudation and thus diminish the acidity of the gastric juice.

When the disease is more advanced, and the acid dyspepsia has given place to pituitous dyspepsia, it is imperative that the patients exercise excessive rigorousness with regard to their alimentary hygiene, and submit to a milk diet for a time. This heroic medicament, as well as incomparable nutrient, which we have seen so useful in putrid dyspepsia, is still more indicated here, for it moderates the exaggerated acidity of the gastric juice, and gives the stomach an opportunity to rest, while at the same time supplying the organic needs. This is an important point in the therapeutic problem under solution, for in this acid dyspepsia arrived at the state of pituitous dyspepsia, there is not only functional disorder, there is also chronic inflammation of the stomach; you witness, in fact, what the Germans call *catarrh* of the stomach. This chronic inflammation differs in many respects from the pathological conception which Broussais entertained of gastritis, but it exists nevertheless, and to cure this gastrorrhœa resulting from the inflammation of the mucosa, you must give the organ rest.

The milk treatment renders immense service, and you have seen in our wards with what rapidity by this means our patients obtain amelioration. I say *amelioration*, because unfortunately the proverb: "Who hath once drunk, shall drink again" is applicable to the majority of our patients, who, when once they have left our hospital, greatly improved in health, if not cured, speedily revert to their old drinking habits again, and thus cause a return of all their gastric ailments.

How are you to direct this milk treatment? When you are called upon to treat these victims of intemperance, and along with the local symptoms on the part of the stomach, there are general symptoms from alcoholism, you should not abruptly enforce abstinence from all spirituous liquors. In these cases you may employ koumiss, which along with the milk principles furnishes a little alcohol, and enables you without any disadvantage to await the period when you can suppress altogether the intoxicating element; when this time comes, you will order the milk to be taken for eight days, in the quantity of two or three quarts a day. It may be diluted with Vichy water—two tumblersful being added to the daily allowance, so that the patient shall get from fifteen to thirty grains of bicarbonate of soda in each quart of milk.

Then, when the symptoms of gastric irritation are alleviated, you will allow the patient to take milk porridge, farinaceous puddings, creams and custards; in a word, during another eight days the diet shall have for its basis milk and eggs. Then you will begin cautiously to give other kinds of food, even a little white wine, but you will take care for a long time to exclude distilled spirits and the heavier wines.

Certain persons who are by occupation tasters of wine, and wine merchants, easily contract the habit of tippling. When you are called to treat patients of this sort, advise them to drink as much milk as possible, night and morning, and along with their meals, so as somewhat to make amends for the irritant action of the alcohol. It is a fact which has been determined by our experiments on the alcohols, that individuals who live in an atmosphere impregnated with the vapors of ardent spirits, or who without swallowing the alcohol, keep it continually in contact with the buccal mucous membrane, are often affected with severe stomach troubles.*

The gastric catarrh of drunkards may often attain a high degree of severity, for the mucous membrane not only becomes thickened, but it may undergo ulceration, and to the glairy pituitous vomiting soon succeeds hæmatemesis; and then you have before you a symptomatic aggregate which much resembles cancer of the stomach. These are the false cancers which are quite curable, both by milk diet and by lavage of the stomach. Lavage of the stomach, even in cases of drunkard's catarrh, gives excellent results, and you see here in these hospital wards facts which attest the truth of what I say. Under the influence of the cleansing applications which every day depurate the stomachs of these patients, we see the mucus secretion diminish, and the gastric juice secretion reappear. I take care after each lavage to give to the patient milk in which I introduce a certain quantity of meat powder (100 grammes for example); milk powder may also be added. One may also, when the catarrh of the stomach is accompanied by considerable pain, employ the milk of bismuth, of which I have spoken to you elsewhere.

As for the thermal treatment, a few suggestions may be appropriate. In acid dyspepsia, you had better avoid the ferruginous waters and those which are too highly charged with carbonic acid. You will give the preference to the Vichy waters, and if you desire a water less charged with mineral ingredients, you will counsel Bagnoles, Alet and Evian. In pituitous dyspepsia, Vichy, Royat, and Saint Nectaire, will render you great service. I may say the same of the German waters of Hombourg, of Kissingen, of Carlsbad, of Marienbad; in less aggravated cases you can order the Chatel Guyon waters or those of Saint Moritz, of Vic-sur-Cère, in Auvergne, of Brides and of Saint Gervais in Savoy.[9]

Among these thermal springs, two must be regarded as unrivalled; Vichy, on the one hand, Carlsbad, on the other. I have already spoken to you of the Vichy waters, and shall not return to them now, but I wish to say a word or two about the Carlsbad waters which play so important a part in the treatment of affections of the stomach. Carlsbad constitutes the type of sodic sulphate water, and Sprudel is considered as the most important as it is the most famous spring of this station. Caulet has shown us moreover how rigorous is the alimentary hygiene carried out at this station, where one sees (what by the way is quite uncommon) the physicians and hotel-keepers work in unison to obtain from these waters the most useful results in the treatment of gastric affections. This it is that explains the popularity of these springs.

Such are the principal indications to be fulfilled in the treatment of acid and pituitous dyspepsia. In the next chapter we shall begin the study of the therapeutics of functional troubles of the muscular coat of the stomach.

NOTES TO LECTURE IX.

[1] Pituitous vomiting (*la pituite*) consists in the expulsion in the morning of a ropy viscous matter constituted by true mucus, mingled with an insipid liquid and the saliva swallowed by the patient during the night. According to Frerichs, the matters thus ejected by drunkards contain compounds of sulpho-cyanides, and have almost always an alkaline reaction.

According to Leven, the liquid thus expelled by the stomach comes by exosmosis from the blood-vessels of the gastric mucosa. (Bull. de l'Acad. de Méd., session of March 10, 1874.)

[2] Charles Richet injected into the stomach of Marcelin during digestion, two hours after the ingestion of food, some Vichy water, and observed that, far from augmenting the acidity of the gastric juice, as some authorities had claimed, alkalies and Vichy water lessen this acidity.

[3] Vichy (Allier). Alkaline springs; their temperature varies between 44 and 14° C.; their richness in sodic bicarbonate, is about 5 gms. per litre. There are 11 of these springs; the four mentioned in the text as cold springs, are alone fit for exportation.

[The analytical table of the original is omitted as being of less interest to practitioners in this country than to those on the continent. We have no alkaline springs in this country comparable with these Vichy waters, unless we except the Congress springs of California, which contain 2 grams per litre of sodic bicarbonate; the Soda springs of Wilhorts, Oregon are also strongly alkaline, Trans.]

[4] The Vichy springs belong to Allier, a province in the centre of France. The Vals station is in Ardeche, a department of southern France. The Vals springs are numerous; the waters are all cold. We may enumerate St. Jean, Rigolette, Precieusè, Désirée, Magdeleine, Marquise, Souveraine, Chloé, Source des Bains, Convalescents, St. Louis, Pauline, Vivaraises and Dominique, (arsenical). They contain lime, alum, iron, and especially bicarbonate of soda.

St. Jean contains 1.48 gm. of bicarbonate of soda per litre; Rigolette 5.80 gm.; Precieusè 5.94 gm.; Désirée 6.40 gm.; Magdeleine, 7.28 gm. There is much free carbonic acid, and considerable chloride of sodium.

[5] Patterson's powder has the following formula:

Take of:

Subnitrate of bismuth, ...	1 part.
Hydrate of magnesia, ...	1 "
White sugar, ...	8 "

Mix and triturate,

Dose, 10 grains.

Trousseau's powder is made as follows:

Take of:

Calcined magnesia, ...	2 parts.
Bicarbonate of soda, ...	3 "
White sugar, ...	10 "

Mix and triturate.

Dose, 30 grains to be taken before meals.

Another formula of Trousseau's is the following:

Take of:

Bicarbonate of soda,

Prepared chalk,

M. Magnesia, ... ā ā gr. iii.

For one dose. To be taken three or four times a day two hours before each meal and before bed time; take in a little plain water, or sweetened water.

Trousseau's pills are as follows:

Take of:

Subnitrate of bismuth, ...	1 decigram.
Carbonate of lime, ...	25 milligrams.
Honey, ...	q.s.

F. S. A. One pill. Take from two to twenty such pills a day.

Gendrin's antacid powder is thus made:

Take of:

Bicarbonate of soda, ...	2 grams.
Subnitrate of bismuth, ...	1 "

M. Divide into four powders.

[6] The antacid potion of Radius is as follows·

Take of:

Calcined magnesia, ...	4 grams.
Syrup, aurantii corticis, ...	14 "
Peppermint water.	90 "

M. To be taken in dessert spoonful doses.

[7] According to Bouchardat's table, the proportion of alcohol in the native wines of France varies from 5 to 23 per cent. The strongest is Marsala, which contains 23.83 per cent. A part of the table is here reproduced:

Percentage of alcohol in certain French wines.

Marsala	23.83	White wine of Sauterne	15.00
Red Madère	20.52	Tonnerre	10.70
White Madère	20.00	Red wine of Gironde	9.21
Port	20.00	White " "	11.57
Bagnols	17.00	Chateau-Latour	9.33
Malaga	17.42	Red Bordeaux	10.10
Rousillon	16.88	White wine of Pouilly	9.00
Common Malaga	15.00	Léoville	9.10
Red Jurançon	13.70	Frothy wine of Champagne	11.77
Lunel	13.70	Frontignan	11.84
Champagne	12.77	Chateau Margaux	8.75
Orleans	10.66		

Certain wines of central and northern France, like almost all those of the environs of Paris, contain not more than 5, 6, 7, per cent. of alcohol.

'In our experimental researches on alcohol poisoning, we found that the introduction of alcohol by the skin, determines grave lesions on the part of the stomach and duodenum. At the necropsy of animals killed by alcohol injected under the skin, we noted hemorrhagic softening of different points of the mucous membrane.

Jaillet has undertaken experiments to ascertain the action of alcohol on the stomachal mucous membrane, and by a process which consists in rapidly administering to dogs large doses of alcohol, followed by sulphate of strychnine to oppose fatal effects, he has determined in the mucous membrane of these animals gastritis with ulceration of the mucosa.*

'A brief reference to these (foreign) spas will be appropriate here.

BAGNOLES. In Orne, Lower Normandy. There are two principal springs, ferruginous and sulphurous. Feeble mineralization.

ALET. In Aude, France. Four principal springs, bicarbonated, calcic, and magnesian; one of these is ferruginous.

EVIAN. In Haute Savoy. The principal springs are six in number; mineralization almost negative. These waters are feebly bicarbonated.

ROYAT. Sodic bicarbonated waters, with a little chloride of sodium.

SAINT NECTAIRE (Puy de Dome, France). Gaseous, thermal waters; sodic bicarbonated, with equal parts of bicarbonate of soda and chloride of sodium, and traces of arseniate of soda.

HOMBOURG es-Monts (Hesse). Sodium chloride in large proportion; carbonic acid in excess and a little iron. The springs are five in number, the most important of which are the Elizabeth and Louise springs.

KISSINGEN in Bavaria. Waters athermal, gaseous, feebly ferruginous, and sodic chloridic.

CARLSBAD in Bohemia. These are the type of sodic sulphate waters; there are ten principal springs whose temperature varies between 40° and 50° C. The most important is Sprudel, whose waters are alterative and laxative.

MARIENBAD in Bohemia. Sodic sulphate springs, strongly effervescent. These springs are eight in number, of which La Croix is most employed, being much sought after by those suffering from chronic affections of the digestion. Temperature of the water 8.5° C.

CHATEL GUYON (in Puy de Dome, France). These springs are of rather low temperature, poly-mineralized, effervescent. The springs at this station are very numerous.

SAINT MORITZ in Switzerland. Athermal springs, moderately calcic, bicarbonated, feebly ferruginous, strongly effervescent. These waters are cold; are much used along with whey.

VIC-SUR-CÈRE in Cantol, France. Cold alkaline waters, strongly effervescent.

BRIDES. In Savoy, France. Hyperthermal, calcic and sodic sulphate, moderately sodic chloridic, feebly sulphurous. Temperature 34° C.; tonic in small quantities, while six or eight tumblersful prove laxative.

SAINT GERVAIS. In Haute Savoy, France. Athermal or hypothermal, mildly sulphated, or sodic chloridic; feebly calcic sulphated, or ferruginous. Principal springs are seven in number. Temperature varies between 32° and 38° C.

* Dujardin Beaumetz and Audige, Experimental Researches on Alcohol Poisoning, Paris, 1879. Jaillet, Alcohol, its Combustion, its Physiological Action, its Antidote, Paris, 1883.

Of all these springs Sprudel is one of the most important; according to Ragsky, the composition of Sprudel water is as follows:

Sulphate of potassa,	0.1635
" soda,	2.3719
Carbonate of soda,	1.3619
" potassa,	1.0307
" lime,	0.2976
" magnesium,	1.1239
" strontium,	0.0008
Protocarbonate of iron,	0.0028
" " magnesia,	C.0006
Phosphate of aluminum,	0.0004
Fluoride of calcium,	0.0036
Silica,	0.0728
Total	5.4307
Free carbonic acid,	499cc.

The temperature of this water is 73.05 C., and it must be allowed to cool before using internally. Its taste is salty and strongly alkaline. It issues bubbling in intermittent jets, hence the name of Sprudel (*boiling*). From two to three glasses are usually drank a day. From the point of view of stomach affections, the Carlsbad waters are particularly applicable to gastro-intestinal irritations so frequent beyond the Rhine, where the ordinary diet is much more rich and substantial than in our country.

The Carlsbad waters are strongly purgative. The rules laid down for the use of this water at the Sprudel station (according to Caulet) are as follows: The water is drank early in the morning (from 5 to 7 o'clock). An hour after the last tumblerful (at 8 A.M.), a moderate breakfast is taken of bread with milk and coffee; the quantity being carefully measured beforehand. The dinner is at 1 P.M., and is more substantial, but the patient is allowed but one plate of meat. The supper is at 8 P.M., and consists of soup or broth, a cup of chocolate or an egg. A rule which is considered inviolable by the hotel-keepers, is to give only aliments of best quality, and every article of food and drink must have been ordered by the physician.

LECTURE X.

TREATMENT OF ATONIC DYSPEPSIA AND OF DILATATION OF THE STOMACH.

SUMMARY.—Functional Troubles of the Muscular Coat—Atonic Dyspepsia—Flatulent Dyspepsia—Dilatation of the Stomach—Catheterism of the Stomach—Pharmaceutical Means—Tetanizing Medicaments—Bitter Drops of Baumé—Bitters—Quassia—Columbo—Bitter Ptisans—Absorbent Powders—Mechanical Means—Topical Stomach Medication—Stomach Pump—Electricity—Dietetic Means—Hydrotherapy—Gymnastics—Thermal Treatment.

IN the previous chapters we have studied the treatment of the functional troubles of the mucous membrane of the stomach, we come now to the consideration of the modifications produced in the functions of the muscular coat, and I shall first sum up briefly what we know of the anatomy and physiology of this muscular investment. It is a thin stratum enveloping the stomach in its whole extent, and constituted by fibres disposed in such a manner that they form by their direction several secondary layers. This muscle has for function to agitate the alimentary mass, and impregnate it with gastric juice.[1] Brinton has well shown the course which the alimentary bolus pursues under the influence of these movements, which are rhythmical, and are produced regularly and constantly from left to right, that is to say, from the greater curvature to the pyloric extremity. Leven, who has studied attentively these peristaltic movements, affirms that they take place even during fasting, but that they are more active during the digestive process. According to this authority, aliments sojourn but a very short time in the stomach, which has for its sole function to soak the alimentary bolus with gastric juice, and to pass it rapidly into the intestine by the pyloric orifice which opens for this purpose, six to eight times a minute.

These rhythmical movements you have been enabled to observe in a female patient occupying No. 12 ward Sainte Marie. This woman, still quite young, was affected with cancer of the pylorus; the thinness of the abdominal walls, and the hypertrophic thickening of the muscular coat enabled us to see the movements of the stomach, which were effected under the influence of digestion. We could remark that the least impression on the walls of the abdomen, provoked vermicular and rhythmical movements,—a true systole of the stomach, which, commencing at the greater curvature, terminated at the pylorus. Schiff pretends that the movements may take place in a contrary direction, but Leven denies this, and asserts that there are no antiperistaltic movements, even when there is vomiting.*

Under what influence are these movements produced? This is a very interesting question. The muscular tunic receives certain plexuses of nerves which have their seat in the superior and inferior layers; these are the plexuses of Auerbach and of Meissner, consisting of very numerous nervous filaments. These plexuses come from two sources: from the pneumogastric, on the one hand, and the great sympathetic on the other. These two nerves have a different action, and in this regard the experiments of Pflüger and those more recently performed by Braam-Honckgeest, seem demonstrative.† Excitation of the pneumogastric has for its effect to accelerate the movements of the muscular coat; it is the motor nerve of the stomach and intestine, while on the other hand, the great sympathetic moderates these movements, and is considered as a nerve of inhibition. Such are in brief our physiological and anatomical acquisitions regarding the muscular coat.

Let us now study the functional troubles of the muscular investment. They are of two kinds; either there is atony of the muscular coat, and hence enfeeblement of the peristaltic movements—this is atonic dyspepsia, or else the movements are exaggerated, perverted, and the stomach rejects its contents and we have vomiting. These two states must be examined separately; let us commence by the study of the particular form of dyspepsia dependent on atony of the muscular coat. Atonic dyspepsia presents several stages. At the onset, the patient feels while gastric digestion is going on, a sensation of weight and fulness in the stomach; he is forced to unbutton his vest because it compresses his abdomen, and he experiences a general torpor resulting from a slow and laborious digestion.

At a more advanced stage you observe a notable swelling of the stomach, and if you examine the gastric region, you see this organ distended by gas, well delineated under the abdominal walls. This distention is a consequence of the weakness of the muscular coat, which passively yields to the pressure of the gas which is generated in the stomach; this is what is described under the name of *flatulent dyspepsia*. The patient has frequent eructations, and if he shakes himself he experiences a peculiar swashing sensation—a sort of *glou-glou*—identical with the Hippocratic succussion. This noise, due to the shock of liquids and of gas, and which Chomel has considered as peculiar to the dyspepsia of liquids, is a characteristic sign—not as Matice thinks of cancer, but of want of contractility of the muscular coat.[a]

* Leven, On the Movements of the Stomach (Gaz. Méd. Dec. 1875.)

† Braam-Honckgeest, Pflüger, Arch., Sept. 1862 and 1873, p. 163 and 17.

Now that I have spoken to you of this bruit, permit me to call your attention to a sound which is not indicated by writers on diseases of the stomach; it is a metallic tinkling heard in certain cases of extreme distension of the stomach, and which, with the previous symptoms, leads one to think of the possibility of pneumothorax. How explain this metallic tinkling, how avoid a mistake in diagnosis? If you examine your patient attentively, you will notice that this bruit corresponds with the beatings of the heart, and that it is due to the shock of the heart against the diaphragm which is forced upward by the dilated stomach, and to the transmission of this bruit to the gas-distended ventricle of that organ. By noting then the excessive development of the stomach, and the co-existence of the tinkling sound with the beating of the heart, you will not fail to recognize the cause of this symptom.

At the end of a certain time, the stomach paralyzed, and performing its contractile functions in an incomplete manner, becomes more and more distended, and one has then to deal with the most advanced period of the disease; there is now dilatation of the stomach. Kussmaul has well studied this form of dyspepsia with dilatation, and Penzoldt has written a very complete monograph on this subject.[3]

Dilatation of the stomach may have two origins; sometimes it depends, as we have just seen, on want of contractility of the muscular coat, which permits the ventricle to become distended under the least influences; sometimes it is produced by mechanical troubles.

In the first case, the paralysis of the muscular coat may be due to general atony of the muscular system, or to modifications effected in the innervation of the stomach. Thus it is that we observe gastrectasia as the result of atonic dyspepsia or of hysteria.

At other times this paresis results from inflammation. You know in fact, that when any phlegmasia affects the muscular layer, it destroys the contractility of the fibres. This is what happens in chronic gastritis, and invariably you will see catarrh of the stomach accompanied by more or less dilatation of this organ. Brinton, for instance, attributes the dilatation of drunkards to paralysis of the muscular coat, consecutive to general infiltration of the connective tissue.

Other causes which produce gastrectasia are of mechanical order, and result either from the introduction of too great a quantity of food into the stomach, as in the case of excessive eaters, or, (as is more frequently the case) from the presence of an obstacle which prevents the food from passing through the pylorus. In the latter case the muscular coat of the stomach undergoes great development, and you see along with dilatation an hypertrophy of the gastric walls. This is precisely like what takes place in the bladder when there is stricture of the urethra.

Whatever may be the cause of the dilatation, the symptomatic aggregate is the same, at least as far as the local signs are concerned. By the sight and by percussion, you notice a marked development of the stomach, which is often well delineated under the abdominal walls. You notice also an exaggerated sonorousness in the left hypochondrium over the costal parietes, by reason of the distension of the great *cul de sac* of the stomach which presses up the diaphragm. In order well to understand these modifications of the stomach, you should remember the relation of the ventricle with the abdominal walls, which relations have been well studied lately by Lesshaft of St. Petersburg.[1]

But the most characteristic sign is that peculiar splashing sound, heard in well-marked cases, by suddenly shaking the patient, by palpating over the greater curvature in a downward direction, or by pressing quickly and repeatedly over the abdominal walls. Authorities have laid much stress on this "*bruit de clapotement*," as it is called, and which Chomel described with so much minuteness many years ago, but this swashing noise cannot be regarded as a sign of dilatation of the stomach, unless it is produced in certain conditions. When it is seated within the natural limits of the stomach, this sign is of little importance, and may hardly deserve to be called pathological; but in order that it may have its full value, this bruit must be produced below a horizontal line leading from the umbilicus to the left border of the costal cartilages. In order to obtain this splashing sound, it is necessary that the stomach shall contain a certain quantity of liquid, therefore in the case of persons who are fasting it will be a good plan to have them drink a quantity of water before making the examination.[2]

In connection with this sign, there is a mistake which must be avoided; namely, confounding the gurgling noises which are produced in the large intestine with the swashing sounds of gastric origin of which we have just spoken. You know the close anatomical relations between the stomach and transverse colon, and you easily understand how such a mistake might be made. The stomachal bruit has however a different tone from the intestinal bruit; moreover the direction of these sounds is not the same. As for those produced in the intestine, they are propagated along the ascending and descending colon, while those of the stomach are limited to the region of that organ. Moreover, to remove all doubt, you can judge of the volume of the stomach, whether augmented or not, by auscultating the abdominal region; when you make your patient drink in a standing position, you hear sometimes at a point more or less remote from the natural limits of the gastric ventricle, the sound of the collision which results from the fall of the liquid to the lower part of the stomach.

But I do not think it of any practical utility in order to measure these dilatations, to employ the procedures counselled by Leube and Penzoldt, these measurements being of no great help to your diagnosis.[3]

Vomiting is not a constant accompaniment of dilatation of the stomach. It is especially characteristic of gastrectasias of mechanical origin, and then it takes on a peculiar character. It comes on only every second, third, fourth, or fifth day, when it is extremely abundant and consists of all the food the patient has eaten during the preceding days.

Bouchard has attributed to these dilatations quite a pathogenetic rôle, and taking up again under another form the views of Beau, who, as you know, assigned to dyspepsia, primary, secondary, and tertiary constitutional troubles, Bouchard thought that this dilatation was the expression of an acquired diathesis, and engendered a great number of diseases.

While recognizing that dilatation is much more frequent than was formerly supposed, for the very reason too that we now look for it with greater care, it seems to me difficult fully to adopt Bouchard's views, for if dilatation of the stomach may be the origin of general troubles of nutrition which favor certain diathetic affections, one is justified in demanding if this dilatation be indeed a primitive fact, and if it may not itself result from a general disorder of the nervous system reacting on the innervation of the muscular coat of the stomach.[7]

From a therapeutic standpoint we ought to distinguish the treatment of atonic dyspepsia from that of dilatation of the stomach merely; in the former are especially indicated the tetanizing medicaments, bitters and antiseptics; in the latter such mechanical means as lavage of the stomach have great importance. There are also certain hygienic rules applicable to both affections.

In atonic dyspepsia you endeavor to act on the muscular fibre, and stimulate its contractions. Here we have an indication for the tetanizing medicaments with elective action upon the striped or unstriped muscular fibre. The vegetal productions containing strychnia attain this end, and there is a preparation which gives excellent results in these cases, and deserves an especial mention; I allude to the *bitter drops of Baumé*. This tincture is given in the dose of one to five drops before or after meals. You can also employ "Tastour's powder" which contains nux vomica, four grains of which, containing one grain of nux vomica, may be taken at meal time.[8]

The bitters accomplish the same end, and though we have not precise therapeutic indications respecting these medicaments, I am nevertheless led to believe that they act by exciting the muscular contractions of the stomach. The first rank must be assigned to quassia amara and columbo.

Quassia is of ancient and classic usage. It is administered in cases of atonic dyspepsia, especially in the first period, under the form of macerations or infusions. You know that quassia gives up its bitter principles to cold water; you can then macerate from one to two drachms of the chips in a quart of cold water; this is a handy form for administration. The quassia-wood cups are much in use; there is, however, an inconvenience attending their employ, for when they have been for some time made the receptacle of mixtures of wine and water, this liquid penetrates the wood, ferments, and ever after sours everything which is poured into these cups. You will do better, then, to prescribe weak infusions, made with the chips and cold water. Such infusions may be taken a short time before meals.[9]

Some physicians prescribe quassin. Campardon has shown us the influence of this active principle upon the contraction of the smooth fibres in general. If you employ amorphous quassin you will order two grains daily in granules each containing one-third of a grain; if you make use of crystallized quassin, the dose is only one-sixth of a grain.

Columbo is given in powder, in the dose of from five to fifteen grains, or in the form of wine or elixir which are good preparations in the treatment of atonic dyspepsia.[10]

Then comes the series of "bitter species;" first germander, the lesser centaury, and wormwood, which constitute the bitter species properly so-called; then hops, holly, chiccory, bitter orange peel, with which you can make ptisans which may be often taken with benefit.

You are aware that all these substances enter into the composition of formulæ more or less complex; compound decoctions, elixirs and pills, are made which all contain for basis these various bitter plants; the "English Stomachal Decoction," the "Visceral Elixir of Hoffman," the "Tonic Pills of Moscow." You see every country has given a special formula, and I simply mention these preparations without attaching much importance to them.[11]

By the side of these substances called bitters, we must place two medicaments which give good results in this form of dyspepsia; I refer to rhubarb and aloes. I shall have more to say about these two therapeutic agents when I come to the diseases of the intestines, and the subject of purgatives is before us. Our interest at the present time in the two purgatives just mentioned is due to the fact that they are often associated in stomachic preparations which are given in the form of powder, wine, or pills.[12]

Against the accumulation of gas, which often results from vicious fermentation of the food on the one part, and the weakness of the walls of the stomach on the other, you may employ certain absorbent and antiseptic powders. As for the first, Belloc's poplar charcoal powder deserves to be placed at the head.[13] I do not think that this prepared charcoal acts as an absorbent of gases, for it is well known that this absorption does not take place unless the charcoal is dry, but I believe that we can explain its favorable action by its antiseptic effects which are most manifest. It is in the same way that the inert powders act, such as subnitrate of bismuth, which also antagonize fermentation.

Iodoform has also been recommended as being antifermentative. While recognizing the aseptic power of this substance, I am not a strong advocate of its employment, for it has always occasioned, in cases where I have used it, more or less irritation of the stomach, and I much prefer the carbon bisulphide water of which I spoke in the last lecture, and which you may administer in the dose of from four to six tablespoonfuls a day.

There remains, finally, the most important point to be considered, namely, the treatment of dilatation of the stomach by special means. The therapeutics of gastrectasias, from whatever cause, consist especially and almost exclusively in lavage of the stomach, and just as in the case of individuals who are affected with stricture of the urethra, or who from any cause are unable to empty their bladder completely, it is the duty of the physician to withdraw the residue by catheterism, so also it is equally important in gastrectasia, by repeated washings of the stomach to remove from that cavity liquids which sojourn and stagnate there.

These liquids, which have recently been well analyzed by Van der Velden, undergo putrefactive changes by their prolonged sojourn in the stomach, and their presence is a cause of constant irritation to the mucosa. In order to rid the stomach of these putrid liquids, it is necessary thoroughly to wash out and medicate that organ.[14]

Therefore, gentlemen, this operation becomes obligatory upon you in such cases, and whenever you resort to it, even when the patient is affected with cancer of the pylorus, you will give relief.

As for the manual procedure of this operation, I must refer you to what I have said in a previous lecture, recommending to you at the same time always to have care to terminate your lavage of the stomach by a "gavage" with alimentary powders and milk.

How long should the treatment of dilatation of the stomach by lavage be continued? This depends absolutely on the cause of the gastrectasy. The treatment should often be continued a very long time, even in cases of simple dyspepsia, and I have seen patients presenting no stricture of the pylorus, obliged to practice lavage for years; instances of this kind you will find in the thesis of my pupil, Dr. Lafage.* This long continuance of a remedial procedure must not daunt you, for the patient derives such advantage from the lavage that he performs it with regularity, and you will see a great many persons who treat their stomachs with the same scrupulous cleanliness as they do their hands and their face.

Apart from lavage, the other means are of a secondary order; I ought, however, to say something to you about electricity and massage.

Furstner and Neftel have shown us that by employing induced and feebly intermittent currents, one may arouse the contractions of the stomach. Macario and Bonnefin have often derived good effects from electricity. I see no harm in the use of this means to provoke the contractions of the stomach, the muscular coat of which is affected with paralysis, while, at the same time, recognizing the fact that in most cases the

* Dilatation of the Stomach, and Its Treatment by Lavage. (Thèse. de Paris, 1881.)

current acts rather on the abdominal walls than on the stomach itself. It is not the same when the electrical current is applied directly to the stomach. Perli in 1879, and Bocci in 1881, advised to make one of the electrodes penetrate into the stomach itself.[15] But it is Bardet who has rendered the application of electricity easy, by constructing the instrument which I here present (Figure V), and which consists, as you see, of a stomach syphon divided into two parts, which are joined by a metallic portion in the form of a letter T, which permits the introduction of a stylet into the interior of the tube which penetrates the stomach. This stylet is terminated by an olive shaped carbon point, and its inferior extremity does not extend beyond that of the sound. The stylet is a copper wire to the extremity of which one of the electrodes may be fixed. The

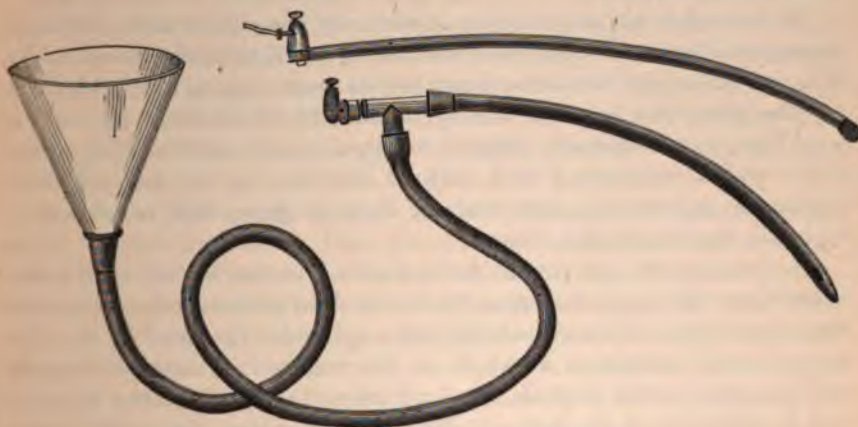

FIG. 5.

sound is first made to penetrate the stomach without the stylet, then the latter is introduced. Then pains is taken to fill the stomach with a certain quantity of water by means of the syphon, and it is by the intermediation of this water that one is enabled easily to electrize the internal surface of the stomach. The negative pole is the one that is passed into the stomach, the positive pole is applied externally over the gastric region. It is the constant current of which you will make use, but you will have care to interrupt this current from time to time. The force of the current ought not to exceed twenty-five milliampères, and the duration of the séance is from five to ten minutes; then you are careful to syphon out the stomach so as to remove the liquid which you have introduced. I have often made use of this method in my service, and I have obtained good results from it, especially in cases of enormous dilatation, ordinarily so obstinate and so rebellious to all our modes of treatment.

Dally has also counselled methodical massage of the stomach, and Hand, basing himself on physiological experiments, has proposed to compress artificially the pneumogastric nerve in order to augment the contractions of the stomach; these compressions he practices on the left side of the neck. This completes the therapeutic means properly so-called; let us pass on to the hygienic means.

How can you, by hygienic means, combat this atony which so paralyzes the muscular coat of the stomach? Let us begin with alimentation.

As far as possible, you will follow the rule laid down by Brown-Séquard for the treatment of the dyspepsias, a rule which applies almost exclusively to this variety of functional trouble. The number of meals must be multiplied, and the patient must be made to eat every hour, but very little at a time. You will choose aliments which are the most nutritious and most digestible possible in a small volume, such as juicy underdone meats and roast meats.

To favor the imbibition of the aliments by the gastric juice, you will recommend that the food be well masticated, and if the patient cannot do this, you will advise him to use finely hashed meats, taking care to exclude for the most part fats and starchy substances, which often sojourn a long time in the stomach without undergoing any modification. You will do well to recommend such azotized substances as have already undergone a commencing fermentation, such as game that is somewhat high, old cheese and sour crout.

Recommend to the patient to be reserved in the matter of drinks. Schroth and Bartels go farther and order absolute abstinence from liquids; this is what Chomel described many years ago under the name of the dry diet cure, the advantages of which in the treatment of atonic dyspepsia and dilatation of the stomach, Huchard has quite recently shown us. In fact in dilatation of the stomach, drinks remain a long time in the ventricular cavity, and their presence often determines the characteristic *glou-glou*. Put your patients then on a dry diet, enjoining abstinence from liquids.[16]

Recommend especially to your patients to avoid at whatever cost that lethargic torpor which seizes them after meals. Prescribe regular exercise after eating, so as to combat that pernicious tendency, so common in these diseases. For young and old after a hearty meal, walking is better than lying down.

Another important point is to excite the general circulation in order to favor the gastric congestion which accompanies digestion; for this congestion, as you know, has much to do with the contractions of the muscular fibres; this you will accomplish by out-door air and exercise, such as walking and racing. To these means you will join the usage of hydrotherapy and gymnastics.

Hydrotherapy has not only a tonic action on the economy, but it acts directly on the stomach by the local effect of cold over the surface of that viscus. Remark what takes place in a person affected with dilatation of the stomach; the application of cold over the abdomen provokes peristaltic movements of the muscular coat of the stomach. Here is an indication which is well fulfilled by hydrotherapy, and nothing can better accomplish this end than the circular douches directed over the pit of the stomach.

Gymnastics may have a good influence in the treatment of atonic dyspepsia. My friend, Dr. Tourangin, has shown me a number of patients so affected, and who were, as he claims, cured by a well directed course of gymnastics alone.

But what you ought especially to urge upon your patients suffering from atonic dyspepsia, is to attend carefully to the state of their bowels. In fact, the muscular lining of the intestines is a continuation of that of the stomach, and paralysis of the one induces paralysis of the other; hence it is that almost all persons suffering from atonic dyspepsia are constipated. It will be necessary then to stimulate the muscular fibres of the intestine, and not to add paresis of this part of the alimentary canal to that already existing in the gastric portion of the digestive tube. The patient should be enjoined regularly to solicit a stool, and if habit cannot overcome the constipation, he should be directed to resort to some of the purgative mineral waters.

Atonic dyspepsia, and especially flatulent dyspepsía, demand a quite special thermal treatment. Here you are not to select those waters which have a derivative effect on the bowels, but rather those which act on the cutaneous surface; you should, in a word, prefer external medication with baths, to the internal usage of the waters, therefore you should avoid the too gaseous waters which are more injurious than useful in these cases, and send your patients to Plombìeres, to Luxeuil, to Bourbon-Lancy, to Ussat, to Bagnères de Bigorre, to Lamalou, to Saint-Sauveur, or to Aulus.

When you have to deal with a case of dilatation of the stomach and your patient is practicing lavage, you can send him to those watering places where lavage is conducted systematically, as to Vichy or to Chatel-Guyon. Good effects are derived from these waters by bringing them directly into contact with the walls of the stomach by means of the syphon. Such are in brief, the dietetic rules which are applicable to the treatment of atonic dyspepsia and of dilatation of the stomach.

In the next chapter we shall study the troubles due to perversion of the movements of the stomach; I refer to vomiting, which by reason of its frequency deserves to engage our attention for a short time.

NOTES TO LECTURE X.

[1] In the stomach the muscular tissue varies in thickness; at the fundus it is thin, (¼ to ⅓ of a line); in the middle it has a thickness of about ½ a line; in the pyloric region finally, about ¾ of a line, and even a line. It consists of three incomplete layers: 1, most externally, longitudinal fibres, especially at the cardia, where they arise from the expansion of a part of the longitudinal fibres of the œsophagus; and also at the pylorus and in the *pars pylorica*, whence, tensely stretched, they are continued upon the duodenum; 2, circular muscles, in the middle region, from the fundus to the pylorus, where they are accumulated, constituting the sphincter of the pylorus; 3, most internally, oblique fibres, which, in connection with the circular fibres, embrace the fundus as in a sling, and run obliquely upon the anterior and posterior walls of the stomach, toward its greater curvature, where they terminate upon the outer surface of the mucous membrane, or unite together.

According to Leven, the stomach is divided into three portions; the first, situated on the left, cardiac portion, serves always as a reservoir for the food, and the movements in this portion are little pronounced; the vessels and the peptic glands are few in number here. The second or right portion, constitutes the useful part of the stomach; the movements there are energetic; the circulation is active, as is also the gastric juice secretion. Finally, in the third portion, called pyloric, the movements are still very manifest, but the secretion of gastric juice ceases at this point. It is generally three or four hours after a hearty meal that the movements of the stomach are most energetic.*

[2] Dr. Thwald has analyzed the gases of the stomach in several of his patients with the following result:

Carbonic acid,	20.57
Hydrogen,	20.57
Marsh gas,	10.75
Oxygen,	6.52
Nitrogen,	41.38
Sulphuretted hydrogen,	Traces

Leven has found oxygen, nitrogen, and carbonic acid. The two last may be wanting, but oxygen always is present.

In a fasting dog he obtained from the stomach 17 cubic centimetres of gas and the relative proportions were 6.4 carbonic acid, 12.4 oxygen, and 81.2 nitrogen.

In his study of the gases of the digestive tube, Leven has, moreover, shown that these gases do not come from the food, but from the air, from the blood, and from fæcal matters.

[3] Penzoldt has given us a good history of dilatation of the stomach. This pathological condition was not noticed till the sixteenth century,

* Leven, On the Movements of the Stomach. Traité des Maladies de l'Estomac, 1879, p. 9. Kölliker's Microscopical Anatomy, Am. Ed. p. 503.

and it was Fabricus Aquapendens who was one of the first to point out the extraordinary dimensions to which the stomach may attain. In 1623, Spigel speaks of a stomach which could hold four gallons of liquid; in 1685, Bonnet describes the case of a woman with an enormous dilatation of the stomach. Mauchard in 1697, also mentions a case of gastric dilatation. In the XVIIIth century, facts of this kind were multiplied, and numerous authors described, though rather under the title of anatomical curiosities, cases of excessive stomachal dilatation.

In 1743, Widmann, Van Swieten and Morgagni, laid the foundations of the pathogeny of this affection, and remarked that excessive spirit drinking, exaggerated contractions of the stomach, and cancer of the pylorus were the more frequent causes.

Lieutaud in 1752, was one of the first to record observations of dilatation of the stomach without constriction of the pylorus.

In 1833, Duplay published his work on dilatations of the stomach, in which he recognized the following causes:

1. Stenosis and obliteration of the pylorus; 2. Abnormal adhesions of the stomach; 3. Destruction of the muscular fibres; 4. Induration of the cellular tissue, which borders on the pylorus; 5. Atrophy of the entire muscular coat; 6. Hydatid tumors developed in the cavity of the stomach; 7. Paralysis of the walls of the stomach.

Naumann in 1834, admitted three species of dilatations: 1, by gluttony; 2, by atrophy of the muscular layer in the cachectic; 3, by stenosis of the pylorus.*

'Lesshaft has studied the situation of the stomach in 1200 cadavers previously frozen, and these are his results: The stomach is not horizontally placed, with the great *cul de sac* on the left, the pylorus on the right, the lesser curvature above, and the greater below. When it is full, it does not undergo torsion around its axis, in such a manner that the greater curvature is in front, the lesser behind, the anterior wall looking upward, and the posterior downward.

Normally, five-sixths of the stomach is on the left of the median line, and only one-sixth on the right. The cardia corresponds in front to the junction of the sixth and seventh costal cartilages with the sternum, and behind to the fibro cartilage which unites the ninth dorsal vertebra to the tenth.

The great *cul de sac* is seated on the left of the cardia. Its most elevated portion attains, on the mamillary line, the height of the fifth rib, often that of the fourth intercostal space.

Leaving the great *cul de sac*, the greater curvature descends in the left hypochondrium, and then turns horizontally to the right toward the median line; its horizontal part is situated more or less low, but generally it passes behind the middle third of the space which joins the base of the ensiform cartilage to the umbilicus. The lesser curvature commences at the level of the left border of the base of the xiphoid cartilage, and takes a direction at first a little to the left, and downward, then descends vertically to the left of the vertebral column. At the level of the extremity of the cartilage of the eighth rib, it turns to the right to terminate at the pylorus, which corresponds with the right border of the sternum. The position of the stomach is then principally vertical; the great *cul de sac*

* Penzoldt, Die Magenerweiterung Erlangen, 1875. Mathieu on Dilatation of the Stomach. Revue de Méd., May 10th, 1884.

is directed upward, the greater curvature to the left, the lesser to the right.

The opening of the pylorus looks to the right and often slightly backward, and corresponds to the right border of the sternum; the anterior wall of the stomach looks forward, the posterior backward.

What position does the stomach occupy when it is full? Folds of peritoneum fix this viscus superiorly, on the right, on the left, behind and below. These folds are the shorter the nearer you approach the cardia and pylorus, which are also the points of the stomach which are most fixed; moreover the fold of peritoneum which extends from this viscus to the spleen is very short in its upper portion, so that these two organs are intimately connected.

The most mobile parts are in that portion of the stomach which is situated under the gastro splenic ligament, and the inferior part of the pyloric portion, but they can only take a direction downward, for every displacement of the greater curvature forward would have for its result to make traction on the spleen, which is itself fixed by peritoneal folds.

These anatomical relations suffice to show that the stomach can not move around its own axis in such a way that the greater curvature is placed in front; it can only dilate regularly while its external border takes an extension more to the left and downwards. Cases of gastrectasy show this in a most evident manner.*

[s] This is the way Chomel expresses himself with regard to this particular bruit: "The symptom peculiar to this dyspepsia is the production in the gastric region of a *swashing sound*, due evidently to the presence simultaneously of a larger quantity than natural in the stomachal cavity of gas and liquids. This bruit is heard during movements, whether the patient rises or lies down, or suddenly reclines on one side or the other. The medical attendant readily hears the sound, which is almost constantly to be detected at whatever period of digestion he may examine the patient, and even when the patient is fasting; all that he has to do is to press energetically, or give a few smart taps with the hand over the left part of the epigastrium, in the point corresponding to the great *cul de sac* of the stomach. It is equally well produced by placing the two hands over the loins of the patient and giving to the trunk two or three lateral shocks. This *bruit de clapotement* may be confounded with a similar bruit of which the large intestine is sometimes the seat, which is easily produced by the movement of the whole trunk, but better still by pressure of the hand over the region occupied by the colon. It is met with especially in subjects who have recently taken an enema, and with those who are affected with serous diarrhœa. The knowledge of these conditions and the special seat of the stomachal *clapotement* suffice to distinguish it from the intestinal *clapotement*.†

[6] These measurements are made by means of an œsophageal sound, which is made to penetrate as deeply as possible into the stomach; the extremity of the sound is felt through the abdominal walls; from this the distance is measured to the part of the sound embraced by the incisor

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* Lesshaft, On the Situation of the Stomach, its Form and its Function. Arch. de Virch., vol. 76, fasc. 1.

† Chomel des Dyspepsies, 1867. Audhoui, Clapotement de l'Estomac. Compt. Rend, de l'Acad. des Sciences, July, 1884.

teeth. This, in a woman of average height (1.53 metres) is 56 centimetres, or 59 centimetres for a man whose height is 1.60 metres.

In cases of dilatation of the stomach, measurements have been given by Penzoldt of 64, 70, and 73 centimetres.*

' Bouchard observes that dilatation of the stomach is extremely frequent. He has found it in 30 per cent. of his patients, and on restricting the number to chronic diseases, the proportion is 60 per cent. He considers as dilated, only those stomachs where the *bruit de clapotement* could be heard —during fasting—below the middle of a line drawn from the umbilicus to the border of the left ribs. He has described a very complex sum of symptoms resulting from this dilatation, and has analyzed two hundred and twenty cases, describing several forms. There is, first, a latent form in which the patients do not experience any dyspeptic troubles; then a second form accompanied by flatulent dyspepsia, gastralgia, or intestinal dyspepsia; sometimes hepatic disturbances predominate.

Finally, Bouchard admits larvated forms, which comprehend types very numerous and widely different. There is the neurotic type with all the symptoms of nevrosism, or of hypochondriasis; the cardiac type, with palpitations, intermittences, and false angina pectoris; the asthmatic type with pulmonary troubles; the renal type in which Bright's disease may be recognized; the cutaneous type, observed chiefly in children, and which is accompanied by eczema; finally the rheumatic type, with nodosities of the joints. He considers all these troubles as dependent on fermentations taking place in the digestive tube, and which have for their origin animal alkaloids, which engender them. According to him, dilatation of the stomach is the realization of an acquired diathesis, and gives rise to a great number of diseases.

Dujardin Beaumetz, in commenting on this communication, observed that Bouchard in adopting the views of Beau, attributed to dyspepsia all the conçomitant symptoms without any more positive proofs than those adduced by Beau, for in these cases one is always bound to ask if the dilatation of the stomach instead of being the primary origin of the trouble, is not simply a manifestation.†

' Tastour's Powder.

Take of:

Pulverized nux vomica, ...	5 centigrammes
Pulv. canella alba, ...	1 decigram
Carbonate of lime, ...	1 decigram

M. For one powder.

The "Bitter Drops of Baumé" may be conveniently replaced by the tincture of nux vomica; dose, from three to ten drops three times a day. Baumé's "bitter drops" contain Ignatia-amara, (strychnos ignatii) alcohol, absinthe, carbonate of potassa and soot.

' Quassia is obtained from the Simaruba excelsior. It is the wood of quassia amara which is officinal, this is a native of Surinam, and is a small tree or shrub. It imparts its bitter qualities to water and alcohol;

* Franz Penzoldt, Die Magenerweiterung, Br. Erlangen, 1875. Leube Zur Diagnose der Magendilatation. (Deutsch, Arch. für Klin. Med., Vol. XVI., p. 394.)

† Bouchard, On the Pathogenetic Rôle of Dilatation of the Stomach, and the Clinical Relations of this Disease with Divers Morbid Accidents. (Gaz. Méd., 1854.)

the bitter principle was first isolated by Winckler and called by him *quassin*, which is amorphous or crystalline, white, opaque, inodorous, inalterable in the air, intensely bitter, soluble in water and alcohol, insoluble in ether. Campardon has shown that quassin is one of the best stimulants of the contractility of the unstriped muscles in the dose of two grains a day, when the amorphous is given; and ⅛th of a grain, in the case of the crystalline.

The Jamaica quassia is similar in its properties to that of Surinam, but has a more marked action on the nervous system; according to Gubler, it is toxic to birds, and resembles nux vomica.

Surinam quassia wood contains no tannin or gallic acid, hence the infusion of this wood is a good excipient for the salts of iron. (Campadon, on Quassine, its Physiological and Therapeutic Action.)*

[10] COLUMBO (Calumba) is the root of Cocculus palmatus, menispermum palmatum, (Menispermaceæ). It is a native of tropical Africa; is a diœcious creeping plant with gray twining stem, and thick, fleshy roots, which are cut in slices and dried in the shade. The root as it reaches us, is in flat, circular or oval pieces, from ⅛th inch to nearly an inch in thickness, and from 1 to 2 inches in diameter; thinner in the center than at the circumference; of a greenish yellow color.

Planche in 1811, found in Columbo an azotized substance, a bitter yellow substance, and one-third of its weight of starch; there was a trace of volatile oil, salts of lime and potassa, oxide of iron and silica. In 1830, Wittstock of Berlin, discovered a bitter crystallized principle which he called *columbin*. This crystallizes in colorless rhomboidal prisms, slightly soluble in water, alcohol and ether. According to Bödecker (1830) the yellow color is owing to *berberina* combined with *columbic acid*. Columbo contains no tannin. Doubtless both *columbin* and *berberina* contribute to the remedial effects of columbo.

Columbo is a pure bitter tonic, devoid of astringency.

BOUCHARDAT'S ELIXIR OF COLUMBO.

Take of:

Columbo root,	16 grams.
Gentian, "	16 "
Bistort, "	16 "
Cinchona bark,	16 "
Bitter orange peel,	16 "
Juniper berries,	32 "
Alcohol at 80°,	40 "
Filtered water,	1,000 "
Hydrochloric acid,	15 "

Mix and macerate a fortnight, filter and preserve for use. Dose—A tablespoonful after each meal.

GERMANDER. By this the Teucrium Chamædrys is meant, a labiate perennial European plant. The leaves and flowering tops are used.

This species must not be confounded with the *teucrium marinum*, or the *teucrium scordium*, which have somewhat different properties.

A "bitter ptisan," common in France, is made by infusing one hour in a quart of boiling water two drachms of a mixture of equal parts of dried germander leaves, lesser centaury tops, and worm-wood tops. This

* (Bull. de Thér. Nov., 15th, 1882).

formula may be varied ad infinitum. The infusions of gentian, columbo, quassia, aurantii co, cinchona, cascarilla, chirata, etc., of the U. S. Ph. in doses of a fluid ounce are all excellent stomachic preparations.

The LESSER CENTAURY (Gentiana centaurium), is of the gentian family, which it resembles in its general properties.

HOPS (Humulus lupulus), is too well known to require description. The strobiles are medicinal. The active principle is lupulin, which is very bitter, containing, according to Chevalier and Payen, a volatile oil, a bitter matter (lupulite), resin, gum, an extractive matter, a fatty matter, osmazome, malic acid, malate of lime, and salts.

The strobiles are used in infusion or decoction (one ounce to the quart), in alcoholic tincture (dose, a fluid drachm). The dose of lupulin in powder is from 5 to 30 grains.

CHICCORY (Cichorium intybus), grows in Europe and America; it contains extractive matters, chlorophyl, saccharine matter, albumen, and salts. Is a mild tonic bitter, which may be taken in decoction or infusion, (an ounce steeped in a pint and a half of water down to a pint, and administered in doses of one or two fluid ounces).

HOLLY (Ilex aquifolium), contains, according to Deleschamps, an active principle *ilicine*. It is used in decoction (an ounce of the fresh leaves to the quart).

GENTIAN (Gentiana lutea), is an excellent popular bitter. The active principle is *gentianin*. It is given in infusion, tincture, extract, wine, etc. The Compound Tincture of the U. S. Ph. is a useful stomachic in doses of a teaspoonful before meals.

The tonic pills of Moscow are as follows:

Take of:

Extract of columbo,	} ā ā	5 centigrams.
" gentian,		
" quassia,		
" ox gall,		

Pul. gentian root q.s.

For one pill. Dose—One or two pills after meals.

[11] The "English Stomachal Decoction" contains bitter orange peel, lemon peel, and cloves. The "Visceral Elixir of Hoffman" has bitter orange peel, cinnamon, carbonate of potash, gentian, wormwood, buckbean, cascarilla, and Spanish wine.

CHAMOMILE which is not mentioned in the text, is a very valuable mild bitter, whose cold infusion will render good service in some dyspeptic cases.

The following is the "Stomachic Powder" of the London Hospitals:

Take of:

Pul. rhu.,	1 grain.
" ginger,	1 "
" chamomile,	15 grains.

M. Make one powder; to be taken an hour before or after the principal meal.

[12] COMPOUND WINE OF RHUBARB.

Take of:

Canella bark,	1 part.
Rhubarb,	3 parts.
Malaga wine,	100 "

Macerate together four days, express and filter.

Dose—A tablespoonful before each meal.

PILULA ANTECIBUM; (French dinner pill).

Take of:

Aloes socotrinæ,	ℨ vi.
Extract of cinchona,	ℨ iij.
Pulv. cinnamon,	ℨ i.
Syrup of wormwood,	q.s.

M. Make into five grain pills.
Sig. Take one pill before each meal.

[13] VEGETABLE CHARCOAL.

This is prepared with willow, poplar, or birch wood. Given internally, it acts according to Gubler, as a slight excitant, and as a mechanical absorbent. The carboligni most employed is the poplar charcoal of Belloc, which is given in the dose of a dessertspoonful in wafers or capsules.

[14] Van der Velden has analysed the liquidremoved from the stomach in cases of gastrectasia, and has found it always acid and containing free hydrochloric. In cancer of the stomach, hydrochloric acid disappears and does not appear even after the lavages. This permanent disappearance of hydrochloric acid from the liquids removed from the stomach, is, according to Van der Velden, a characteristic sign of cancer accompanied by dilatation of the stomach.*

[15] Perli employed faradization of the stomach at the same time as lavage in cases of chronic catarrh and dilatation of that organ, using the stomach pump for that purpose. The means of application was a sound terminating at its distal extremity in a metallic bulbous point, which was continuous with a conductor passing through the middle of the sound, and in communication with the battery. Perli noted that he obtained very energetic contractions of the stomach when the external conductor was placed at the height of the ninth dorsal vertebra, a little to the left of the vertebral column.

Bocci has also made experiments on the direct electrization of the stomach. He made use also of a Faradic machine.

Bardet in his electrotherapic service of the Cochin Hospital, has used with success the apparatus described in the text in several cases of dilatation with vomiting.†

[16] Against certain dilatations of the stomach which Chomel described under the name of dyspepsia of liquids, he recommended a dry diet, consisting in the suppression of drinks. Huchard has adopted these views, and has shown all the a lvantages accruing from abstinence from liquids in certain dilatations of the stomach.‡

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* Van der Velden, Gastrectasy and its Relation to the Presence or Absence of Free Hydrochloric Acid in the Gastric Juice. Deutsch. Arch. für Klin. Med., XXIII., 4.

† Bardet, Bull. Gén. de Thér., 1884, t. cvi., p. 529. Perli, Il Morgagni, May, 1879, Bocci, Lo Speriméntale, June, 1881.

‡ Huchard, On the Dry Diet Treatment of Diseases of the Stomach, and Especially of the Dyspepsia of Liquids. (Bull. Gén. de Thér., Aug. 31st, 1884, p. 145.)

LECTURE XI.

TREATMENT OF VOMITING.

Summary—Vomiting — Definition—Causes — Dietetic Treatment—General Means—Potions of Rivière—Plaster of Diachylon—Of Theriac—Of Opium—Hydrate of Chloral in Sea-sickness, and "Land-Sickness" —Injections of Morphine—Vomiting of Pregnancy—Employment of Alcohol—Of Pepsin—Of Tincture of Iodine—Of Creosote—Ether Spray — Tobacco Smoking — Nervous Vomiting — Hydrotherapy—Bromide of Potassium—Vomiting Due to Lesions of the Kidneys—Of the Lungs—Vomitings of the Phthisical.

UNDER the head of atonic dyspepsia, we have studied the consequences of enfeeblement of the contractile power of the muscular coat of the stomach; we are now to consider another modification affecting this muscular investment, attended with perversion and exaggeration of its movements; phenomena which manifest themselves by the rejection of alimentary matters contained in the stomach. And since we are frequently to meet this symptom in the course of these studies, permit me here, in a general manner, to discuss the therapeutics of vomiting. Do not think, moreover, that in doing this I am digressing from my subject. Leven has in fact said that vomiting never takes place in a healthy stomach, but that, apart from toxic and other irritant causes, it is always due to dyspepsia of more or less long standing. Although this opinion, taken as a whole, may seem a little exaggerated, it nevertheless applies to a great many cases of vomiting.

Vomiting, you know, is characterized by the sudden expulsion of substances contained in the stomach, resulting not only from the abnormal and exaggerated contractions of the muscular coat, but also, and especially, from the simultaneous contractions of the diaphragm and muscles of the abdomen, the whole constituting a true reflex act, which may have its point of departure in variable regions of the economy.[1]

In this definition of vomiting, I have assigned the important part to the stomach and the contractions of the abdominal muscles. This is a view which I am well aware is not adopted by all the physiologists, and when you consult the writings of Bayle, Schwartz, Hunter, and especially those of Magendie, you will see that these authorities ascribe but a secondary rôle to the stomach. At the same time, on reading attentively these memoirs, you will observe that the experimental researches which have been made show only this: that when the stomach is removed from the influence of the abdominal muscles and diaphragm, vomiting does not take place; but this is no reason for denying to the muscular coat of the stomach all participation in the ordinary act of vomiting.

Schiff shows, on the contrary, that the stomach takes an active part in vomiting, that under certain circumstances the normal movements of the muscular coat of the stomach, which habitually take place from left to right, that is to say, from the great tuberosity toward the pylorus, may take place in an opposite direction, and force the contents of the stomach from the pylorus toward the cardia.

If we quit the domain of physiology for that of clinical experience, we shall find indubitable evidence that the stomach by its mucous and muscular coat, plays an important part in the mechanism of vomiting, and that in this complex act the abdominal pressure is far from being the only factor. Here, for instance, are two patients; the one has a very severe bronchitis, with incessant fits of coughing, and yet, despite all these paroxysmal efforts of the thoracic and abdominal muscles, he does not vomit; by his side is a phthisical patient, who has but few fits of coughing, and yet whenever the cough comes on, he vomits his food. How do you explain this difference? In the case of the one the functions of the muscular and mucous coats of the stomach are intact, while in the other the existing dyspepsia explains the facility of the vomiting under the least pressure of the abdominal muscles.

Recall to your minds that curious, almost unique, case which you observed in this hospital in No. 15, ward St. Lazare. I refer to a certain patient who, with the intention of suicide, had swallowed a caustic liquid; you remember that the autopsy of this patient showed us almost the entire stomach—mucous and muscular coats—transformed into a vast eschar; and for eight days he lived thus, drinking a great quantity of milk, and without once vomiting in all this time. Here the transformation of the walls of the stomach into a non-contractile and insensible eschar sufficiently explained the absence of the vomiting.[2]

While, therefore, I am free to admit in explanation of the mechanism of vomiting, the preponderant *rôle* assigned to the contractions of the abdominal muscles, I must also insist that the muscular and mucous coats of the stomach have an important part, and that perfect integrity of the functions of these membranes is antagonistic to the act of vomiting.

I have said that the reflex act, which is called vomiting, has for its point of departure variable regions of the economy. We will now examine into these different sorts of vomiting, and the treatment which should be opposed to them. It seems to me most advantageous to give you, first of all, the general therapeutics of vomiting, applicable as they are to nearly all cases, and to reserve for a special description the remedial means necessitated by the different varieties of vomiting.

An important place must here be given to dietetics. Experience has demonstrated the efficacy of iced drinks, effervescent waters, and abstinence from all food, whether solid or liquid. Recommend the employment of a mixture of milk with ice and seltzer-water, which may be sucked in small quantities through a straw or pipette. With these means you can associate internal and external medication.

Among the pharmaceutical means we have first the potion of Rivière, which bears a marked resemblance to the *mistura effervescens* of the United States Pharmacopœia. This potion, as you know, consists of two parts. There is No. 1, which is alkaline, and No. 2, which is acid. You give the patient first a tablespoonful of the alkaline solution, and immediately follow it by the same quantity of the acid potion.[3] Then come the preparations of opium and belladonna, and here you may advantageously avail yourselves of the hypodermic method for the introduction of morphine and atropine. Medicinal lavements have been recommended, but it must be confessed that this method generally fails, on account of the efforts of vomiting not permitting these lavements to be retained; you can, however, utilize the rectum for your opium and belladonna suppositories, which are better retained.

To this treatment, you may add the use of plasters, applied to the epigastric region. Gueneau de Mussy has long insisted on the happy results which may be obtained from the employment of this means in obstinate vomitings.[4] You can make use of the diachylon plaster with or without belladonna; the emplastrum theriacæ, or the opium plaster, all may render you service. Finally, with still greater prospect of benefiting your patient, you may resort to revulsives applied over the stomach, such as sinapisms, vesicatories, and the cautery.

Such, gentlemen, are the general means to employ in the treatment of vomiting, from whatever cause it may arise. Let us now take up the consideration of certain species of vomiting.

We have, first of all, dyspepsia with vomiting predominant. In fact, certain persons vomit with a strange facility; the least error in diet, a little food badly borne, too strong a smell, exercise a little too energetic, a keen emotion—all this, in these patients, manifests itself by vomiting. As the rejection of food is a common symptom in all forms of dyspepsia, you will have, first of all, to combat, by appropriate means, the dyspepsia; then you will be able to employ against the vomiting the different pharmaceutical means which I have just enumerated. Hyposulphite of sodium, and salicylate of sodium, have also been recommended to combat certain kinds of acid vomiting, where one often meets a peculiar alga, which Goodsir was the first to find, the *sarcina-ventriculi*. These substances have for their end to destroy these parasites, whose intimate action in the production of vomiting, despite the researches of Windmüller, is far from being clearly defined.[5]

As for directions respecting diet, much judgment is required in the selection of the proper food, and you will often have to be guided rather by the caprice or idiosyncrasies of the patient than by the most carefully formulated scientific considerations; for nothing is more strange and unaccountable than the way different persons are affected by different aliments—one who, for instance, vomits substances the most digestible, will often tolerate without inconvenience substances that are really indigestible.

Then we have a particular condition in which vomiting plays an important part, a condition which is temporary, but which may be the cause of more or less serious evils—I allude to sea-sickness. Although we are ignorant of the primary cause of these vomitings, a cause which is without doubt multiple, and in which we have the influence of sight, smell, and modifications produced in the equilibrium of the abdominal viscera, it is nevertheless a form of sickness which is very common, and which every physician will be obliged to treat.

It has been recommended to support the abdominal parietes by a broad bandage, whose object is to prevent the displacement of the intestinal mass; I think that small results must follow this means.

Another mode of treatment has been scientifically tested; I refer to the chloral treatment. Giraldes was the first to recommend this mode of managing sea-sickness; after trying it on himself, he adopted a hint which he obtained from Pritchard in the London *Lancet*. Being called to England on business, and having suffered in all his previous voyages from protracted vomitings, he took a draught of chloral, and had no more vomiting. Since then this practice has become general, and the physicians of the Transatlantic Company and the navy surgeons derive great benefit from the chloral treatment of sea-sickness. The chloral is taken at the moment of the departure, the dose, which may be given in potion or in syrup, being from 15 to 45 grains. If the patient suffers from thirst, you can advise him to drink iced champagne, which is also indicated to combat the vomiting.[6]

Dr. Garipuy has also employed the same treatment in cases of land-sickness; I refer to that vertigo and those attacks of vomiting which some persons experience when they are subjected to any trembling movement, whether of carriages or railroad cars.

You can also use in sea-sickness another means which has given good results: I refer to injections of morphine. The Baron of Theresopolis is one of the strongest advocates of this mode of treatment, and he cites a great number of observations where these injections have caused disappearance of all the grave incidents caused by sea-sickness. Dr. Philippe Vincent also commends these injections in sea-sickness.[7]

You should be very sparing in the use of these injections, and watch attentively their effects. Morphine, in fact, determines of itself in some persons severe and prolonged vomiting. In those cases where the injections of morphine are badly supported, you can sometimes advantageously make use of the mixture of which I have spoken to you before, and in which atropine is combined with the morphine. It is especially in those vomitings which have for point of departure an intense pain, whether in the stomach or in some other organ of the abdominal cavity, that you will derive benefit from these injections of morphine and atropine.

Among the organs which have a direct influence in causing vomiting, the uterus is pre-eminent, and we see certain metrites, certain uterine congestions and ulcerations, accompanied by this symptom; but it is principally in pregnancy that these vomitings are, so to speak, the rule.

This vomiting is more likely to supervene during the first four months of gestation. It is an inconvenient and painful symptom for which the physician is often consulted, but which has ordinarily little gravity. Sometimes, however, this morning sickness acquires a formidable intensity and persistency, and one finds himself in presence of incoercible vomitings, which if not combated in time by an energetic medication, and even by the intervention of the accoucheur, may end in death.

It is desirable, then, that the physician shall have at hand powerful therapeutic means to combat these vomitings; and, without going farther into the subject, which would require for its complete treatment details which you will find in the special treatises and text-books of obstetrics, I shall set forth the different measures to which you may advantageously resort. Here everything has been tried, everything has succeeded, and everything has failed; hence the list of remedies is a long one.

In the first rank, we have the alcohols, which Bouchardat has vaunted, and which are in common use in the treatment of the vomitings of pregnancy. I have even seen pregnant women who before had a great repugnance to spirituous liquors, not only bear them well during this period, but even long for them. And here, gentlemen, it is just those alcohols which are the strongest which give the best results. You will then prescribe whisky, rum, cognac, and especially the elixir of Grande Chartreuse,* which may be taken in the dose of a few drops on a lump of sugar.

By the side of these remedial measures you have a medicament which also gives good results, and which our regretted friend, Dr. Gros, long ago recommended: pepsin given in the dose of from 5 to 10 grains has sometimes arrested the most obstinate vomitings.

You may also make trials of Lasegue's remedy, who was in the habit of ordering in these cases tincture of iodine in the dose of from five to ten drops in a little sweetened water. In a recent thesis, Dr. Olli has shown that this remedy may be beneficially tried in all forms of dyspespia with vomiting. In England they employ creosote, which, since the labors of

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* See Dunglison's Dictionary under head of Arquebusade.

Bouchard and Gimberd, has been very much given in pulmonary complaints, and may be administered in wine or capsules mixed with oil. It is a medicine which may be sometimes advantageously tried.

You may also have recourse to a measure which has given me some success, and which has been recommended by Lublesky, of Varsovia. This physician, who had previously published several memoirs on pulverizations of ether, and shown the advantages which might be derived therefrom in chronic affections, has conclusively shown that the same method may give good service in vomiting from whatever cause.* With a hand atomizer, like that of Richardson, for instance, you can spray the region of the stomach with ether for three or four minutes, and then make the patient eat a little food.

In the case of one of my patients who had almost incessant emesis, I obtained by this means a notable diminution in the number of vomitings. These pulverizations are attended with no inconvenience. Certain Spanish physicians, and in particular Galceran and Rodrigues Mendez, have employed these sprays with success.

There is another simple expedient advised by Gros, namely, tobacco smoking. Having remarked that one of his lady patients, who was pregnant and suffered from incoercible vomitings, experienced marked relief when in a room that was full of tobcaco smoke, the idea suggested itself to him of recommending this patient to smoke; she did so, and her vomiting entirely ceased.

Make use, then, of all the means that I have indicated; add injections of morphine, lavements of chloral, inhalations of oxygen, which Hayem considers as one of the best remedies in dyspepsia with vomiting, and which Pinard has applied to the treatment of the vomiting of pregnancy; resort also to "gavage." Sometimes you will attain your end, at others you will fail, and you will then be obliged to have recourse to dilatations of the neck of the womb, suggested recently, or to premature delivery, which obstetricians have unanimously consented to employ if medicinal means fail.

By the side of these vomitings of pregnancy, I must place those which hysteria determines, and which, like the preceding, are characterized by a persistency which often defies all therapeutic means.

Apropos of these hysterical vomitings, I must make a distinction. In certain neuropathic patients you will see supervene veritable crises of vomiting and gastralgia, and for months the patient will tolerate hardly any food; then the gastric form disappears, to give place to other nervous troubles. Nothing in the examination of the patient will reveal to you the cause of these vomitings. The uterine functions are well performed, the urine is abundant and voided without difficulty, and one can invoke in explanation of these disorders only the nervous state to whose influence the patient is subjected; this is the so-called nervous vomiting, to which

I shall have occasion again to return when I come to the treatment of hysteria.*

Against these vomitings, which belong to the groups of affections which Huchard has very happily characterized by the name of gastric hysteria, you can employ two orders of remedies which have given me excellent results, namely "gavage" (or forced feeding) and electricity.

It is especially in hysterical patients affected with spasmodic troubles of the pharynx and œsophagus, that the method of "gavage" succeeds; and a patient who is in the habit of vomiting all her food immediately after its ingestion, finds that these vomitings cease when the food is introduced by the stomach-tube. You may employ as a nutrient the meat-powder and milk before spoken of; you can also precede each "gavage" by a lavage. I have by this method obtained results which were truly marvellous, such as Charcot and Geoffroy have also obtained. But in other cases this method becomes insufficient, and notwithstanding the gavage the patient vomits still; it is then that recourse should be had to electricity.

It is to Apostoli that we are indebted for the rules of the electrical treatment of vomiting, and you often have seen him in my hospital apply his method with success. This method consists in the positive polar galvanization of the right pneumogastric. The positive electrode is placed just outside of the inner extremity of the clavicle, in the point marked by the depression caused by the interval between the two inferior fasciculated origins of the sterno-mastoid muscle; this electrode, which is moistened, should be of small dimension; the negative electrode is held in the hand of the patient. The battery which is used is that of Gaiffe, with "collector," and the quantity of electricity employed varies between ten and twenty milliampéres.[9] As for the duration of the séance, it is very variable, and one ought not to cease the application of the electricity till the patients find their sensations of spasm and vomiting gone.[10]

You may also employ direct electrization of the stomach with the apparatus of Bardet. You will follow here the same procedure as that which I described to you in a previous chapter under the head of dilatation of the stomach; only it is the positive pole which must be placed inside of the stomach, the negative electrode being applied over the walls of the abdomen. Moreover, it is the constant current which you will use, and not the interrupted.

To forced feeding and to electricity you may join the use of prolonged baths, which sometimes succeed, as Ferrand and Dauchez have shown.†—The duration of these baths is from three to eight hours, and the temperature from 68 to 82 F. In other cases, vomiting in the hysterical is symp-

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* Clinical Theripeutics, G. S. Davis, Ed. page 105.

† Dauchez, Prolonged Baths in Gastric Hysteria. Bull. de Thér. t. cvi., p. 529.

tomatic of another pathological condition; the urine is not secreted, and this hysterical anuria, which Charcot has mentioned, and of which Fernet, Juventin, and Secouet have given examples, is accompanied with more or less abundant vomitings, in which urea in variable quantity is found. These vomitings resemble those of urinous dyspepsia. The latter is, in fact, almost always a dyspepsia with vomiting, and it results from a damaged state of the kidneys. As soon as these glands cease to perform their functions, the urea and excrementitious matters of the urine, retained in the blood, seek elimination by the intestines or by the stomach. The patient urinates, as it is said, by his stomach, and this it is which explains the frequency of the vomitings which accompany the nephrites, and in particular interstitial nephritis. The treatment ought here, of course, to be different; we are not so much concerned with combating the vomiting as in restoring the secretion of the kidneys by the exhibition of suitable diuretics, and when medical means fail, you will find yourselves powerless to arrest these vomitings, which supply the place of a function which is no longer performed.

In patients affected with urinary complaints, who incompletely empty their bladder, you will often see attacks of vomiting supervene, and it is one of the most common signs of the digestive trouble which afflicts this class of invalids.[11] These vomitings are of a very persistent character, are often even provoked and augmented by all attempts to interfere with or control them, becoming absolutely incoercible.

In pulmonary affections, vomiting is an incident which is sometimes followed by grave consequences by preventing alimentation. This is what happens in young children, in whom the mechanical act of vomiting is so easy. The convulsive cough of pertussis provokes vomiting, which if the paroxysms are often repeated, may be so frequent that alimentation can no longer go on; the patient wastes away, and may succumb to an intercurrent disease, facilitated by the gradually increasing debility. This condition in pertussoid patients demands careful attention. The little patient must be fed frequently, in small quantities, and is sometimes benefited by sips of strong coffee, cognac, or some other alcoholic stimulant which promotes digestion; foods should be given which are rapidly and easily digested.

Phthisis in the first stage gives rise to vomitings which are more or less frequent.. In his thesis, Dr. Varda, of Smyrna, one of my pupils, has shown that these vomitings are due to several causes, the principal of which are the dyspepsias, the intensity of the cough, compression of the pneumogastric nerve, etc.[12]

But whatever may be the instigating cause of gastric troubles in the phthisical, they are tributary to one and the same medication, namely, to "gavage." In fact, by a circumstance the physiological explanation of which is lacking, while foods introduced by the mouth are vomited, those which are conveyed to the stomach by the flexible tube are well tolerated; and when I come to speak of the treatment of phthisis, I will show you all the benefits which you may derive from Debove's method.

As to vomitings due to cerebral affections, if from a clinical point of view they present a great importance, they have little interest therapeutically, unless from the fact that there is so little that can be done to relieve them.

Finally, gentlemen, do not forget that there are certain obstinate vomitings which may be cured by the simple application of a truss; this is the case with vomitings caused by certain hernias, either of the stomach or omentum, and which sometimes protrude through the linea alba over the gastric region, and may become irreducible.

Such, gentlemen, are the considerations which I desire to present respecting the therapeuties of vomiting. I have dwelt especially on certain aspects which you will be most often called upon to treat. In the next chapter we shall study the neuroses of the stomach.

NOTES TO LECTURE XI.

[1] Many contradictory opinions have been put forth concerning vomiting, and many theories have been proposed to explain the mechanism of this phenomenon.

Vomiting was first attributed to spasmodic contractions of the stomach, then Bayle (in 1681) and Chirac (in 1686) referred it to contractions of muscles of the abdomen. Schwartz advanced the same view, and showed that if the stomach has contractions these are not necessary for vomiting, which, moreover, never takes place when the stomach is separated from its relations to its abdominal walls. Haller also admits the rôle of the abdominal muscles and of the diaphragm, but thinks that the antiperistaltic movements of the stcmach may sometimes suffice to effect vomiting. According to Hunter, the act of vomiting is accomplished entirely by the diaphragm and abdominal muscles, and it is not necessary that the stomach should participate in the act.

In 1813, Magendie undertook a series of experiments, and showed that vomiting is due, not to the stomach, but to the action of the diaphragm and abdominal muscles. When, in fact, the diaphragm is paralyzed, the vomiting is feebly performed, but still takes place, owing to compression of the abdominal muscles; it does not, however, take place when the abdominal walls are removed. Replacing the stomach of a dog by a hog's bladder adapted to the lower part of the œsophagus, Magendie injected into the veins of the animal tartar emetic, and the contents of this new stomach were shortly expelled by contraction of the abdominal walls.

The experiments of Magendie, confirmed by those of Legallois and Beclard, were attacked by Maingault and Courdon, who assigned the principal rôle to the stomach.

Tantini repeating these experiments, has shown that if instead of adapting the hog's bladder to the digestive tube above the cardia, it is adapted below, vomiting does not take place; it is in consequence necessary to admit a certain action due to this portion of the stomach.

According to Budge (1840) it is the contraction of the diaphragm and abdominal muscles that provokes vomiting. But this act is aided by the sudden contraction of the pylorus; the pyloric shock being communicated from right to left to the contents of the stomach.

Rühle in 1857 affirms that at the moment of vomiting there is an ascent of the cardiac portion of the stomach; the movements of the stomach are exceptional, and the pressure exerted by the abdominal muscles and the diaphragm is sufficient to overcome the resistance of the cardia. According to Schiff, the cardia opens by the active contraction of the longitudinal fibres proceeding from the œsophagus, and which dilate that orifice even before the abdominal pressure comes into play, at the moment of nausea. Dr. Patry of St. Mauritius, on examining a young man who had been eviscerated by a bull, observed that during vomiting the stomach contracted visibly, but not enough to expel its contents; the œsophagus contracted more strongly, and at the moment of vomiting, the cardia opened to let the vomited matters escape. Vulpian has also observed in a stomach removed from the abdomen, and separated from the influence of the diaphragm and abdominal muscles, quite strong contractions, going from the pylorus to the cardia.

Arnozan and Franck have studied the state of the thoracic and abdominal pressure during vomiting; they have pointed out two distinct phases in vomiting; in the first there is a series of inspirations, which tend to equal the abdominal pressure without exceeding it; in the second the thoracic pressure equals the abdominal; it is to this phase that the expulsive efforts correspond. According to these experimenters, the vomited matters escape the cardia during the period of thoracic aspiration.

According to these various experiments, one may judge what is the influence respectively of the stomach, of the œsophagus, of the diaphragm, and the abdominal muscles, in the act of vomiting.*

[2] The case was reported to the Medical Society of the Hospitals, Nov. 9, 1877, by the interne of St. Antoine Hospital. The patient was a man forty-seven years of age, who, with the intent to commit suicide, drank the contents of a vial full of a caustic liquid; (nature of the caustic not determined). He entered Oct. 19, 1876, and died suddenly the 27th,, supporting without vomiting the daily large quantities of milk which were given him for his nourishment. At the autopsy the stomach was found in almost its entirety transformed into an eschar, so that scarcely any wall of separation could be said to exist between the stomach and the viscera in its immediate vicinity.

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* Bayle, Dissertations, Toulouse, 1681. Chirac, An Anatomical Experiment Concerning the Nature of Vomiting, 1686. Schwartz, Inaug. Dissertations Containing Observations on Vomiting. J. Hunter, Remarks on Digestion. Magendie, Memoir on Vomiting, 1813. Legallois and Beclard, Experiments on Vomiting. Bourdon, Memoir on Vomiting, 1819. Rostan, Memoir on Vomiting. Budge, On the Mechanism of Vomiting, Bonn, 1840. Patry (Bull. de l'Acad. de Méd., 1862–1863). Schiff, Lessons on the Physiology of Digestion, 1867. Longet, Physiology. Vulpian, Lectures on Vomiting, École de Médecine, 1874. Lauder Brunton, On the Physiology of Vomiting (Practitioner, 1874). Arnozan and Franck, On Vomiting. (Soc. de Biol, Séance, April 9, 1879.)

[3] Potion of Rivière (French codex.)

No. 1. ALKALINE POTION.

Take of:

Bicarbonate of potassium, ...	2 grammes.
Common water, ...	50 "
Syrup, ...	15 "

Mix.

No. 2. ACID POTION.

Take of:

Citric or (tartaric) acid, ...	2 grammes.
Common water, ...	50 "
Syrup limonum, ...	50 "

Mix. A tablespoonful of No. 1, may be taken by the patient and this followed immediately by a tablespoonful of No. 2; the liquids combining in the stomach. Or they may be first mixed in a cup and drank during effervescence.

[4] Gueneau de Mussy's plaster consists of two parts each of diachylon and theriaca (a French preparation containing opium), and one of extract of belladonna. Clin. Méd., t. I., 1874, p. 230. [The emplastrum belladonnæ, or the emplastrum opii of the U. S. Ph. in which the extracts are incorporated with Burgundy pitch, are probably equally efficacious.]

[5] The sarcina ventriculi is an alga of the genus morismopœdia; it presents itself under the aspect of little cubes, having a regular form, which is very characteristic. Besides the stomach, where it is frequently met with, it has been found in the urine, or even in gangrenous foci. According to Windmüller, this sarcina is the cause of the acidity of the vomiting in certain cases of dyspepsia.

[6] In 1871, Dr. Pritchard in the Lancet, pointed out the good effects of chloral as a means of preservation from sea-sickness.

Giraldes had been always seasick when he crossed the Channel with the sea a little rough, so on the advice of a physician of Boulogne, he took, on the departure of the boat, a quantity of syrup containing five grains of chloral. On his return from England, he took a potion containing eight grains; both trips were made without any sickness. In another trip from Calais to Dover, the sea being excessively rough, Giraldes on embarking, swallowed a potion containing twenty grains of chloral in syrup and peppermint water; he had no sea-sickness on this occasion nor on the return voyage, when he repeated the dose.*

[7] The Baron of Theresopolis employs the following injection:

Take of:

Muriate of morphine, ...	30 centigrammes.
Distilled water, ...	20 grammes.

M. Inject ten drops of this solution into the epigastric region.

Philippe Vincent, physician to the Cunard Company, also considers the injections of morphine as the best medicament to oppose to seasickness. He uses two to three centigrammes a day. The following solution contains morphine and atropine in a suitable form for hypodermic injections:

* Giraldes, On the Treatment of Sea Sickness. (Bull. Gén. de Thér., t. 87, p. 47). Obet. Arch. de Med. Navale. June. 1875.

Take of:

Muriate of morphine, ...	10 centigrammes.
Neutral sulphate of atropine, . .	1 " "
Cherry laurel water, ...	20 grammes.

M. One gramme of this solution contains one-half centigramme of morphine and one-half millogramme of atropine.*

[8] Lublesky administers douches of ether spray over the epigastric region, and over the corresponding region of the vertebral column; he advises to prolong this douche two to five minutes, and even longer, if the patient finds that it does good, and to repeat it every three hours. In rebellious cases, Dr. Lublesky alternates the douches of ether with douches of chloroform.†

[9] In his work, Apostoli insists on the time when the electricity should be applied for the relief of vomiting. This is his mode of procedure:

1st stage.—About three minutes of positive polar galvanization, the stomach being empty; this is a preparatory séance.

2d stage.—Without interrupting the electrization, the patient is made to swallow little by little, and in small portions, the food or drink which is "antipathic" to him, and which he knows would be likely to provoke vomiting.

3d stage.—The séance is continued till the patient no longer experiences any sensation of spasm or vomiting, and till he feels a sense of *bien être.* Apostoli recommends, moreover, to make two applications a-day, and in eight cases of hysterical vomiting, of which four were incoercible, cure was obtained at the end of from one to eight séances. (Apostoli, On a New Electrical Treatment of the Epigastric Pains and Gastric Troubles of Hysteria.)‡

[10] Gubler and Paret have recommended valerianate of caffein for hysterical vomiting; it may be given in pill form; dose a couple of grains before meals.§

[11] This is what Prof. Guyon says *apropos* of vomiting in urinary patients:

The vomitings in urinary patients are of grave import when they last long, and are frequently renewed. They often complicate buccal dysphagia, and then the nutrition of the patient, already compromised, becomes no longer possible. It is such patients as these that die without fever with a progressive lowering of the temperature, and who are at once the victims of blood poisoning (urea, etc.), and of inanition.

We have followed the history of many of these patients, and have witnessed their attacks of vomiting, not only as the result of the ingestion of food, even in small quantity, but have seen their painful retchings as they heard in the adjoining room the rattling of dinner dishes, or smelt the food that was cooking; this was the result of a curious sort of reflex

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* Garipuy, Revue Médicale de Toulouse, 1876, p. 234. Baron de Theresopolis, Morphine in Sea Sickness. Bull. de Thér., 1883, t. 105, p. 472. Philippe Vincent, Hypodermic Injections of Morphine in Sea Sickness. Brit. Med. Jour., Aug. 18, 1883.

† Bull. de Thér., t. xciv., p. 322.

‡ Bull. de Thér. Nov., 1882.

§ Jules Paret, On the Employ of Valerianate of Caffein, Paris, 1875.

action, and one which indicates that in these conditions of loss of function the vomiting is due quite as much to the thought of food, as to functional provocation of the stomach, which refuses to act and testifies this in advance. In these patients, in fact, vomiting follows immediately after ingestion of food.*

[12] These are Varda's conclusions (Thèse de Paris, 1876).

"Vomiting in the phthisical is, in the great majority of cases, a morbid phenomenon of reflex nature. The vomitings which we call mechanical *i.e.*, those which are preceded by fits of coughing, have not this origin, and take place by a mechanism purely physical.

"This phenomenon may appear quite at the onset of the disease, and constitutes then an initial symptom (glandular engorgement); sometimes, and more frequently, a while after the invasion (gastric lesions), or even at an advanced period, and as a precursory sign of death (gastric lesions, tuberculous meningitis).

"It is less frequent than one would suppose.

"Its etiology may be referred to four heads, which are in order of frequency: 1, lesions of the gastric mucosa; 2, compression or lesion of the pneumogastrics, by reason of glandular engorgements of the mediastinum and of the neck; 3, efforts and fits of coughing; 4, neoplasms of the basis cranii, or of the meninges.

"In fine, from a prognostic point of view, the appearance of this symptom ought always to be considered as of evil import, and it ought to be energetically combated, for its persistence considerably aggravates the condition of the patient."

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* Guyon, A Clinical Study of the Digestive Troubles of Urinary Patients. (Rev. Mens. de Méd. et de Chir., Jan. 10th, 1878.)

LECTURE XII.

TREATMENT OF NEUROSES OF THE STOMACH.

SUMMARY.—Cardialgia—Gastralgic Dyspepsia and Gastralgia—Treatment by Preparations of Opium—Morphine, Chloral—Treatment of Disorders of the Sense of Hunger and Thirst—Dysorexia—Anorexia—Boulimia—Essential Anæmia—Hygienic Treatment—Pharmaceutical Treatment—Artificial Alimentation—Gavage—Arsenical Preparations—Thermal Treatment.

IN the preceding lectures we have been occupied with functional disorders of the muscular and mucous coats of the stomach; to-day we commence the study of the perturbations affecting the nervous system of this organ, and you already know that I include in this group of neuroses the modifications which concern the sense of hunger and thirst.

In the normal state the digestive act is unconscious, and is performed without discomfort or pain; but in the pathological state, the muscular contractions of the stomach are accompanied by a sensation of distress which sometimes acquires a great intensity. The patient then experiences severe cramps and an aching pain in the stomachal or dorsal region, and in other cases, a very disagreeable sensation which seems to be seated at the inferior extremity of the œsophagus, and which has received the name of *cardialgia*. All these symptoms characterize gastralgia; and we must now state the difference between gastralgic dyspepsia and gastralgia properly so-called.

The difference hinges on the following fact: while in gastralgia the pain is chiefly felt during fasting, and apart from the digestive periods, and seems to subside on the introduction of alimentary matters into the stomach, in gastralgic dyspepsia, on the contrary, the pain is experienced while digestion is going on.

I shall not dwell longer on the sufferings experienced by the gastralgic, and must refer you for more lengthy details to the special treatises on diseases of the stomach, remarking only that this neuralgia of the stomach has, with some authorities, a predominant rôle in dyspepsia, and according to Lasègue, the dyspepsias are nothing but neuroses of the stomach.

Do not think, gentlemen, that this so common affection, gastralgia is always benign. I am now attending a man forty-five years of age, who is taken every two or three months with formidable gastralgic attacks; the pain at the pit of the stomach is atrocious, and for the fortnight during which the crisis lasts, all food is rejected. Then all ceases as by magic, and from this state of suffering no symptom remains, till a new attack sets in. Moreover, there are no biliary, or renal calculi, nor are there any other organic lesions that I can discover.

Here also, as I have done in the case of vomiting and pituitous dyspepsia, I shall include under the same head the general treatment of gastralgic dyspepsia and gastralgia. If from the point of view of internal pathology and of clinical medicine, you must keep these two affections distinct, it is not so from the point of view of clinical therapeutics.

What is the treatment of gastralgic dyspepsia? This is an important point in the study of dyspepsia, for the painful affections of the stomach are very frequently met with and one may truly say that in a large city there is not a woman or a young girl who has not experienced at times pains of greater or less severity in the region of the stomach. It is one of the most habitual manifestations of chlorosis and anæmia, and one of the most common of the neuralgias.

Here you will resort, not to pepsin, nor to strychnine, nor to the bitters; it is opium which, in these painful forms of dyspepsia, gives the most satisfactory results, but it is necessary to select your preparation of opium, and I cannot too much insist on this point. It is not enough to say that opium is indicated in gastralgia, we must also know the preparation which agrees the best with the particular trouble, and here is one of the great advantages of polypharmacy.

Although I am in general, but little favorable to complex formulæ, I recognize nevertheless that for some medicaments, and for opium in particular, medicinal combinations often modify very happily the active element which enters into the preparations, and certainly the pills of cynoglossus (extract of opium), theriaca (an electuary of opium), and diascordium (another opium compound), the wines and vinegars of opium, the syrups of opium, have a different action from that of morphine, and each of these preparations has a different indication.*

In the form of dyspepsia under consideration, the preferable opiate, as Monneret has shown, is the Vinegar of opium (acetum opii), or the English "Black Drops;" I know of nothing better to combat distressing gastric sensations. At the moment of the painful crisis, you will give to the patient from one to three drops of this vinegar on sugar or in a little water, but remember that this acetic preparation is very rich in opium, and for that reason you should be very careful in its administration.[1]

Gallard has modified this preparation, and has made a solution of

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*The combination of opium with powerful stimulants such as capsicum, with analgesics such as chloroform, ether, belladonna, sometimes gives better results than when the opiate is given singly. An excellent preparation of the kind is *chlorodyne* (Collis Browne), or *chloroanodyne* (Parke, Davis & Co.).—Trans.

muriate of morphia, called in contra-distinction, *white drops*, and which is given in the same dose as the preceding.[2]

There are also powders, pills, and syrups, containing morphine. These you can use, but you should, however, always give the preference to powders over syrups, which are generally bad preparations in dyspepsia, since in the greater number of cases, the opiate must be taken just before meals, and syrups disturb the gastric digestion.

In some cases you may have to resort to subcutaneous injections of morphine, but you must always remember that if these injections are among the most powerful of therapeutic agents to employ in painful affections of the stomach, they are nevertheless attended with this serious drawback, that the patient soon becomes dependent upon them and finds himself, before he is aware of it, a morphiomaniac.

By the side of morphine we must place chloroform water, a new medicament introduced into therapeutics by Nathalis Guillot and thoroughly studied by Lasègue and Regnault. It gives excellent results in gastralgia with dilatation of the stomach, assuaging the distress and antagonizing putrid fermentations, chloroform being, as you know, not only an anæsthetic agent, but also a powerful antiseptic. Nothing is easier than the preparation of this chloroform water; it consists simply in shaking together chloroform and water, then decanting the liquid.[3]

The name of *saturated chloroform water* is given to this solution, which contains a little less than one per cent. of chloroform. You must not use this chloroform water in a state of purity, and it should be diluted with an equal quantity of water, constituting what is called dilute chloroform water, which is given in doses of from one teaspoonful to a tablespoonful. Ordinarily, in cases of gastralgia, you will prescribe this dilute chloroform water in dessert spoonful doses every quarter of an hour, till the pain disappears. Moreover, there is an infinite number of combinations made with this preparation, as Beurmann has shown, and you can select from the divers formulæ which he has given.

By the side of chloroform water, we may place the solution of bisulphide of carbon, of which I have spoken to you before, and which is prepared exactly in the same way as chloroform water. This liquor carbon bisulphide is less calmative than the chloroform water, but its anti-putrefactive power is greater, so it is rather in dilatations of the stomach accompanied by putrid fermentation and more or less discomfort, that you should utilize this liquor, reserving the chloroform water for cases where the pains are much more severe. The inert powders give excellent results in the treatment of gastralgia, as Trousseau has already shown; in these cases it is the subnitrate of bismuth which you should employ, and you may if you wish, make use of the following mixture.

Take of:

Subnitrate of bismuth, . . .	ā ā	℥ ijss.
Magnesia carb., ...		
Prepared chalk, ...		
Phosphate of lime, ...		

M. Divide into forty powders which may be given in wafers or capsules; one to be taken with each meal.

When I come to speak of the treatment of the neuralgias, I will show you that among the therapeutic means applicable to this condition, electricity deserves the first place. The neuropathic states of the stomach are also tributary to this kind of treatment, and in these cases you will employ positive polar electricity, according to the method of Apostoli, and to which I have referred in the previous chapter.*

But electricity is not the only remedy applicable to neuralgia of the stomach; all the other means advised for the relief of pain, which I have mentioned in the chapter on the treatment of neuralgia,* and in fact all the calmative preparations have been recommended in gastralgia.

You, of course, understand that as gastralgia is but a symptom, you should as far as possible direct your treatment to the cause of the gastric pain, and this cause you will be able to find, it may be in an alteration of the blood, as in the gastralgia of the anæmic, it may be in hepatic disorders, as in the painful crises of individuals affected with gall stones, or it may be in alterations of the mucous membrane of the stomach, as in cancer or simple ulcer of the stomach. Having then found the cause, you will endeavor while treating the pain to combat the morbid state of which it is the expression.

Such, gentlemen, are the special indications in the treatment of gastralgia. I will now indicate the treatment of modifications affecting the sense of hunger and thirst. This sense may be augmented, diminished, or perverted.

I shall take up the subjects of dysorexia and anorexia, but shall pass rapidly over that of perversion or heterophagia, because this affection does not present any marked importance from a therapeutic point of view. In fact, heterophagia is observed chiefly as an accidental and secondary symptom which manifests itself at the beginning of pregnancy, or it may be under the influence of a profound perturbation of the intellectual faculties.

Those disorders described under the name of *pica* and *malacia*, present little gravity, and the physician has generally only to yield to the longings of his patient, especially if these pertain to alimentary substances more or less indigestible, but which may nevertheless, in the particular instance, be well digested by the patient. As for the modifications in the functions of the stomach which are under the influence of mental aliena-

* Vol. iii. Clinical Therapeutics, G. S. Davis, Detroit, 1885.

tion, the treatment must be directed to the cerebral or mental state, rather than to the stomach. There remains the disease described by Heusinger under the title of *geophagia;* this I have never observed, and as it is not likely that you will ever witness it, I do not think it necessary to give you a complete description of its treatment, and shall have to refer you to works such as that of Lebert, which give a full account of this strange perversion of the functions of the stomach.

Dysorexia, like the foregoing disease, is sometimes met with in pregnancy, or in certain states of chloro-anæmia, or neuropathy, where the sense of hunger is never satisfied.[a] You should know also that this insatiable desire to eat is habitual in diabetes, therefore I recommend you whenever you observe such cases carefully to examine the urine before deciding your diagnosis and treatment.

Whenever this morbid hunger is dependent solely on nervous disorders, and when it is but an epiphenomenon of a grave affection, you may combat the symptoms by opiates. Opium, you know, has for one of its effects to diminish the desire for food, to appease or extinguish the appetite, and the old saying "*Qui dort dine*" (he who sleeps dines), is especially applicable to those who make use of opiate preparations.

You must not, however, think this an invariable rule; I have in mind one of my confrères who for more than thirty years has been taking each day from half an ounce to an ounce of laudanum, and whenever he tries to leave off this medicine, he invariably loses his appetite and digestion, and feels weak and prostrated. For this patient, whose accuracy of judgment cannot be called in question, opium is the best stimulant of the digestive functions. This is but an isolated case, but do not forget that this admirable medicament possesses tonic properties; by reason of the stimulation which it gives to the brain, it arouses all the physical forces, and morphiomaniacs, as a rule, seek to obtain from opium, not so much calm and repose, as the necessary stimulation for their enfeebled organism. This reservation being made, opium may be used to diminish the boulimia; to its employ you will join in the case of nervous patients, hydrotherapy and bromide of potassium, and above all, you will endeavor to regulate the meals so that the patient shall eat frequently a small quantity of nutritious food.

Of all the perturbations affecting the sense of hunger and thirst, the most common and the most difficult to overcome is certainly anorexia.

There are very many causes which produce this state, and it would need an entire chapter to set forth in its entirety the etiology and semeiology of anorexia. Blood diseases, febrile affections, profound perturbations of the economy, manifest themselves by a diminution of the appetite. This diminution is often due to a lessened secretion of gastric juice; you know in fact, that Dr. Beaumont in his observations of Alexis St. Martin, noticed that during fever the mucous membrane of the stomach ceased to secrete gastric juice. In other cases the real cause escapes us, and we do not know how moral influences, mental distress, and the emotions, suspend the appetite. However this may be, it is quite a common symptom, which you will often be called upon to combat.

Whatever may be the treatment chosen, do not forget that there will be cases in which you will fail completely. When the loss of appetite really exists, and is absolute, the patient, despite all your solicitations, and despite the danger which he incurs from inanition, will resolutely refuse to take food, and he will die rather than submit to the painful task of eating.

Do not think, gentlemen, that this picture is overdrawn. Recall to mind those two women, the one occupying a bed in our female ward, the other in the foundling hospital, whom we had so recently under our observation. Both were anæmic, suffering from that anæmia called *essential* and *pernicious*, words which indicate our ignorance of the primary cause of the disease, but which denote that despite an attentive examination, no pathological condition was found in the organs explaining the cachetic state of the patients; these two women could not eat, and notwithstanding our endeavors to vary their diet, notwithstanding our daily exhortations, these unhappy beings assured us that they could not swallow nourishment, although there was no obstacle on the part of the œsophagus or stomach.

These two patients soon succumbed, and, as already the clinical examination had shown, at the autopsy no lesion was found capable of explaining the death. We noted fatty degeneration of the organs, and in particular of the pancreas, but was this degeneration primary or secondary? This it is impossible to say.

It is not alone in these cases that you will meet with obstinate anorexia; you will observe it also after convalescence from typhoid fever, and other grave affections. Here, as in many other disorders of the stomach, hygiene plays the chief rôle. The patient must change his scene, he must live in the open air, in the mountains, at the seaside; he must be made to journey, and his dietary must be constantly varied.

It is in these cases that the physician ought to be both good cook and clever practitioner. You will perhaps be able to stimulate an appetite by means of appetizing sauces and condiments. You will not forget too, that often cold meats please the most; this is the case with bacon, meat pie, game, salads, etc.; in a word, study the gustatory whims and desires of the patient.

As for medicaments properly so-called, the arsenical treatment[6] may render you service; I know of no better. Arsenic exercises a real stimulant action on the digestive functions, and if I do not fully adopt the mechanical explanation of the Germans, who pretend that arsenic acts directly on the capillaries of the stomach and intestine, and that in dilating these vessels, it causes an active congestion of the organs, I do not fear to affirm nevertheless, from a clinical standpoint, that there is no better stimulant of the digestion than the arsenical preparations. Use then Fowler's solution, the granules of Dioscorides, or the arsenical pills, or the solution of arseniate of soda. Whatever may be the form used, the result will be the same; the appetite will return, the functions of the skin will be promoted, and the patient will get well.

With these preparations I associate, but on a subordinate scale, the bitters and certain tonics which stimulate the organism, such as canella, ginger, cardamom, nutmeg, etc., of which more or less complex combinations have been made, such as the aromatic powder of the United States pharmacopœia.[7]

But it is necessary to bear in mind that these hygienic and pharmaceutical means will fail in cases of stubborn anorexia, which you will then have to combat by artificial alimentation. In fact, nothing is more indicated in such cases than gavage. In instances of anorexia due to cerebral derangements, we have seen that the demented and insane have been able by this means to live for months and years, although absolutely refusing to eat and drink. To-day, thanks to the syphon, and especially to the alimentary powders, this method has become much more practicable, and we are enabled, in patients affected with mental alienation, and those that are the subjects of anorexia, from whatever cause, to employ tubes of small dimensions through which our homogeneous mixtures made with the alimentary powders may pass without any obstacle. In the insane patient you can pass the tube by the nares; in sane individuals on the contrary, you will introduce it by the mouth, and you will make use of the ordinary syphon or the "gaveuse" such as I employ. By the easy peptonization of the molecules of meat powder, we often see the patients under its influence recover their appetite and call for food. It is then a kind of treatment which is obligatory in such cases.

But I cannot finish what pertains to the treatment of the neuroses of the stomach without pointing out to you here the really useful applications of a new alkaloid, cocaine. Since Köller showed that cocaine anæsthetizes by its local action the mucous membrane of the conjunctiva, there has been a disposition to apply the same remedy to the relief of pain due to affections of the mucous membranes, and to the spasmodic troubles which have their source in modifications of these membranes. I was one of the first to show the advantages that might be derived from cocaine, not only in the treatment of gastralgia, but also in that of other neuroses of the stomach.[8]

You should make use of two per cent. solutions, and direct this solution to be taken in drop doses, or what is better still, apply it directly to the mucous membrane of the stomach by means of the œsophageal sound. I have thus caused disappearance of the severe distress of gastralgia, and even of vomiting and boulimia. It is in fact, probable that the waste restraining qualities which we have attributed to coca leaves result from their anæsthetic action on the pharynx and stomach, this action destroying momentarily the sensation of hunger and thirst.

The hydrothermal treatment of gastralgic dyspepsia is very important. Hydrotherapy plays also a dominant rôle. You can here employ the waters of Bagnoles, Alet, Evian, and especially Pougues. You ought to avoid waters which are too mineralized and too gaseous; you can also prescribe the Spanish waters of Ubervaga of Alzata, of Solari of Cabras (Cuença).

Such, gentlemen, are the therapeutic rules applicable to neuroses of the stomach. In the next chapter we shall study buccal and intestinal dyspepsia.

NOTES TO LECTURE XI.

[1] Here are the different formulæ of the opiate preparations:

WINES OF OPIUM.

A. LAUDANUM OF SYDENHAM. (French codex.)

Take of:

Crude Smyrna opium in slices, ...	40 parts.
Saffron (crocus sativus), ...	20 "
Bruised cinnamon (laurus cinnamomum), .	3 "
" cloves (caryophyllus aromaticus), .	3 "
Malaga wine, ...	320 "

Macerate a fortnight; agitate from time to time, express and filter. Seventy-five centigrammes represent five centigrammes of extract of opium.

B. Rousseau's laudanum, which is made with opium, honey, brewers yeast, alcohol and water (a process of fermentation being instituted during its preparation) is twice as strong as Sydenham's.

C. SYRUPS OF OPIUM.

SYRUP OF THEBAICA. (French codex.)

Take of:

Extract opii, ...	1 part.
Distilled water, ...	4 parts.
Simple syrup, ...	495 "

Dissolve the extract in the distilled water, filter, and add the syrup; 20 grammes represent 4 centigrammes extract opii.

SYRUP OF YELLOW AMBER. (French codex.)

Take of:

Syrup of opium, ...	200 parts.
Spirit of yellow amber, ...	1 "

Dose—10 to 40 grammes (ʒ ii to ʒ x).

PAREGORIC ELIXIR. (The formula of the French codex is the same as that of the U.S.Ph.)

D. ACETUM OPII. (B. Ph.)

Take of:

Crude opium,	1 part.
Distilled vinegar,	4 "

Digest eight days and filter. Dose—5 to 10 drops.

E. BLACK DROPS. (French codex.)

Take of:

Bruised Smyrna opium,	100 parts.
Vinegar,	600 "
Saffron,	8 "
Nutmeg, in coarse powder,	24 "
White sugar,	50 "

Macerate the opium, the saffron, and the nutmeg, with 450 of vinegar for ten days; shake from time to time; heat over a sea-bath half an hour, strain, express; add the rest of the vinegar to the dregs, let macerate twenty-four hours, and express and strain; mix the two liquids, filter and add the sugar; evaporate over a sea-bath till the weight is reduced to 200.

The black drop represents a quarter of its weight of ext. opii; 1 part = 2 parts of Rousseau's and 4 parts of Sydenham's laudanum.

[2] GALLARD'S "WHITE DROPS."

Take of:

Muriate of morphia,	1 gramme.
Cherry laurel water,	50 "

Dose—one or two drops on a lump of sugar before meals.

[In this country, Magendie's solution of morphia is more generally in use. It contains 16 grains of morphine muriate to a fluid ounce of water or cherry laurel water. Dose—5 to 10 drops. The officinal solutions are: 1, the Liquor Morph. Acetatis—4 grs. to the fluid ounce; 2, Liquor Morph. Hydrochloratis—same strength as the above, the dose of both being 15 to 30 drops; 3, Liquor Morph. Sulphatis, 1 grain to the fluid ounce. Dose—a teaspoonful, containing $\frac{1}{8}$th grain.

The MORPHINE PILL of the Codex contains 1 centigramme ($\frac{1}{6}$th grain) to each pill.

BONNET'S powder consists of bismuth, 1 gramme, morphine muriate, 2 to 4 milligrammes. To be taken before each meal.

The SYRUP of MORPHINE of the French codex contains 5 centigrammes hydrochlorate morphia dissolved by the help of a gramme of dilute acid in 98 grammes of syrup. 20 grammes contain 1 centigramme of morphia. Dose—one or two tablespoonfuls.

Of the ETHER PREPARATIONS for internal use: 1, Hoffman's anodyne (spts, eth. sulphuric co., dose 20 to 60 drops) is the most in use. 2, A syrup of ether directed by the French codex. Regnault and Adrian give the following formula: Take of sugar 440 parts, distilled water, 490 parts, alcohol at 90°, 50 parts, ether 20 parts. Put in a bottle, shake and preserve. The whole of this might be given as a dose if the parts taken are made to mean grains.*

* Jour. de Pharm., January, 1868.

*A NEW MODE OF USING AN OLD REMEDY.—CHLOROFORM WATER.

Chloroform, an old remedy in the practice of the majority of practitioners, though doubtless a new remedy in the experience of the octogenarian, may be utilized for other purposes than anæsthesia, and the saturated chloroform water, first formularized by Guillot in 1844, and which was afterward made the subject of a series of trials by Lasègue and Regnault,* and still more recently by Beurmann,† is not only an excellent and handy excipient for many medicines, but possesses valuable analgesic properties. It is a stable preparation, and the savor is especially agreeable, sweetish, and when diluted one half, devoid of all piquancy and acridity; it makes a good combination with nearly all medicines which it is desirable to administer in a liquid menstruum, disguising the insipid or unpleasant taste of many of them; it markedly enhances the sedative and anodyne properties of analgesic and narcotic remedies. Lasègue especially recommends chloroform water as a suitable vehicle for the administration of morphia, in union with which it forms one of the best palliative cough medicines, as is generally acknowledged, in advanced phthisis.

Probably no better excipient for the salts of iron can be found. The mode of preparation is very simple. Into a flask two thirds full of pure water, pour an excess of chloroform, agitate well the mixture several times for the space of an hour, and allow the chloroform to deposit itself on the bottom of the flask. Decant or syphon off the clear supernatant liquid. The solution should be perfectly transparent, containing a little less than one per cent. of chloroform. For internal administration it is generally desirable to dilute this saturated solution with an equal quantity of water; the dose of the dilute aqua chloroformi being about a dessert spoonful.

Lasègue has shown the unreliability of alcohol as a solvent for chloroform, and the difficulty of making a good preparation of chloroform water from the officinal spirit solutions. Nor are the emulsions free from a certain irritant effect and even causticity, felt for some time in the stomach after the ingestion; sometimes manifesting itself as acute pain.‡

Among the therapeutic advantages of chloroform water is one on which Lasègue and Beurmann much insist, namely, its use as an analgesic in painful stomach affections, whether these proceed from indigestion or from organic disease. In the pains of indigestion it is almost without a rival, speedily mitigating the functional distress by its marvelous topical sedative action. In the painful intestinal disorder often accompanying the completion of digestion, it is of no utility. Beurmann has had favorable experience with its employ in allaying the acute suffering and nausea which attend dilatation of the stomach, especially during the digestion of food. He also strongly recommends it in cases of gastralgia, and here he is seconded by Dujardin-Beaumetz, who introduces the diluted chloroform water by the stomach-tube, performing "lavage" with the solution, his formula being two teaspoonfuls of saturated *aqua chloroformi* to the quart of liquid. This preparation he regards as both calmative and antiseptic,

* Archives gén. de Médecine, 1879 and 1882.

† Bulletin gén. de Thérapeutique, t. cv., p. 97.

‡ Lasègue, loc. cit., and Études Médicales, t. ii., p. 1147. Alcohol at 90 per cent. dissolves nearly twice its weight of chloroform. At 80 per cent. 1 gramme of chloroform is soluble in 1 gr. 15 of alcohol. At 60 per cent. 1 gramme requires 6 gr. 10 for its solution. At 20 per cent. 1 gramme requires 62 grammes for its solution, etc.

and the washing process is, above all, indicated in gastric dilatation. Lasègue also finds advantage from chloroform water in the pains and nausea which accompany cancer of the stomach.

From the list of formulæ given by Beurmann we select the following:—

℞	Sat. chloroform water,	13 parts.
	Peppermint water,	3 "
	Water,	12 "

M. Dose—a tablespoonful for a calmative stomach potion. Good nervous vomiting and the vomiting of pregnancy.

℞	Saturated chloroform water,	3 parts.
	Syrup of orange,	3 "
	Liquid morph. sulph.,	1 part.

M. Dose—one or two teaspoonfuls. The above is a useful form for the administration of morphia.

℞	Hydrate of chloral,	1 part.
	Syrup aurantii cort.,	25 parts.
	Sat. chloroform water,	50 "

M. Dose—a tablespoonful. The acrid taste of chloral is much modified when administered as above.

℞	Sat. chloroform water, peppermint water, ā ā	50 parts.
	Syrup of poppies,	30 "
	Bromide of potassium,	1 part.

M. This preparation in teaspoonful doses is exceedingly valuable in the therapeutics of infancy.

The following is called by Dr. Beurmann the "salicylic potion":—

℞	Salicylate of soda,	8 parts.
	Syrup,	30 "
	Peppermint water,	20 "
	Dilute chloroform water,	100 "

The disagreeable taste of salicylate of soda is almost completely disguised in this mixture.

The following, called "hæmostatic potion," contains iron:—

℞	Dilute chloroform water,	130 grammes.
	Syrup aurantii cort.,	20 "
	Liquor ferri perchloridi,	gtt. xx.

M. Dose—a tablespoonful. The styptic taste of the ferric chloride is almost completely removed in this combination.

Lasègue recommended a now somewhat famous hydragogue cathartic potion, which is made by rubbing up one gramme of gamboge with fifty of syrup of orange and one hundred of saturated chloroform water. The dose is a tablespoonful every morning or every second morning.

The above formulæ are examples of the therapeutic range of this medicament. They can be varied at pleasure by the practitioner to meet special indications.*

'According to Semmola, the most salient phases of gastralgic dyspepsia are a great intolerance of food, with epigastric pain and gastralgia, often

* From an article by the translator in the Boston Medical and Surgical Journal.

followed by vomiting, with other symptoms which accompany every sort of slow or difficult digestion.

The causes which constantly produce these kind of nervous dyspepsias are those which exhaust the nervous system in general, but principally care and mental worry, disappointments, the violent emotions, and sexual excesses, especially when these causes have operated during the process of digestion and repeatedly.

There may exist in the long run in these cases of nervous dyspepsia a true catarrh of the stomach, but it is always secondary, and ensues as the result of three influences:

1. The same vice of innervation affecting the capillary circulation of the stomach, (vaso-motor paralysis);
2. The prolonged presence of aliments which very slowly digest;
3. The irritant action of all the products of a defective digestion.

'Boulimia is a morbid symptom characterized by an insatiable hunger, not proportional to the losses of the organism. The old writers divided boulimia into boulimia so-called, into cyanorexia, or canine hunger, and into lycorexia, or wolfish hunger. The very definition of boulimia shows that one cannot include under this name the hunger which supervenes in the convalescence from certain acute diseases, or that which follows excessive bodily exertion.

Different causes have been assigned: boulimia may depend on certain congenital malformations or anomalies of the digestive tube, on chronic diseases of the abdomen; it often appears in pregnancy, in mental alienation, in general paralysis, in hysteria, in exophthalmic goître (Trousseau), and especially in diabetes.

It sometimes occurs transiently after the ingestion of certain medicaments (iodide of iron, Nat. Guillot), or after eating food too highly seasoned; it has been said too, that patients affected with tænia, are sometimes boulimic.

Individuals suffering from boulimia eat a great deal, and a short time after their meals they are suddenly taken with an irresistible desire to eat more; if they cannot satisfy this want, they experience pains in the stomach and malaise, sinking sensations and even syncope; after having gorged themselves, they are overcome with torpor while digestion is going on; digestion is, moreover, slow and difficult. Sometimes the enormous alimentary mass which the boulimic consumes is totally digested, sometimes it is rejected immediately afterward by vomiting (cyanorexia), or, passing rapidly into the intestine, it produces energetic peristaltic movements, and is got rid of by diarrhœa, which rapidly enfeebles the patient, (lycorexia). The stools are ordinarily fetid, as are also the sweat and the sudoral secretions. When the disease has not acquired a very pronounced degree of acuteness, a fair state of general health may be maintained for some time; but in other cases, notwithstanding the abundance of food eaten there is a progressive emaciation, a diminution of the forces and the intelligence, and the patient succumbs, either to the progress of the disease, or to some intercurrent disease.

There are degrees in boulimia; the patients are not all equally voracious, but there are some that consume incredible quantities in the twenty-four hours. Percy, for instance, cites the case of a man named Tarare, seventy years of age, weighing 100 pounds, who would eat in twenty-four hours an amount of beef equal to his own weight; this man one day eat a meal prepared for seventeen persons, he was even on one occasion accused of having devoured a child four years of age.

[6]Arsenical Preparations in Common Use.

Fowler's solution.—This solution is officinal in the U. S. Ph. where the formula for its preparation is given. Dose—5 to 10 drops three or four times a day.

Pearson's solution.—The formula for this preparation is found in the French Codex, and in the U. S. Ph. It is an aqueous solution of arseniate of soda, containing one grain of the salt in a fluid ounce. The dose is about twice that of Fowler's solution.

Granules of Dioscorides.—Each granule has 1 milligramme ($\frac{1}{60}$th grain) of arsenious acid, combined with mannite and honey. Dose—4 to 10 a day, before meals.

Granules of arseniate of soda.—The quantity of arsenic and the dose are the same as in the above.

Liquor sodæ arseniatis.—Take of arseniate of soda, 5 to 10 centigrammes, distilled water, 250 grammes; Mix. Dose—one or two dessert-spoonfuls a day.

[American pharmacists have put in the market pills of arsenious acid, sugar-coated or gelatine coated, $\frac{1}{20}$, $\frac{1}{30}$, $\frac{1}{60}$, and $\frac{1}{100}$ grain. A pill containing $\frac{1}{30}$ grain is a very handy pill; one of these may be taken *ter die*, after meals.]

[7]*Pulv. Canellæ Co.*—This powder is officinal in the Ph. Br. The *pulvis aromaticus* of the U. S. Ph. which may be found described in the U. S. Dispensatory, is similar in composition and in properties to the above. Dose—10 to 30 grains.

Pulv. cretae aromaticus.—This is made with 3 parts of aromatic powder and 1 part of chalk. The *pulvis cretae aromaticus cum opii* is the same, with the addition of a little opium; every ℈ii has 1 grain opium.

[8]*Coca, Erythroxylum coca*, (erythroxylaceæ), is a shrub which is a native of Peru. The leaves are medicinal, and have long been noted for their stimulant and tonic properties. Niemann in 1860, extracted from coca an alkaloid cocaine; formula; $C^{17}H^{21}NO^{4}$. The muriate (in 4-sided prisms) is alone used in medicine.

To Köller, in 1884, we are indebted for our knowledge of the local anæsthetic properties of cocaine. It has of late been found also that a general anæsthetic action may be obtained by subcutaneous injections of this alkaloid. [Thus a hypordermic injection of a Pravaz syringeful of a four per cent solution of cocaine muriate is found to possess analgesic properties in neuralgia similar to, and almost equal to those obtained from the subcutaneous usage of an ordinary dose of morphia, only the effect is not so lasting. At least this has been my experience.—Trans.]

LECTURE XIII.

BUCCAL AND INTESTINAL DYSPEPSIA.

SUMMARY.—Saliva—Starchy Dyspepsia—Dietetic Treatment—Pharmaceutical Treatment—Diastase—Extract of Malt—Intestinal Dyspepsia—Intestinal Juice—Bile—Pancreatic Juice—Pancreatin—Ileo-Cæcal Dyspepsia—Preparation of Pancreatin—Eupeptic Preparations.

THUS far I have been occupied with disorders pertaining to the stomachal digestion; but if the stomach plays a preponderant rôle in the congeries of the digestive acts, there are other factors as well, and no consideration of dyspepsia would be complete that should omit to take into account the perturbations affecting the processes of buccal and intestinal digestion. Therefore in this chapter I shall take up the buccal and intestinal dyspepsias.

Starchy foods, as you know, undergo the action of the saliva,[1] and it is by reason of the diastase which the latter contains that starch is converted into dextrine, then into assimilable sugar. Mialhe has furnished in this regard the most precise and exact data. I cannot here enter minutely into the subject of the composition and secretion of the saliva. What I desire to remark is that the salivary ferment, the *ptyalin* of Berzelius, the *diastase* of Mialhe, is only found in mixed saliva; we are still ignorant where this special ferment is developed, which, as Mulder has shown, shares with all albuminoid substances in process of decomposition, the property of saccharifying starch.

But if the saliva be insufficient, or if the impregnation of the aliments therewith be incomplete, the disorders which result will make themselves felt only on the part of the stomach and intestine. In fact, as Charles Richet has shown, if the acid medium of the stomachal digestion cannot of itself transform amylaceous matters into sugar, it nevertheless favors the action of the saliva on these substances. So, when starchy matters are not insalivated, they remain in the stomach as foreign bodies till expelled by the contractions of the stomach; they then pass into the intestine and are subjected to the action of the pancreas, which digests these substances, as Bouchardat and Sandras have shown.

Therefore individuals affected with buccal dyspepsia, or as it has been rightly called, dyspepsia of starches or amylaceous dyspepsia, experience as the result of an exclusively vegetable diet, disorders which are characteristic especially of atonic dyspepsia; they have a feeling of weight and pressure and twinging pains in the region of the stomach; symptoms which indicate that the gastric digestion is ill-performed.

What remedies will you prescribe for these patients? Here too we must give the first place to dietetics. To persons suffering from these disorders you should recommend abstinence from starchy articles of diet, and if they can not submit to this regimen, you should limit, as far as possible, the quantity of farinaceous foods, and cause such alimentary substances to be taken in a soft boiled state, so as to destroy the protecting envelope of the starch granules, which opposes the salivary impregnation. Recommend them to eat slowly, to masticate with care, especially when eating such articles as bread or fried potatoes.

Already in a previous lecture I have insisted on this point, but I think it best to return to it now; this dyspepsia of starches is in fact a frequent disease in persons who by their profession are obliged to eat rapidly, physicians for instance. Hence it is that it is not advisable to include in the dietary of such persons, and particularly in that of the principal meal, which is generally devoured with greatest haste, more than a limited quantity of bread and of amylaceous substances. Their repast should be meat and bread, rather than bread and meat.

As you see, we can summarize as Mialhe has done, the dietetic rules in these two sentences; relative abstinence from starches on the one hand, and complete and prolonged mastication on the other.

As for the pharmaceutical treatment, it consists in the employment of diastase, the use of which is based on the soundest principles of physiology. We have seen that when the stomach does not secrete enough gastric juice, it is necessary to give pepsin and a mineral acid; the employment of diastase is just as much indicated in amylaceous dyspepsia. In fact, the identity of the diastase discovered by Dubrunfaut, and isolated by Payem and Persoz in the grains of cereals in the process of germination, with the animal diastase of Mialhe, is complete, and both possess the property of transforming starch into sugar.

Coutaret has done much to promote the proper application of this diastase to therapeutics, and it is in following his precepts and those of Duquesnel, who has given a very interesting study on these diastase products, that we to-day know the most favorable indications for these substances, which are diastase or maltine, the extracts and the elixirs of malt.

Diastase is obtained by making an infusion at 30°C., of ground malted barley, then by coagulating the albumen at 70° C., and precipitating the diastase by absolute alcohol. This is the process of Payem and Persoz. It gives an impure product. The processes of Berthelot and of Schützenberger, furnish much purer diastases.[2]

This diastase or maltine, when it is dried, constitutes a white azotized powder, amorphous, without savor, soluble in water and in weak alcoholic solutions, insoluble in alcohol, and which, as Bouchardat has shown, loses its properties when it is mixed with certain substances, such as alkalies and strong acids.

You can make use of this maltine in the dose of from 10 to 20 centigrammes; and here you have two forms which are in common use; the malt powder, which is given in the dose of 50 centigrammes to a gramme, and the extract of malt the dose of which is from one to two grammes.[3]

There is a syrup of extract of malt (one part of malt extract to ten of simple syrup), but the best preparation in my opinion, is Duquesnel's elixir, the dose of which is a tablespoonful at the commencement of each meal. [Duquesnel's elixir is made as follows: Malt extract, 1 part; Simple syrup 10 parts; Malaga wine 10 parts.] You may also make use of the liquid extracts of malt, but at the same time with a good deal of reservation, for many of these preparations contain but little diastase, and some none at all.

The subject of intestinal dyspepsia is more complicated than the preceding, and this is due to the fact that the intestine in its participation in the digestive process has multiple functions. Three elements concur in the performance of chyliferous digestion; the intestinal juice, the bile, and the pancreatic juice.

Let us sum up the physiological notions which we possess relative to the action of these three products of secretion. Physiologists are not agreed in ascribing to intestinal juice a digestive action of its own. According to some, this juice, which is slightly alkaline and albuminous, emulsifies fats, transforms starch into sugar after the manner of pancreatic juice, and has an action on the digestion of albuminoid matters. According to other physiologists, this juice has no digestive property.[4]

You comprehend how difficult must be the solution of the problem, by reason of the impossibility of isolating each of the secretions of the different glands of the intestine, and that according to the part from which the intestinal juice is collected, different results have been obtained. But if physiology is unable to solve the problem, from a clinical point of view we have important data furnished by experimentation in cases of artificial anus, and the experiments of Busch of Bonn, and of Diffenbach of Berlin, seem to us in this regard demonstrative.

These had to do with certain patients the subjects of an artificial anus high up in the intestine; little sacks containing albuminous substances, were introduced into the false anus, and were found in the fæcal matters completely emptied, the contents having apparently been digested. It is not then doubtful that the intestinal juice possesses a digestive power of its own, and this is a fact of considerable importance and which serves as the basis of the operation proposed by Surmay of Ham for cases of obliteration of the pylorus, an operation which consists in opening the duodenum and practicing enterostomy.

As for the bile, physiologists are still in disagreement; some thinking that this liquid is purely excrementitious, others making it play an important and notable part in digestion. Here, too, clinical experience shows us on what side the truth is; in fact, in cases of biliary fistula where the bile escapes by an exterior opening instead of flowing into the intestine, there supervene profound disturbances of the nutrition; the unfortunate subjects pine away and succumb to the disorder which affects the intestinal digestion.

It is evident then that this liquid has a real action in the intestinal digestion, an action which we may thus sum up: the bile by its presence excites the contractions of the intestine while lubricating its walls, and so true is this, that in individuals affected with obliteration of the bile ducts, constipation is almost always the rule. The presence of this alkaline liquid also facilitates the passage of the chyle into the lacteals, and it would seem also that the bile by its alkaline properties aids the emulsifying of fats, and completes the action of the pancreas; finally, by its antiseptic properties, it serves to check putrid fermentation of the alimentary bolus, a fermentation, which, as Bouchard has shown, plays a preponderant part in the production of certain morbid symptoms of the economy. I shall return to this point when I come to speak of the treatment of the intestinal diseases.

If there is still a dispute as to the real digestive action of intestinal juice and bile, all physiologists are agreed in admitting the predominant action of the pancreatic juice in the intestinal digestion. This juice possesses the three following properties: first as Bouchardat and Sandras and Valentin have shown, of saccharifying starchy matters; second, of transforming albuminoid matters into peptones, and this fact, foreseen by Eberle, Purkinje, and Papenheim, has been definitely demonstrated by the experiments of Claude Bernard and Corvisart; lastly, it possesses the curious property of emulsifying fatty matters, by causing them to break up into glycerine and fatty acids. Do not think that these effects are but little marked; the following statement shows you the digestive power of pancreatic juice. It has been proved that pancreatin, an active product which Dufresne has obtained by acting upon the pancreas with ether, will convert nine times its weight of starch into sugar, emulsify twenty-five times its weight of fat, and peptonize thirty times its weight of cooked albumen. The pancreas is then, you see, one of the most active and powerful glands concerned in intestinal digestion, and you see the important part which it must perform in completing the digestive action of the buccal and stomachal cavities.[5]

This pancreatic digestion has, moreover, been the subject of recent very important labors; Heidenham, Kuhne, Podolinsky, Herzen, have shown that in the pancreas there exists no ferment, but a substance called *zymogene* which may produce one.[6]

All the digestive processes which we have just enumerated take place almost exclusively in the small intestine, and seem to cease in the large intestine. Hence it is, that physiologists who are disposed to ascribe an important rôle to the cæcum in the intestinal digestion, are compelled to take their facts, not from instances observed in man, but in certain herbivora which have this portion of the intestine very much developed.[7]

In man the cæcum is only rudimentary, and the rôle which it is called to play in intestinal digestion is very insignificant, if indeed it has any part at all; hence we are led to believe that that variety of dyspepsia described by Bachelet of Lyons under the name of ileo-cæcal dyspepsia has no legitimate right in the group of functional troubles of the digestion, and does not merit a special description.

When I spoke of buccal or amylaceous dyspepsia, I told you that this form of dyspepsia manifests itself by symptoms whose seat is the stomach; likewise stomachal dyspepsia may be attended with intestinal symptoms. I showed you that in putrid dyspepsia in which the secretion of gastric juice is not sufficient, the albuminoid matters pass into the intestinal tube without being peptonized, and if the secretion of pancreatic juice is not sufficiently abundant to complete this digestion, these undigested substances, it is easy to understand, act as foreign bodies in the intestine and determine colic of a more or less severe nature. You have the type of this in crapulous indigestion, in which the individuals not only vomit their surfeit, but also suffer from colic and diarrhœa.

But there is a very interesting point to consider, namely, what becomes of the peptonized substances when they reach the first portion of the duodenum. We know that gastric peptonization takes place only in an acid medium; arrived at the ampulla of Vater, where the bile duct and pancreatic ducts meet, the chyme finds an alkaline medium, and the work of peptonization by the gastric juice must cease; nothing now remains but the parapeptones of Meissner, that is to say, that precipitation which takes place in the acid peptones when neutralized by an alkali.

This phenomenon is plain beyond dispute; it shows that Leven's theory that the alimentary substances simply pass through the stomach to undergo the chemical processes of digestion in the intestine, is not quite in accordance with physiological facts, since we see peptonization come to a stop in the duodenum. We must then admit with Richet that the aliments remain in the stomach a sufficient time for the peptonization of albuminoid matters to be effected, and that it is not till after the accomplishment of this act that the peptones pass into the intestine and are absorbed in a neutral or alkaline state by the vessels of the intestine.

This fact is important; it shows us that the too rapid passage of aliments from the stomach into the intestine by reason of inordinate activity of the muscular coat may be a cause of intestinal dyspepsia, resulting from the presence in the intestine of a quantity of food substances too great for the pancreas to digest.

At other times it is the pylorus which by ill performance of its rôle as porter of the stomach, (πύλη port, οὖρος keeper) lets non-peptonized substances pass out of the stomach. This incontinence of the pylorus, which Louis de Seré was one of the first to point out, has always intestinal dyspepsia for its consequence.[8]

Intestinal dyspepsia, whether resulting from incomplete digestion of albuminoid and amylaceous matters, whether from too great an abundance of fatty substances, whether from insufficient secretion of pancreatic juice or of bile, always manifests itself by the following symptoms: The patient experiences some considerable time after eating, abdominal pains of greater or less severity, borborygmi, colic, uncomfortable distension of the intestinal coils; finally, there is a more or less abundant diarrhœa.[9] What treatment will you oppose to this order of symptoms?

Just as we advised pepsin in the functional troubles of gastric digestion, and diastase in buccal dyspepsia, we here employ pancreatin, and Defresne has rendered a real service to therapeutics in introducing this substance into the materia medica.

Pancreatin, obtained by the action of ether on the pancreas, presents itself at first in a viscous state, after which it is evaporated to dryness; it is precipitated from its solutions by alcohol; at the temperature of 70° C., (158° F.), pancreatin is rendered inert; acids and powerful alkalies destroy its digestive properties, which nevertheless manifest themselves in a feebly alkaline or acid medium.

Defresne has devised many preparations of pancreatin; he has made powders, pills, and an elixir. The powder is given dissolved in water, or in capsules, dose, 5 to 10 grains. The pills, each containing 3 grains, are given before meals; dose, 3 to 5. The elixir is a good preparation; each teaspoonful contains 4 grains of the active substance.

All these preparations are administered either at the beginning or middle of a meal, for pancreatin ought to be taken along with food, of which it aids the digestion. In fine, the use of this medicinal agent must be continued a long time; this is a point on which our colleague Huchard has justly insisted, in showing us all the advantages which may be derived from pancreatin in gastro-intestinal dyspepsia.[10]

At the same time, do not forget that pancreatin, like pepsin, is a ferment, that is to say, a substance that easily spoils, and that often its therapeutic effects are rendered nil by reason of the profound modifications which this ferment undergoes in its preparation. You see then that here too, the most important rôle still belongs to hygiene.

Recommend then to your patients affected with intestinal dyspepsia to pay especial attention to their food, and to take only those aliments which, in little volume, are the most nourishing, in order not to impose too much work on this part of the alimentary canal. Order a diet largely azotized, and avoid as much as possible fats, whose digestion is performed exclusively by the pancreas. But above all, proscribe, absolutely, from the dietary of your patient cane sugar; you know in fact, since the labors of Claude Bernard, that the transformation of cane sugar into glucose takes place exclusively in the intestine.

We have now to consider the treatment of the colic and flatulent distension of the intestines which characterize these cases. We have, in fact, while on the subject of gastric dyspepsia, seen perturbations in the functions of the muscular coat produce special dyspeptic disorders; likewise if you analyze the disturbances ensuing in intestinal dyspepsia, you will see that you must ascribe a considerable share in their production to troubles affecting the muscular investment, and that, according as the peristaltic movements are exaggerated or abolished, there supervene more or less serious derangements in the digestive act; this is what Seé has described under the name of intestinal atony, and which he considers as pseudo-dyspepsia. But as I propose to devote a series of lectures to the treatment of intestinal affections, I shall return to these points when I come to speak of the therapeutics of diarrhœa and constipation.

We have seen that in the treatment of stomach dyspepsias there are multiple preparations applicable to several forms of dyspepsia; the same may be said of dyspepsia in general, owing to the ingenuity of pharmacists, who have endeavored to associate in complex formulæ the principal ferments of digestion; thus we have compounds of diastase, pepsin, and pancreatin. Such are the eupeptic preparations of Tisy, the "Pepsin and Diastase Wine" of Chassaing, the "Elixir of Grez," etc. I am inclined to think that these combinations do more harm than good, and that in most cases the attentive study of the different symptoms presented by the patient, will enable you to decide to what particular ferment you should give the preference.[11]

In the next chapter I shall consider the therapeutics of the secondary dyspepsias.

NOTES TO LECTURE XIII.

[1] The saliva, product of secretion of the different salivary glands, is a liquid which is ordinarily alkaline, and only exceptionally acid. The composition of saliva, according to Jacubowitsch, is as follows:

Water,	995.16
Epithelium,	1.62
Ptyalin,	1.34
Phosphate of sodium,	0.94
Alkaline chlorides,	0.84
Sulpho cyanide potassium,	0.06
Lime, combined with organic matter,	0.03
Magnesia, combined with organic matter,	0.01
	100.00

According to some physiologists, sulpho cyanide of potassium does not exist in human saliva; according to Longet, it is constant in the saliva from all the glands, parotid, submaxillary, sublingual and buccal; its presence is characteristic of saliva, though the quantity is but insignificant. Kletzinski is of opinion that this salt has for its end to prevent the development of fermentation in the saliva.

Pasteur has found in human saliva a microbe of figure of 8 aspect, and very minute. (Micrococcus Pasteuri, Sternberg). This microbe causes death very rapidly in the hare, by producing an intense congestion of the lungs. Armand Gautier in his turn, has shown that the saliva of man contains in the normal state alkaloids having a toxic action for certain animals, and in particular, birds. These alkaloids are analogous to the animal alkaloids which he has described under the name leucomaines.

[2] Diastase is prepared in the following manner:

Malt, dried at a temperature of 50° C., (122° F.), is reduced to coarse powder and put to macerate for an hour or two in twice its volume of water at 30° C, (86° F.). When the maceration is terminated, the whole mass is strained through a coarse linen cloth and expressed.

The liquid obtained is heated to 70° C. (150° F.), in a sea-bath maintained at 75° C., (167° F.). As soon as the albumen is coagulated, it is strained anew through linen, or better, filtered through paper, if the volume of the liquid be not too great. It is then allowed to cool, and absolute alcohol or alcohol very concentrated is turned into the liquid, which is kept agitated. It is necessary to use a considerable quantity of alcohol, at least seven or eight times the amount of the liquid employed. The diastase, insoluble in the alcohol, is precipitated under the form of white flakes, which are collected on a filter, and then spread in their moistened state and dried on glass plates heated in a stove at the temperature of 40° C., (104° F.).

The product obtained is pulverized, and kept in dry flasks. One kilogramme (2 lbs.) of malt gives about 15 grammes (225 grains) of dried diastase. This may be still further purified by redissolving in water and re-precipitating by alcohol. Duquesnel's method is still more complicated; the diastase is precipitated by tri-basic phosphate of lime.

Diastase, which possesses the property of transforming into sugar two thousand times its weight of starch, commences its action on hydrated starch at 15° C. (59° F.), attains its maximum of intensity at 70° C. (150° F.), but loses its properties at 85° C. (187° F.). This, says Duquesnel, explains the inertness of a great many of the diastase preparations which are made at too high a temperature.

Duquesnel's mode of testing diastase:

Take a wide mouthed flask; put into it 10 grammes of a 10 per cent. solution of starch; add 5 centigrammes of the diastase to examine; stir together with a rod and heat in a sea-bath at the temperature of 60° C., (140° F.). At the end of a certain time, if the diastase is good, the starchy pultaceous mass will be seen to undergo disaggregation, liquify and lose little by little its property of turning blue by iodine, a property which ends by disappearing altogether, and often in less than an hour, if the quantity is not too great for the diastase in the flask. At this moment the transformation is complete, but if one would measure the saccharifying power of the diastase he must have care to employ an excess of the starch solution.

When the reaction is completed, that is to say, after several hours (generally about six), in order to be sure you have not arrested the operation too quickly, you add distilled water enough to make a volume of 100 cubic centimetres; you agitate carefully and filter, and in this clear liquid you detect the presence of glucose by Fehling's standard solution, which is without effect on a similar *check* solution of starch which has been heated in the same conditions, but without the presence of the diastase.*

[1] There are several Extracts of Malt and similar preparations which go by the name of Maltine, manufactured in this country, and in general use. Of these, I may specify Trommer's, made in Fremont Ohio; Keasby and Mattison's of New York:—these extracts are some of them medicated with iron, strychnine, quinine, pepsin and pancreatine, hypophosphites, etc.

Reed and Carnrick make a very fine "Maltine" plain or medicated. The well known firm of Tilden and Co. manufacture various forms of malt extracts. The dose of all these preparations is from a teaspoonful to a tablespoonful, after meals; patients generally prefer to take their malt undiluted. Amend of New York makes an excellent Malt powder, the dose of which is a teaspoonful. Magee's Malt with Cod liver oil and Syrup of Hypophosphites is a very pleasant mixture, in which the taste of cod liver oil is almost completely disguised. Trans.

[2] There is found in the intestine, besides the mixture formed by the saliva and gastric juice, the bile, and pancreatic juice, a liquid composed of intestinal juice, and mucus, and secreted by the tubular glands of Lieberkuhn and the follicles and glands of Brunner.

The function of the intestinal juice has long been misunderstood, but to-day it is pretty well known, owing to the labors of Haller, Leuret, and Lassaigne, Frerichs, Bidder, and Schmidt, etc.

The intestinal juice is a colorless viscous liquid, of acid reaction, uncoagulable by heat, and giving an abundant precipitate with alcohol and the metallic salts. Its density at 15° C., is 1.010.

COMPOSITION OF THE INTESTINAL JUICE OF A DOG.

(Bidder and Schmidt.)

Water,	98.
Organic matter,	0.5
Salts,	1.5

* Duquesnel, Bull. gén de Thér., t. lxxxvii., p. 75.

COMPOSITION OF INTESTINAL JUICE OF A HORSE.

(Colin and Lassaigne.)

Water,	98.1
Organic matter,	0.45
Salts,	1.45

According to the labors of O'Funk, who experimented on hares, and those of Kölliker and Müller, whose experiments were performed on cats, the intestinal juice is different in herbivora and carnivora; that of the herbivora has no effect on albumen, while that of the carnivora digests albumen well.

[5] Pancreatic juice is poured into the duodenum by two distinct ducts; that of Wirsung and the accessory duct. The secretion is intermittent and like the bile is most abundant at the time of meals. Claude Bernard has also shown that when you experiment with pancreatic fistulas in animals, the liquid collected at the beginning of the experiment is viscous (this is normal pancreatic juice), while at the end of the experiment it becomes watery. The action of this juice has been studied by many physiologists (Tiedemann and Gmelin, Purkinjee and Papenheim, but especially by Valentine of Berne, and Bouchardat and Sandras of Paris in 1844). The latter made use for their experiments of artificial juice obtained by macerating portions of pancreas in water. Eberle in 1834, was the first to point out the action of pancreatic juice on fats. Bouchardat and Sandras have insisted more particularly on the saccharifying properties of this juice, and Donders, by his experiments on animals on which he had produced a pancreatic fistula, has put this matter beyond doubt.

In 1846, Claude Bernard showed the property which pancreatic juice possesses of emulsifying fatty bodies by decomposing them into fatty acids and glycerine.

The property of digesting albuminoid matters has been contested by Keferstein and Hallwachs, and admitted by Corvisart, Brinton, and Meissner.

The composition of pancreatic juice, according to Tiedemann and Gmelin, and Bidder and Schmidt, is as follows:

PANCREATIC JUICE OF A DOG.

(Tiedemann and Gmelin.)

Water,	91.72
Organic matter, analogous to albumen, and insoluble salts,	3.55
Matter soluble in alcohol, (and salts soluble in alcohol),	3.86
Matter soluble in water (and salts soluble in water),	1.53
	100.00

PANCREATIC JUICE OF A DOG.

(Bidder and Schmidt,)

Water,	90.08
Organic matter (pancreatin and mucus),	9.04
Salts,	0.84
	100.00

[6] Zymogene is transformed into pancreatin after death. Herzen pretends that under the influence of the pancreatogenous matters contained in the blood, the pancreas charges itself with zymogene, but that the

latter does not become pancreatin till the spleen has furnished it a special ferment. This is also in accordance with the facts advanced by Schiff.

Albertoni has shown that the digestive power of the pancreas on abuminoid matters manifests itself in the fœtus at the commencement of the last third of intrauterine life; later in fact than that of the stomach.*

[7] It is especially in the herbivora that we find the cæcum voluminous. In the horse it forms a pouch with a capacity of 35 quarts. It is also very large in the rodentia, such as the hare and porcupine. In the carnivora it is scarcely more than rudimentary.

Bachelet of Lyons, has laid great stress on the anatomical relations of the large intestine, which almost covers the stomach, and according to him, the pretended gastric pains of which a great number of dyspeptics complain, have their seat in the transverse colon.† He attributes to the large intestine and to the cæcum the digestion of non-azotized foods, and in certain cases of dyspepsia with non-assimilation of fats and starch, with great emaciation, he believes the fault to be with the above mentioned portion of the digestive tube.

[8] "The pylorus may commit many negligences; it may even lose its property of contraction and remain relaxed; this incontinence has for effect to prevent the sojourn of aliments in the stomach, and thus to suppress the stomachal digestion." *Louis de Séré, "On the Rôle of the Stomach and of the Pylorus in Digestion," Paris*, 1874. He adds that in other cases there are painful spasms of the pylorus, and that this state, which is generally due to an irritation of the solar plexus, equally stops gastric digestion, by arresting the secretion of gastric juice.

[9] Caulet is of opinion that the late appearance of the dyspeptic phenomena is not sufficient to compel the admission of intestinal dyspepsia. He thinks that digestion goes on at the same time throughout the whole extent of the active portions of the digestive tube. The intestinal digestion, according to him, begins at the same time as the stomach digestion. In fine, he affirms that the tardy appearance of the dyspeptic manifestations is characteristic of gastric dyspepsia, and especially of atonic dyspepia.‡

[10] Defresne prepares pancreatin in the following manner. The fresh pancreas of a hog is triturated and reduced to a pulp, and placed with ether in a recipient; the whole is submitted to a temperature of 112° F., for twenty-four hours. At the end of this period the glandular parts are completely resolved into pancreatic juice, while the fibrous tissue floats on the surface of the liquid. This ethereal solution of pancreatic juice is then evaporated down to a dry state under the influence of a strong current of air, at a temperature of 104° F. Obtained by this process, pancreatin presents itself under the form of a pale yellow powder, very soluble in water, of a fresh, animalized savor; its solution is viscous as pancreatic juice itself; it coagulates *en masse* by heat, like the white of

* Herzen, Lessons on Digestion, Firenze, 1877. Podolinsky, Arch de Pflugér, t. xiii., p. 422. Weiss, Virchow's Archiv., lxviii., p. 413. Kuhne and Lea, Heidelb., Nat. Hist. Med. Verth., t. ii., 1879. Albertoni, On the Digestive Power of the Pancreas in Fœtal Life. Lo Sperimentale, fasc. 7, 1878.

† Bachelet, Nouveau Guide du Dyspeptique, Paris, 1865.

‡ Soc. de Hydrol., t. xviii., 26, 1872–1873.

egg. Alcohol precipitates it from solution; the precipitate, soluble in water, is the pancreatic ferment, while the liquid part is inert.

According to Defresne, 15 grains of pancreatin digest 4 ounces of fibrin, an ounce and a half of fresh meat, or 1 ounce of cooked albumen.

The pancreatin pills are made as follows: Take of pancreatin, ʒ i. honey gr. vijss, magnesia q.s. F. S. A. pil. No. xx. (which should be silvered). Each pill contains a little more than 3 grains pancreatin.

ELIXIR OF PANCREATIN.

Take of:

Pancreatin, ...	4 parts.
Dry white wine, ...	120 "
Crystallized sugar, ...	175 "
Tincture of coffee, ...	10 "

M.

"Mourrut and Vulpian have declared themselves opposed to the association of different ferments. Portes has shown that pepsin and diastase are not incompatible; but, according to him, pepsin and pancreatin cannot be associated.*

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*Jour. des Connais Méd., August, 1879.

LECTURE XIV.

SECONDARY DYSPEPSIAS.

SUMMARY.—Secondary Dyspepsias—Cardiac, Hepatic, Tabetic Dyspepsias—Chlorotic Dyspepsia—Evils of the Ferruginous Medication—Diathetic, Scrofulous, Herpetic, Arthritic Dyspepsias—Disorders Consecutive to the Dyspepsias—Nervous Troubles of Gastric Origin—Stomachal Vertigo—Abdominal Angina—Multiple Forms of Dyspepsia—Conclusions.

GENTLEMEN: When I was engaged in tracing the plan of the dyspepsias, and the divisions which I proposed to make in this group of functional disorders of the stomach, I told you that there were secondary dyspepsias which necessitated a special treatment addressed more particularly to the cause of the functional trouble than to the disorder of the stomach. Without here attempting to treat this subject completely, which would require several lectures, a subject, moreover, for which I must refer you to special treatises and which you will find well handled in the remarkable study of my colleague Raymond "On the Dyspepsias,"* I desire nevertheless to call your attention to two or three varieties of this group of dyspepsias.

Here we shall have to consider the dyspepsias from two principal points of view; first in their relation to the affections of which they are a manifestation; second in their relation to diseases which may in their turn have for origin the functional troubles of the stomach.

The local affections which may manifest themselves by stomach troubles are numerous, and we have already, while on the subject of vomiting, spoken of the dyspepsias which have for their point of departure the uterus and kidneys. I shall not then return to this point, and shall only glance at the functional gastric disorders which accompany diseases of the heart, liver, and nervous system.

Raynaud, and more recently Prof. Germain Seé have shown that certain affections of the heart, of larvated form, may manifest themselves by disturbances of the digestion; these are the true cardiac dyspepsias. As for the liver, Senac has pointed out the importance of functional troubles of the stomach in the diagnosis of gall stones. In patients affected with biliary calculi, apart from the painful crises, you in fact, see a more or less obstinate dyspepsia almost constantly present, dyspepsia of a dis-

* Raymond, Des Dyspepsies, Thèse d'Agrégation, Paris, 1878.

tressing form, returning every day in paroxysms, appearing especially about nightfall; these symptoms of hepatic dyspepsia do not disappear till the patient is freed form his gall stones.

In regard to the nervous system, you all know the vomitings which accompany cerebral affections, and in particular, those of the meninges; lesions of the spinal cord have also a marked action on the development of dyspeptic disorders, and we have here one of the most difficult forms to treat. When I come to speak of the treatment of the chronic myelitis.* I shall dwell more particularly on those troubles of the stomach, which Charcot was one of the first to describe minutely. But what I can assure you is that these disorders are especially characterized by crises of painful dyspepsia, which often manifest themselves years before the appearance of the medullary symptoms. Therefore, whenever you observe in a patient these painful paroxysms, repeating themselves at intervals more or less wide apart, and rebellious to all means of treatment, examine attentively the state of the lower extremities (which may already show symptoms of coming paralysis); examine also carefully the ocular phenomena, and you will often find there precious indications respecting the origin of this dyspepsia.

Alterations of the blood also give rise to dyspepsias, and one of the most frequent of these is that form which is witnessed in anæmia. Almost all chlorotics are dyspeptics, and this is a fact which, by its frequency forces itself on the observation. I have not time here to study in detail the treatment of anæmia and chlorosis, and must refer you to the chapters devoted to the subject in my third volume.* I must, however, put you on your guard against the evils which may result from ferruginous medication in these cases.

Iron, in fact, in many cases, instead of conferring benefit on patients suffering from chlorotic dyspepsia, only augments the gastralgic state, whatever the form of iron which you administer. So in this painful dyspepsia of the anæmic, I much prefer arsenic to iron, and I join to the arsenical medication, the appropriate dietetic means, that is to say, the usage of underdone or raw meats, and meat powders, hydrotherapy, exercise in the open air, gymnastics, etc.

As for the diatheses, they have a very marked influence on the dyspepsias. This subject has been thoroughly studied of late by Pidoux, Bourdon, Durand, Fardel, and still more recently by Cornillon and Senac Lagrange.* We shall have to consider successively the influence of scrofula, of herpetism, and of that of gout and rheumatism on the development of the dyspepsias.

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* Clinical Therapeutics, G. S. Davis, Part II.

† *Ib.*, Detroit, 1885, page 166.

‡ Senac Lagrange, On the Nature of the Dyspepsias and their Vital Conditions as Brought to Light by the Use of the Sulphurous Waters, notably those of Cauterets. Bull. de Thérap., t. cvi., p. 197.

Of all these diatheses, scrofula is that which has the least tendency to determinations toward the stomach; it is not so with herpetism, and you know that Pidoux who has greatly extended the domain of this diathesis, considers the most of the dyspepsias, and especially those which are of a painful order, as due to herpetism.[1]

If all are not yet agreed in recognizing the existence of herpetic dyspepsia, there is no dispute as to the influence on dyspepsia of arthritism, the sole source, according to Bazin and Pidoux of gout and rheumatism.

Just as it is the rule to see the heart affected in acute articular rheumatism, so it is rare to find a gouty patient without stomach troubles. So whenever in your patients you meet a dyspepsia which is obstinate, profound, resisting the means habitually employed, be persuaded that you have to do either with gout, or the product of gout, and in your practice, gentlemen, you will continually find confirmation of this fact.

In these cases the treatment should be directed not only to the stomach, but also to the gouty element, and the uric diathesis which exists in this sort of dyspepsia. Employ the alkaline preparations, and especially those of lithia; supervise at the same time the dietary, so that the azotized materials may be in direct proportion to the muscular labor and the exercise of the patient. As for the regimen, follow as a guide the excellent indications formulated by Bouchardat, recommending at the same time exercise and functional activity.[2]

Constipation has a marked influence on dyspepsia. In the gouty, of whom I have just spoken, you almost invariably observe an atonic dyspepsia complicated with obstinate constipation, and as the muscular coat of the stomach and intestine is continuous, it seems that paresis of the one leads to paresis of the other.

Examine then the stools, and provoke intestinal movements by light saline purgatives, or by some bitter laxative: cascara, aloes, rhubarb, in order to keep up the freedom of the bowels. In these gouty dyspepsias with constipation the whey cure and the grape cure, certain purgative waters, and in particular, those of Aulus, give good results.[3]

As for the influence of dyspepsia on the development of diathetic affections, the question is not yet decided, and despite the affirmation of Beau that in advanced periods of dyspepsia general disorders of the economy may arise from the functional troubles of the digestion, I am far from admitting this view, which starts from the by no means certain postulate that dyspepsia always entails blood-corpuscular deficiency.

If, in fact, in many cases dyspepsia may bring in its train profound disturbances of nutrition, we must remember also that in many others the slowness of the digestion does not hinder complete assimilation of the food, and that in these cases nutrition is in no sense compromised. Moreover it is very difficult to know if the dyspeptic manifestations are not rather the effects of the commencement of diathetic affections than the cause of the latter.

But there is a point to which I desire to call your attention, and one of some delicacy; which pertains to the nervous disorders which have their source in dyspepsia. Already Trousseau, under the name of gastric vertigo has described certain very interesting phenomena which result from digestive troubles; but there are others which are much more curious, and which you will not find described in many of your text-books.[1]

I refer to those strange nervous symptoms which certain dyspeptics experience, and which are a reverberation from the stomach upon the heart or abdominal viscera; symptoms which come on in crises, and to which I have given the name of abdominal angina.

When I spoke to you of diseases of the aortic orifice, I told you that they are often accompanied by a peculiar nervous irritability which reverberates to points more or less remote from the heart, and which has for its origin modifications effected in the nervous elements of the numerous ganglia of the pulmonary and cardiac plexuses which exist in this region. The same anatomical conditions are met with in respect to the stomach, which is in relation with the numerous ganglia of the solar plexus (veritable abdominal cerebrum); and one can easily understand that the modifications taking place in the constituent parts of the stomach may re-act upon the ganglia, and determine there alterations which may in some cases manifest themselves by symptoms of great gravity.

This is what Leven has described under the name of cerebro-gastric disease, an affection which is characterized, as I have just said, by visceral and nervous troubles which affect particularly the functions of the lungs and heart and those of the cerebro-spinal axis; let us examine each of these points.[2]

As for the cardiac troubles, they have been especially well studied by Potain, Barié, and Huchard, and constitute a group of pseudo-angina pectoris consecutive to affections of the stomach and particularly dyspepsia.[3] There are, in fact, a certain number of patients whose paroxysms of angina never appear except under the influence of the digestive act; and who would exist comfortably if they could live without eating.

As for the nervous disorders, apart from the vertigo described by Trousseau and Blondeau, there exist certain modifications of the intelligence; the patient sees his memory fail; he becomes gloomy, taciturn, and especially, hypcohondriacal. The cœliac plexus plays in man the same part as predisposing cause of hypochondriasis that the genital organs do in the development of hysteria in the woman, and many hypochondriacal patients are simply dyspeptics.

Finally, the troubles of respiration are characterized by veritable crises of suffocation, a true gastric asthma which is dependent on the perturbations affecting the gastric digestion.

What gives especial interest to these nervous phenomena, or to speak more correctly, to these vaso motor phenomena determined by the modifications effected in the great sympathetic and in the pneumogastric, is that they are tributary to a treatment immediately directed to the dyspepsia. You ought then in prescribing for these patients to give your principal attention to the stomach, then you should regulate the functions of the nervous system by hydrotherapy. Moreover the treatment of this gastric neurosis has many points of contact with that of neuropathy and I shall return to it again when I come to the treatment of diseases of the nervous system.*

Such, gentlemen, are the particulars which I desired to present respecting the dyspepsias; the description which I have given may possibly seem rather theoretically than clinically exact, but it has this great advantage that it enables you to seize the therapeutic indications which you ought to fulfill in the treatment of the dyspepsias.

All these forms, in fact, are more or less correlated and intermingled, thus constituting two great divisions of dyspepsias: those with atonic tendency, with torpid form, and comprising especially pituitous, atonic and flatulent dyspepsias; the other division, on the contrary, being characterized by its irritative tendency, and here you will find grouped together the acid and painful dyspepsias and vomiting.

I have now finished my task in the exposition of the dyspepsias of adult life, and yours now commences:—I mean to say, that now that you know the principal methods of treating these diseases, it will be your care, by the attentive interrogation of your patient's symptoms, to detect the predominance of this or that form of dyspepsia; it will be incumbent on you to combine and vary your medications so as to respond to each of the symptoms, also to ascertain what part must be assigned to diathesis in these dyspeptic manifestations; in a word, you will have to institute your treatment, and all your skill will be exercised in subordinating, each to each, the principal therapeutic indications which I have formulated.

I cannot in concluding do better, in order to show you the difficulties of your task than to quote the words of Trousseau in their application to this very subject: "It is here more than anywhere else that the physician under the guidance of his inspirations is obliged to feel his way along in the search for indications, which vary according to cases, according to individuals, and which in the same individual are susceptible of variation from one minute to another."†

I shall now complete the study of the dyspepsias in acquainting you with an interesting functional malady which you will often observe, and concerning which families will often claim of you the most minute directions. I refer to the dyspepsia of young infants.

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* See Clinical Therapeutics, Am. Ed., part I.

† Clinical Medicine, t. II., p. 341—1862.

NOTES TO LECTURE XIV.

[1] See the work of Cornillon on the relations of the dyspepsias to constitutional diseases.

Pidoux is inclined to think every chronic undetermined disease which cannot be included in arthritism, scrofula, or syphilis, as herpetic. This herpetic diathesis, according to him, is the cause of fifteen dyspepsias out of every twenty. He gives these as the principal signs of this diathesis: "If there be no crusted tetter, there will at least be likely to be a furfuraceous desquamation of the hairy scalp, look for a sebaceous oozing from the sulcus hidden behind the rim of the ear; the free border of the eyelids is the color of lean bacon; the skin is irritable, dry, harsh, easily becomes puriginous; there are (in females) habitually itchings about the vulva; there is a *prurigo podicis* and an alopecia which are foreign to other diseases of long standing. Give attention to the frequent colds, the dry and habitual cough; examine the throat especially." *

[2] This is the hygienic treatment recommended by Bouchardat in polyuria due to uric acid, gravel, and gout. For diet, he advises to abstain from substances like garden rhubarb (containing oxalic acid) and tomatoes; to use meat sparingly, and to choose fish and shell fish. The vegetables of the season may make a part of the daily fare. Ordinary radishes, the black radish, water cresses and salads are indicated. He forbids the usage of alcohols, and recommends to drink every day a quart of water in which is dissolved a teaspoonful or two of Rochelle salts. As for the excretions, he recommends the patient to go regularly every day to the stool, and empty the bladder every six hours at least. Finally, he recommends exercise, and attention to the skin; every week a bath composed of the following ingredients should be taken; carbonate of potassa 100 grammes, spts. lavender 2 grammes, benzoated tincture of vanilla 5 grammes;—to be added to the water of a bath. Frictions and massage should be practiced after the bath. †

[3] According to Alriq, the waters of Aulus, besides their laxative action, have an excitant effect on the ganglionic nervous system; they also regulate the circulation of the vena portæ, and surprisingly benefit atonic dyspepsia with constipation. ‡

[4] Writers have long given attention to the nervous troubles of gastric origin. Cullen was one of the first to mention the "vapors" which so frequently accompany dyspepsia. Barras also insisted on the sympathy which exists between the stomach and the brain, and on the bond which unites hypochondriasis to gastric disorders. Chomel put in clear light the fact that in certain cases of dyspepsia the sympathetic affections assume such a preponderance that the patient dwells on them exclusively, leaving one side the digestive disorders.

Trousseau dwelt particularly on the vertigo of dyspeptics, to which he

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* Soc. d. Hydrologiè, t. xii., p. 242.

† Bull. de Thér., t. xci., p. 498.

‡ Annales de la Soc. d'Hydrologié Médicale, t. xxiv., 1878.

gave the name of *vertigo a stomaco læso*, a vertigo which Wepfer had mentioned under the name of *vertigo per consensum ventriculi*.

Beau has given a very complete description of all these nervous troubles. He describes a gastric dyspnœa, and a gastric cough. He considers intercostal neuralgia and dorso-intercostal neuralgia as a reflex pain, having its starting point in the nerves of a disordered stomach. Finally, he has given the picture of a form of dyspepsia with neuropathic predominance, and which produces hypochondriasis, hysteria, and even insanity.

Lasègue has also dwelt on the neuroses of dyspeptics. Leven also as described all this pathological aggregate under the name of cerebro-gastric disease. Rueff has summed up all these facts in his inaugural thesis.*

* The nervous symptoms which originate in dyspepsia are multiple, and pertain successively to sensibility, motility, the cerebral faculties, and the functions of the other viscera.

The troubles of sensibility are very complex; there have been noted intercostal neuralgia, pains of greater or less severity running up or down the spine, cephalalgia, and hyperæsthesia of the skin and muscles.

The disorders of motility are much more rare, nevertheless there have been noticed real convulsions, and formications in the extremities.

Do not forget, however, *a propos* of all these phenomena, that often it is the commencement of disease of the spinal cord, and that in these cases the dyspepsia, instead of being primary is only secondary.

The cerebral troubles are characterized by vertiginous attacks of gyratory form, and which Blondeau has divided into several classes, and in particular into vertigo from want of food (*vertigines ab inedia*), and vertigo from too much food (*vertigines à crapula*). The other cerebral troubles pertain to intellectual modifications of which hypochondriasis is the most perfect type. On the part of the viscera, there have been noted palpitations of the heart, and a retardation in the energy of the heart's contractions. Potain has, moreover, dwelt recently on these cardiac disturbances of gastric origin. Dyspnœa and cough have also been mentioned. Leven has endeavored to prove a constant relation between the cerebrum and solar plexus. He maintains that the impressions of the brain are all sent to the solar plexus and reciprocally, that the nervous impressions of the viscera, sent to the plexus, are transmitted to the brain. The intellectual life and the vegetative life interpenetrate each other, and cannot be separated as Bichat thought.†

* Heberden, Wichmann, Butter, Macqueen, have pointed out the relations between angina pectoris and stomach disorders. Potain and Barié have also dwelt on the characters of these anginas of gastric origin. These, according to Huchard, are the symptoms proper to these anginas:

1. This angina pertains to all ages and all sexes.
2. The paroxysms are less violent than in true angina pectoris; their

* Rueff, Study of Nervous Trouble of Gastric Origin, Paris 1880. Leven, on Cerebro-Gastric Disease, Soc. de Biol., Oct. 1881. Beau, Treatise on Dyspepsia, 1866. Trousseau, Clin. Méd., t. iii., p. 42.

† Blondeau, On Stomachal vertigo, 1858. Laboulbene, On Visceral Neuralgias, 1860. Leven, Stomach and Brain., 1884. Barras, Treatise on Gastralgias and Enteralgias, 1827. Chomel, on Dyspepsias, 1857, etc.

duration is longer; they burst forth often after a full meal, or even simply after the ingestion of a few mouthfuls.

3. The pain is just in front of the heart, and not in the sternum; it consists in a sensation of distension of the thorax rather than one of constriction and compression; its duration is longer by a quarter of an hour or half an hour, or even more.

4. When the paroxysm comes on after a meal, which is the rule, the patients experience a difficulty in breathing, they have anhelation rather than dyspnœa. (Barié). They feel a painful sensation in the epigastrium, then the oppression augments, the pulse is small, the extremities are cold, and an agonizing pain sets in, accompanied by a marked syncopal state. This form of angina is then characterized by the production of pulmonary and cardiac distress, by the existence of a sort of dyspnœa or anhelation which often accompanies the painful crises.

5. One often observes signs of reverberation of the gastric affection upon the heart (palpitations, intermittences, lipothymias, asystolic symptoms, etc.), with or without augmentation of the precordial dulness, especially in a transverse direction, existence of a right-sided *bruit de galop* and of a tricuspid insufficiency more or less enduring, accentuation of the second pulmonary bruit, etc.

6. In pseudo anginal attacks, even those of the greatest severity, recovery is the rule, and death is the exception.

The mechanism of these anginas of gastric origin according to Potain, is as follows:

The reflex excitation, which may have its point of departure in the liver, in the intestine, oftener in the stomach, determines an exaggerated contraction of the pulmonary vessels, and an elevation of tension in these vessels, from whence proceeds a certain obstacle in the circulation of the right heart and a consecutive dilatation of the right cavities of the heart.*

* Barié On the Cardio Pulmonary Accidents Consecutive to Gastro Hepatic Disorders, (Rev. de Méd., p. 1 and 117, 1883). Huchard, On Angina Pectoris and the False Angina, (Revue de Médecine, 1883).

LECTURE XV.

THE DYSPEPSIA OF NEW-BORN INFANTS.

SUMMARY.—Dyspepsia of the Newly Born—Athrepsia—The Milk of the Human Female—Its Composition—Its Variations—Means of Determining the Value of Milk—Lactometer—Examination of the Nursing Woman—State of Health or Disease of the Nursing Woman—Influence on the Milk—How Often Should a Baby be Nursed—Artificial Lactation—Goat's and Cow's Milk—The Nursing Bottle—Oatmeal—Weaning—Hygienic Rules of the Newly Born—Constipation—Diarrhœa—Employment of Phosphate of Lime.

THE dyspepsia of new born infants, which is the subject of this chapter, is a subject of great importance, and deserves to be treated with considerable detail. Every day you see in the infant department of our hospital, (Ward Sainte Marie) varied examples of the functional disorders of the stomach in young infants.

The infant at its birth and during a few following months may be regarded as a digestive tube served by organs, and yet this digestive tube is imperfect and in process of formation. Fitted to assimilate only one kind of food, milk, the alimentary canal is completed as the infant grows, and in proportion also a more substantial nourishment becomes necessitated for the development of the young being.

Milk then is the exclusive food of the babe; it meets all the requirements of its organism, and promotes the normal development. In order, however, that this evolution shall go on regularly, it is necessary that all the hygienic rules shall be rigorously observed, for any departure from these laws entails not only functional troubles, as in the adult, but also grave disorders. To dyspepsia, simple modification of the functions of the digestive tube, succeed alterations of the tissues, at first curable, then becoming incurable; it is then that you see unfolded that symptomatic aggregate of which Parrot has traced the description with the hand of a master; I refer to athrepsia. We shall concern ourselves here with only the first period of this state, with the prologue so to speak, of that pathological drama which so fatally entails the death of the little being.

We shall, then, study these functional troubles of the stomach from a therapeutic stand-point, while fully recognizing the fact that it is often difficult to distinguish the simple functional disturbances from the more advanced lesions of the gastric and intestinal mucosa, and to separate, for example, dyspepsia properly so called, from the catarrhal gastritis described by Parrot. The one, in fact, entails the other, and it is sometimes impossible to say when the dyspepsia ceases, and at what time commences the alteration of the mucosa.

How do the dyspeptic troubles of the new born infant manifest themselves? First by symptoms more marked on the part of the intestines than of the stomach, and this is readily understood when you think how rapidly the milk passes from the stomach into the intestine, and of its more prolonged sojourn in the latter; we shall then have to note the signs which characterize intestinal dyspepsia. Our colleague Jules Simon has given a good description of this symptomatic aggregate.*

The infant, after taking the breast, suffers colicky pains in its bowels, it cries, its features are wrinkled, the belly is slightly distended, and painful to pressure; there are borborygmi, and the peristaltic movements of the intestines are exaggerated. If at this moment you examine the passages, you will see that they have lost that golden yellow color, and that consistency which characterize the fæcal discharges of infants in good health; they are grumous and present white masses of undigested caseine, which gives them the aspect of scrambled eggs; slightly fetid gases also escape.

At a more advanced stage the infant becomes fretful, no longer sleeps quietly, starting out from its disturbed slumbers with outcries; it constantly seeks the breast; then ensue vomitings of curdled milk and eructations of wind. This condition may last for some time, and if not relieved by suitable treatment, another order of symptoms appears. There is now fever, the stools become abundant and green, the infant emaciates, and you now observe the characteristic signs of inflammation of the digestive tube; you have before you the beginning of athrepsia.

With what remedial agents are you to oppose these morbid symptoms? It is to hygiene that you are to look for remedies. There are hardly any medicines for the new born infant, and apart from a few mild revulsives, and inert powders, drugs have an action rather injurious than useful in the affections of early infancy. Be then reserved in the employment of pharmaceutical means in the treatment of these infantile diseases; address yourselves to hygiene, and abandon almost altogether the active medications, which often have a disastrous effect in these cases. Let us now take up the hygiene of the new born infant, and particularly alimentary hygiene.

Milk here plays the principal and I may say the only part, as we have already seen, and almost all the functional troubles of digestion in infants result from the fact that milk is either insufficiently or with difficulty

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* Jules Simon, Dyspepsia of the New-born Infant, Union Méd., 1876. Parrot, Athrepsia of the Newly Born, Paris, 1875.

appropriated. Hence we will first take up the study of milk, and I need hardly tell you that with respect to its mode of nutrition, the infant appears before you under one of three conditions; either it is nursed by its mother, or by a wet nurse, or it is bottle fed. The first two states may be considered together under the head of natural lactation.

Woman's milk in the normal state presents the following characters: it is bluish, slightly opaline; mixed with a small quantity of water it assumes a peculiar faint blue tint; it is inodorous, of slightly sweetish taste; its reaction is alkaline. Heat does not coagulate milk, and if you add rennet, you obtain a very incomplete coagulation of casein. If you analyze this liquid, as many chemists have done (particularly Simon, Becquerel, Vernois, Filhol, Joly, and Henri Fèry) you will find that it contains butter, sugar of milk, casein, water and salts.

According to the recent analyses of Henri Fèry made at the Experimental Nursery of the Hôpital Enfants Assistés, the composition of one thousand parts of milk, density 1,03350, is as follows:

Water, ...	873.02
Casein, ...	17.05
Butter, ...	36.79
Sugar of milk, ...	71.10
Salts, ...	2.04
	1,000,00

But, as Charles Marchand has remarked, numerous variations may arise, constituted by a diminution in the quantity of some one of the principal elements of the milk, and we may say with reference to this point that when, with all the elements of the milk remaining the same, there is seen to be an increase in the quantity of the butter, or the sugar, the milk still preserves its nourishing qualities, and children reared on it are generally healthy.[1]

It is not the same when there is augmentation of casein; in this case the increase of the casein leads to a failure of absorption by the digestive tube, which generally renders the milk badly supported. One can readily understand that *vice versa*, milks with a deficiency of butter or of lactose are nutritively insufficient, while those which contain casein in moderation are well tolerated.

On what do these modifications in the nature of the lacteal secretion depend? They result from several circumstances, which we shall take up when we come to consider the condition of the mother or wet nurse. But first we should inquire by what signs you are to determine the goodness of a nursing woman's milk? You can test the milk by the densimeter of Bouchardat and Quevenne, or with the lacto-butyrometer of Marchand, or the lactoscope of Donné, or by Adam's or Esbach's process. You can also adopt the means recommended by Bouchut; we refer to the enu-

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meration of the fat globules which the butter contains. All these means are inferior, however, to that unique test of the nutritive value of the milk under consideration, which test is the infant itself.[2]

But in order to judge whether the infant is thriving or not, it will not do to depend on the eye alone, you must refer to a more impartial criterion, to the scales, which best indicate the daily gain or loss, and the sanitary state of the little being. Natalis Guillot ("On Nursing Women and Nurslings," Union Méd., 1852) has rendered a signal service to the study of the development of the infant, in recommending daily weighing as a part of the medical supervision of the newly born. Bouchaud, Louis Odier of Geneva and René Blache have also shown all the advantages which may be derived from this method of weighings.[3]

Therefore, gentlemen, do not forget to adopt this practice; require that the infant shall be weighed every week, and let this be done by some one whom you can trust; insist that the weight shall be carefully recorded, and whenever the child ceases to gain from twenty to twenty-five grammes a day, be persuaded that some disturbing element has interfered with the natural rate of growth; ply then your interrogatories and your endeavors till you have found the cause of this loss, whether it be in the infant or in the wet nurse, or in some extraneous circumstance.

Besides the condition of the infant, which is the best means of judging respecting the nutritive value of the milk, there are several external signs which may guide in choice of a wet nurse. It is said that the wet nurse should be of dark complexion, twenty to thirty years of age, and that her teeth should be sound; these are conditions more theoretical than practical, and Coudereau* has shown that if one were to judge by the test of the nursling alone, the finest specimens belong to women thirty to forty years old, who are blonde, and have carious teeth, or none at all. Therefore, gentlemen, while giving due weight to circumstances connected with the general health of the wet nurse, your criterion of her qualification must be the state of the infant reared on her milk.

The condition of the mammæ, moreover, has some importance; it is essential that the nipples shall be well formed, that the skin shall be fine and marked out with numerous veins, and that the development of the mammæ shall be constituted by the gland alone. Finally, there is a last question deserving of consideration, namely, the relation between the age of the infant and the age of the milk. It is best to have the two as near together as possible; at the same time, it will not do to attach too much importance to this matter, for sometimes very young infants will thrive well on the milk of a nurse whose period of parturition is long past.

And just here it is well to remark, that at the commencement of lactation the milk contains colostrum and albumen, and that these elements

*Alimentary Hygiene of the Infant, 1877.

render the milk purgative, a condition which favors clearance of the digestive tube in the new born babe.

The food of the wet nurse has a marked importance on the composition of the milk, and just as we see cows produce butter of different qualities according to the pastures where they feed, likewise nursing women give milk of variable quality according to their food. When the diet is too azotized, the milk is charged with casein and becomes indigestible; if the alimentation be insufficient, the milk diminishes in quantity and the infant pines away.

But another point to which I wish particularly to call your attention, is the deplorable effect produced on the infant by alcohol when taken by the wet nurse; many cases of convulsions, whose explanation was a mystery, have resulted from the intemperate use of alcoholic stimulants by wet nurses. Disease, like diet, influences the quality of the milk; Becquerel and Vernois on analyzing the milk of women suffering from fever, have shown that there is a fall in the proportion of the butter, and a diminution in the quantity of liquid, and this even to the point of a drying up of the lacteal secretion.[4]

There is a final circumstance of a physiological character which ought to attract your attention, I allude to menstruation and pregnancy. A nursing woman often sees her menses return, and some have thought that in such cases she ought to cease nursing her child; I do not think so, for with the exception of trifling colicky pains in the infant at the appearance of the menses, generally this change passes unperceived, and I have seen fine nurslings reared by women that were regular in their monthly periods.

Pregnancy also modifies the quality and diminishes the nutritive value of the milk, and without saying absolutely that the milk of a pregnant woman is baneful to the infant, it should be borne in mind that it no longer suffices for nutrition, and for this very reason a woman who finds herself with child should leave off nursing her babe.

Frequency of lactation, also modifies the nature of the milk, hence it has long been the custom to regulate and limit the periods of suckling; it has been said that during the day the babe should be suckled every two hours, while during the night the intervals should be longer. I think, however, that it is not well to be too rigorous on this point, for the infant itself indicates by its cries the need which it has of taking nourishment.[5]

It must, however, be remembered that some infants manifest great voracity, and are subject to indigestion by reason of the too great quantity of milk which they ingest; this would necessitate a careful regulation of the periods of lactation.

But, gentlemen, the infant is not always fortunate enough to have a wet nurse, or the milk of its mother, or wet nurse may be insufficient, and one is obliged to have recourse to artificial lactation. It is here that we come to the most fruitful causes of infantile dyspepsia, and the majority of infants with large bellies, emaciated limbs, pinched features, whom you see in our nursling hospitals are bottle-fed babies. Their disease, (and very often their death) results from the ignorance and infatuation of their mothers, who persist in giving them too highly azotized and rich food—food not suited to the undeveloped state of their digestive tube. Wine is often given to babes in the early months, and no practice can be more baneful or more contrary to sound hygiene. Hence there is no subject more worthy of careful attention and study than this of artificial lactation.

What milk ought to be chosen? This question seems to-day pretty well solved, thanks to the experiments made by Parrot at the experimental nursery established at the Hôpital Des Enfants Assistés. After having made a comparative trial of the milk of the cow, the goat, the bitch, and the ass, it was found that the latter is the best adapted to the alimentation of the young infant, and Tarnier has given the weight of his authority and practice to this doctrine.

But it must be admitted that this result is rather theoretical than practical, for Parrot insists that the infant shall obtain its milk directly from the teat of the ass, which can only be realized in exceptional cases. I know that Tarnier proposes to administer this milk from a cup or spoon, but even in this case we find ourselves in presence of another difficulty which is the high price of the milk (6 or 7 francs per quart), which must greatly restrict its usage. We are then obliged to fall back on the milk which is the most available, and the most in use, that of the cow. Goat's milk has indeed been recommended, but we have no very accurate data respecting the employ of this milk in rearing children, and while recognizing that the goat acommodates itself better than the ass to the conditions of living in our cities, its milk is as rich in casein as that of the cow, and for that reason presents the same disadvantages. We are then obliged in most cases to use cow's milk and to render it as digestible as possible for the young infant; this end is in a measure attained by diluting it with water and sweetening it. To fulfill the latter indication, you can use ordinary sugar, or what is better, sugar of milk, which can now be bought at a sufficiently cheap rate.[*]

As for the amount of the dilution required, all depends on the richness of the milk. If you have a milk that is quite pure, you ought to dilute it with twice as much water; if, on the contrary, you have a milk of which the source and quality are doubtful, and which may have already undergone more than a sufficient watering, you can give it pure; and this is what I recommend to poor women who come to consult me at the hospital with their nursing bottles filled with a bluish white, dirty liquid, looking wholly unlike milk, and the result of a mixture of cow's milk with water gruel, toast water, or some other vile slop, and the consequence of which, on the infant is deplorable enough.'

But do not forget, while considering this great question of the artificial alimentation of infants, that it is not enough to say that one kind of milk is superior to another kind, but it is equally important that the food of the animals that furnish the milk shall not have undergone too great modification, and it is this difference in the feed of animals which explains the difference in the results obtained, and in the analyses made by different chemists.

What quantity of milk ought the infant to take? This is an important point which has been made clear by Parrot's investigations. The babe should take during the first month, 300 grammes (10 ounces) of milk per day; during the second, third, fourth, and fifth months, 600 grammes (20 ounces) per day, and during the other months 800 grammes ($26\frac{2}{3}$ ounces); and to this milk the following quantities of sugar should be added; for the first month 30 grammes (1 ounce) per day; for the second, third, fourth, and fifth, 40 grammes ($1\frac{1}{3}$ ounces) and for the others 50 grammes ($1\frac{2}{3}$ ounces.)

The milk is generally given from the nursing bottle, and there has been a great deal of discussion as to the best kind. The best, because the simplest, and the cheapest, is that sold under the name of the *English nursing bottle.* It consists of a flask-shaped bottle with a stopper through which a glass tube passes, dipping into the milk at one end, while to the other is fitted a rubber tube terminated by a nipple.[a]

With regard to the advisability of using this little utensil, everything depends on the care which is taken to keep it clean. It is of course understood that the milk must be of an even temperature, but this point does not present much difficulty. So hard is it to ensure perfect cleanliness and an aseptic condition of the nursing bottle, that Tarnier discards it altogether, ordering that infants under his charge shall be fed with cup and spoon. If it were a matter which concerned solely our nursling hospitals, I should be fully in sympathy with my colleague of the Maternity, for as you may see every day by the careful inspection which I make of the "biberons" in our wards, I am unable, especially in the summer time, to enforce the desired cleanliness of these bottles. But this is not the case in many families where due attention can be paid to matters of this kind.

An important point in the nurture of the young child is to know just when to modify the milk diet by the addition of other articles of food. Here you have for guide the appearance of the teeth,[a] as their evolution follows the development of the digestive tube, and in proportion, as the teeth appear, the functions of the digestive tube are completed. It is generally at the end of the sixth month that you can begin to introduce into the dietary of the infant such starchy substances as arrowroot, biscuits, bread crusts or gingerbread, which you can give in water or milk slightly salted or sweetened. You can also make use of the malt flour preparations of Miahle and Liebig, as well as a farinaceous combination which has been proposed by Husson.[10]

In a work undertaken in conjunction with E. Hardy, I have shown the advantages of oatmeal as an article of diet, a cereal very much employed in the alimentation of infants and adults in Scotland, and of which the usage is general in England. The mode of preparation is very simple; a couple of teaspoonfuls of oatmeal is allowed to soak an hour or two in half a pint of water; it is then cooked after being sweetened and salted; you obtain thus a rather thin gruel which may be fed to the baby with a spoon.[11]

You can also make use of gruel made from any other meal, taking care to employ as little as possible of fatty substances in its preparation. It may in fact be said that in the infant the function of the pancreas, as far as concerns the absorption of fats, is not developed till a later period. Finally comes the epoch of weaning, fixed especially by the appearance of the other teeth, and in particular, by the canines; an epoch at which the diet may be more varied.

Do not forget, moreover, that it diet plays a considerable part in the development and cure of the dyspepsias of the young child, the other hygienic rules have also their importance. The care of the skin, in regard to cleanliness, and above all, atmospheric conditions have a dominant influence on the health of the little one.[12]

Observe what takes place in our infant department when necessity compels us to increase the number of beds in those unfortunately, too insalubrious wards. We see the little foundlings at once attacked with colicky pains and presenting intestinal troubles, the result of over crowding; vitiated and unwholesome air has in fact a predominant action in the production of dyspepsia. The young infant needs the open air, sunshine, a large and well ventilated apartment, in a word, the main advantages of country residence. This is what explains the difference between the country and city nursling; the one has a good appearance, rosy complexion, firm and resisting muscles; the other is stunted, lean, and delicate. You should then insist on great pains being taken to renew the air in apartments which are occupied by infants in the cradle.

If I have dwelt at some length on this subject of the alimentation of the young child, it is because it is necessary in combating the dyspepsia of early life to understand well the hygiene of infancy, and if you are called upon to treat the functional troubles of the digestion of a babe at the breast, your first care will be to pass in review all the dietetic circumstances which have an influence on the development of these affections, and in such minute interrogation you will find the cause of the evil and its remedy.

I ought, however, to indicate to you certain minor pharmaceutical means. First of all I would recommend the use of magnesia, which is good to combat the constipation of dyspeptic infants, and you know that the infant who has but one stool a day is constipated; two or three stools (at least) in the twenty-four hours is the regular rule. Henry's magnesia is a good preparation and may be given in the dose of a dessert spoonful.

If there is diarrhœa, you can give him lime water with milk, inert powders such as subnitrate of bismuth and chalk, or you may try to advantage the preparation of René Blache, which consists in giving to the infant a teaspoonful of castor oil with a little syrup of gum arabic.

When there is vomiting with too speedy coagulation of the milk, give a tablespoonful of Vichy water every time the child is fed. Such is the treatment of dyspepsia from a pharmaceutical point of view; it is of very little importance as compared with the hygienic treatment.

I must not finish this topic of the medication of early infancy without saying to you a few words concerning the preparations of phosphate of lime, preparations which are manifold; the lacto-phosphate, the acid-phosphate, the chlor-hydro-phosphate, etc. All have for their basis, as you know, a soluble salt of lime, and which is soluble only on condition of being acid.

These phosphates have been much vaunted, and they are of extensive usage. It has been believed, especially since the labors of Dusart, that they might be beneficial by supplying to the growing organism phosphate of lime, so necessary to the bony tissue of the young child.

I am compelled to believe that this is a mistake; the experiments made in Germany, and more recently in France, by Chery-Lestage, and the observations of Sanson and Caulet, enable us to affirm that phosphate of lime, whether introduced in an insoluble state, as the tribasic phosphate, or in a soluble state, as the acid phosphate, does not fix itself in the economy, and passes off in the fæcal matters or in the urine. In this regard the experiments of Heiden of Pommeritz are decisive, despite the more recent observations of Dusart, which in my judgment, have not invalidated those of the German savant.

If you wish to introduce phosphate of lime into the economy of the young child, it will not do to rely on the pharmaceutical preparations, but you should select that form which nature has already assimilated, in making it a component of the vegetable kingdom. Hence the cereals which contain the phosphate in greater or less quantity, bran bread, certain legumes, have a favorable influence on the development of the young infant.[13]

But, you will say, the acid phosphates have often a happy action, and we continually see beneficial results from their use. These facts, gentlemen, are not due to the penetration of phosphate of lime into the economy, but to the fact that these acid phosphates on the one hand may have introduced into the stomach an element useful for digestion, hydrochloric or lactic acid, and on the other, to the circumstance that when once these acid preparations are neutralized in the intestine, there is a precipitate of insoluble calcic phosphate, which in its turn tends to diminish intestinal irritation.

Such, gentlemen, are the brief observations which I wished to make relative to the dyspepsia of new born infants; and with this I conclude what I have to say respecting the functional troubles of the stomach. In the next chapter I shall treat of the therapeutics of ulcer and cancer of the stomach.

NOTES TO LECTURE XV.

[1] Charles Marchand, a pharmacist of Fécamp, has published a very interesting memoir upon the abnormalities of milk and their influence on the nursing child. He divides the milks which he calls abnormal into two classes; those abnormal by excess, and those abnormal by inferiority of one of the lacteal principles, all the others being in proper proportion.

(1.) *Milks abnormal by excess.*—A milk which has a proportion of butter higher than 36 per 1000, ordinarily gives good results, and ought to be recommended; but it is not so if the quantity of butter be greatly in excess of that figure, especially when the lactose does not follow the same rate of increase. Marchand has in fact seen children pine away on a milk presenting all the characters of a good article save in respect to the butter, the proportion of which was above 52 per 1000.

An excess of lactose does not seem to have an injurious influence, but this is not the case with the protein matters, an excess of which may cause gastro-intestinal troubles; hence one should supervise and regulate the alimentation of the wet nurse, which should be sufficiently abundant and composed of a proper admixture of azotized and starchy substances. In fact an alimentation very rich in protein matters furnishes a milk likewise rich in plastic elements, while a regimen in which starches predominate, furnishes a milk richer in butter and in lactose.

Marchand also notes the influence of the age of the milk; the albuminoid matters augmenting according to the needs of the nursling. He thinks that for an infant just born, a milk several months old is an indigestible aliment, provoking vomiting and greenish stools; these ill effects may be obviated by giving one or two teaspoonfuls of pure water with a little bicarbonate of soda, which the infant is made to take after each meal.

(2.) *Milks abnormal by inferiority.*—A milk which contains less than 30 parts per 1000 of butter ought to be rejected. In a case where the butter did not attain the figure of 24.12 per 1000, Marchand was able to supply the deficiency and keep the child in good condition by giving it daily a dessertspoonful of cream in a little sweetened water. A diminution of lactose, which is met most frequently during gestation, or in the course of uterine diseases, is a bad deficiency, which can, however, be remedied by giving the infant after each meal a teaspoonful of sweetened water. The lack of salts, and especially phosphate of lime, may be remedied by giving the latter salt in substance, which is easily assimilable and does not fatigue the stomach.

Finally there are milks so abnormal that they must be utterly discarded, and recourse (in default of a suitable wet nurse) must be had to artificial lactation. Such is the milk of which Marchand gives the following analysis; it was taken from a woman 33 years of age, blonde, of short stature, of firm health, but who had never been able to rear on her own milk any of her eight children. Under A we give the analysis, which may be contrasted with the normal constitution of human milk as given under B.

	A	B
Butter, ...	12.73	36.79
Lactose, ...	76.27	71.10
Protein matters, ...	3.82	17.05
Salts, ...	2.22	2.04
Water, ...	904.96	873.02
	1,000	1,000

WURTZ'S TABLE. COMPOSITION OF 100 PARTS OF WOMAN'S MILK.

Chemists.	Density.	Dry residue.	Casein.	Butter.	Sugar.	Extractive matter and salts.	Observations.
GENERAL MEAN.....	1.0315	12.3	1.9	4.5	5.3	0.18	
Simon..........	1.030	11.62	1.96	3.14	5.76	0.166	Woman A. One month after delivery.
Ibid............	1.030	11.64	2.2	2.64	5.2	0.178	The same, 45 days after delivery.
Ibid............	1.032	13.04	4.52	2.74	3.92	0.287	The same, 3 months after delivery.
Ibid............	1.034	8.6	3.55	0.8	3.95	0.24	The same, 8 days after—(suffering from inanition.)
Ibid............	1.033	11.94	3.7	3.4	4.54	0.25	The same, after 8 days.
Ibid............	1.034	13.86	3.1	5.4	5.2	0.235	The same, after 8 days.
E. Marchand....	"	11.44	0.63	3.287	7.35	0.158	Mixed diet.
Becquerel .... } Vernois ...... }	1.0326	1.09	3.92	2.67	4.36	0.138	Mean of a number of analyses.
Doyeres........	"	15.68	1.53	7.07	6.9	0.18	" " " "
Ibid............	"	16.27	1.18	7.45	7.5	0.16	" " " "
Filhol........ } Joly.......... }	"	12.06	1.5	3.05	6.66	0.85	Wet nurse thirty years of age, Milk of the 24th day. Meagre nourishment,
Ibid............	"	16.24	0.89	7.35	7.15	0.95	The same. Milk at 2½ months.
Ibid............	1.030	12.45	0.85	4.1	6.9	0.8	Ibid.
Ibid............	"	14.44	0.85	6.0	6.8	0.79	Ibid. Milk of fourth month.
Ibid............	1.031	11.39	0.85	4.75	4.85	0.94	Ibid. Milk of tenth month.
Ibid............	1.025	18.3	9.0	6.15	1.27	1.88	Woman having milk, but not nursing; 28 years old; brunette.
			Albumen.				
Ibid............	"	10.50	1.0	2.7	6.0	0.8	Lymphatic sanguine temperament. Milk of the second month.
Ibid............	"	15.53	2.05	6.8	5.89	0.78	Brunette. Milk of the second year.

[1] The densimeter, or lacto-densimeter of Bouchardat and Quevenne, is an arcometer which has three scales on its stem; one median, on which are inscribed the densities comprised between 1016 and 1045; two lateral,

the one colored yellow for pure milk, the other blue for skimmed milk. The instrument being graduated for the temperature of +15°, to employ it you must either reduce the temperature of the milk to +15° or consult for the corrections of temperature, the tables of corrections given by Bouchardat and Quevenne.

You use this instrument as you would an ordinary aerometer; dipping it into the liquid to be examined, you observe the level of the liquid on the stem, and read off the figures that correspond, by this you judge of its specific gravity as compared with pure milk.

It is necessary to bear in mind that the density of pure milk oscillates between 1029 and 1033, and that every tenth part of water added, diminishes the density of the fluid by 3°.

The following table, according to Bouchardat and Quevenne, gives the proportions of butter and cream in milks of different density, as tested by the scale of the lactoscope.

Degrees on the scale of the lactoscope.	Approximate weight of butter per litre.	Percentage of cream.	Degrees on the scale of the lactoscope.	Approximate weight of butter per litre.	Percentage of cream.
25	40	12	39	26	8
27	39	12	40	25.50	8
28	38	12	41	25	7
29	37	11	42	24.50	7
30	36	11	43	24	7
31	35	11	44	23.50	7
32	34	10	45	22	6
33	33	10	46	22.50	6
34	32	10	47	21.50	6
35	30	9	48	21	6
36	29	9	49	20.50	6
37	28	9	50	20	6
38	27	8			

Woman's milk, if it is very rich, marks 20 to 25 degrees; cow's milk, if it is good, 30 to 35 degrees; if it is bad 40 degrees and more.

The *lacto-butyrometer* of Marchand consists of a cylindrical tube divided by three lines into three parts of ten cubic centimetres of capacity; the part nearest the opening is divided into ten parts, representing the degrees of the apparatus.

To use the apparatus, you fill the tube of the instrument one third full with the milk to be examined; you then add two drops of liquor sodæ; then after having agitated it, you pour in ether up to the second third, then alcohol at 86° to fill the remaining third. You then agitate the mixture and let it rest in a vessel full of water at 40° C.; the butter then forms an oleaginous layer on the upper part and occupies a certain number of degrees marked on the tube. In order to ascertain the quantity of butter (P) contained in a litre of milk, you employ the formula given by Marchand; P= 12.60 grammes + $n \times$ 2.33 grammes. 12.60 represents the quantity of butter corresponding to that which dissolves in the alcohol and ether employed; n is the number of divisions which the fat globules occupy; 2.33 represents the quantity in grammes of butter existing in each degree of the graduated tube.

The lactoscope of Donné is a little instrument resembling somewhat an opera glass. [The working of this apparatus is not easy of explanation without suitable cuts, and as it is not used in this country, the description of the original is omitted. For a similar reason, Adam's method is also omitted. The principal methods in use in this country may be found described in Ziemssen's Cyclopædia, vol. xix., p. 366. An ordinary hydrometer answers a very good purpose. The hydrometers in use are graduated according to various plans. The one which has been found most convenient is a simple spindle, about fifteen centimetres long. The stem of this is graduated from 0 to 40°, 0° representing pure water, and 40° representing the specific gravity, 10.40. This range is sufficient for all uses, and the instrument is readily carried in the pocket, and is so short that it floats in an ordinary quart measure. This instrument is of especial use in testing cow's milk. Any milk that stands above 33° is pretty sure to be skimmed, while that which falls below 29° is equally sure to be watered. The creamometer is a much more complicated instrument.]

Bouchut's mode of enumeration of globules is quite practicable where one has a good microscope. The description is condensed from the author's note. "M. Nachet," says M. Bouchut, "has made for me on a glass slide some cells, a tenth of a millimetre in depth. I take up a drop of milk with the graduated dropping tube of Limousin and dilute it with 100 drops of distilled water. This gives me a liquid with a density of 1030; the milk globules readily rise to the top. A drop of this 1 per cent. lacteal solution is put on the glass slide in the cells.

"The eye-piece micrometer contains on its distal lens a tracing similar to that used in the enumeration of blood globules; it projects on the glass slide the image of a quadrilateral with sides $\frac{1}{5}$ millimetre; this quadrilateral is divided into four squares. The number of globules in each square is easily counted, an average is taken, and this is multiplied by 1000 (the cube of 10, the cells being $\frac{1}{10}$ millimetre in depth) then by 100, since the liquid is a 1 per cent. dilution.

"Therefore, if 92 be the number of globules found in a square, the calculation such as I have indicated, gives 2,427,000 for the number of globules of milk in 1 cubic millimetre of milk. By this process I have counted the milk globules in 158 wet nurses.

"In my observations I have made account of the age of the wet nurse and of her milk; I have established certain categories for milk taken before nursing. These are the principal results:

Five times the globules have been from				200,000 to 400,000
Fourteen	"	"	"	400,000 to 600,000
Twenty	"	"	"	600,000 to 800,000
Twenty-four	"	"	"	800,000 to 1,000,000
Sixty-six	"	"	"	1,000,000 to 2,000,000
Twenty-seven	"	"	"	2,000,000 to 4,000,000
Twice "	"	"	"	4,000,000 to 5,000,000
158				

"These numbers comprise the large and middling sized as well as the small globules, all that it is possible to count by adjusting the tube of the microscope so as to vary the field of vision and bring into view all that are in the stratum of milk.

"Despite the diversity in the composition of the milk, and the variations in the quantity of its elements in the same nursing woman, at different epochs of the day, the numeration of the globules, made with care, and several times in the twenty-four hours, gives a medium which well represents the quality of the milk.

"Moreover, if one would investigate deeply the question, and as I have done, proceed from the number of globules to the approximative weight of the quantity of butter per litre, or even determine the approximate density, this is easy by comparing the milk of the cow with woman's milk. The following comprises my observations on cow's milk:

"Take a certain quantity of cow's milk, say 15 grammes; 1, make the exact numeration of the globules; and 2, determine the corresponding density of the milk; then 3, determine by chemical analysis the quantity in weight of butter contained in the milk submitted to analysis.

"In comparing these three kinds of results, I have drawn up a table indicating with what density and with what weight of butter per litre correspond the quantities of globules appreciable by the microscope. In this way, knowing the number of globules in a cubic millimetre of milk, I am able to tell with considerable exactness its weight in butter, and its approximate density."

Bouchut thus shows that by a careful study of the globules in one drop of milk you can come to know its density and its richness in butter. The mean of several analyses should be taken as the standard.

"The medium quantity of globules, valued according to calculations made on 158 wet nurses, is 1,026,000 per cubic millimetre, and 102,600,000,000 per litre, but between 800,000 and 1,000,000 per cubic millimetre, the milk is of good quality. There remains but to determine the quantity, and this is easily ascertained by weighing the infant before and after nursing.

[3] According to Bouchaud, the infant if weighed immediately after its birth and a few days later, is found to have lost weight, but at the end of five or six days he begins to gain, and speedily regains what he has lost. The infant ought to have gained:

At the end of the	first	month,	.	.	750	grammes.
" " "	second	"	.	.	700	"
" " "	third	"	.	.	650	"
" " "	fourth	"	.	.	600	"
" " "	fifth	"	.	.	550	"
" " "	sixth	"	.	.	500	"
" " "	seventh	"	.	.	450	"
" " "	eighth	"	.	.	400	"
" " "	ninth	"	.	.	350	"
" " "	tenth	"	.	.	300	"
" " "	eleventh	"	.	.	250	"
" " "	twelfth	"	.	.	200*	"

[4] The following according to Simon, Becquerel and Vernois † is the composition of a hundred parts of woman's milk examined during diseased states:

* Bouchaud, Thèse de Paris, 1864. René Blache and Odier, Some Considerations on the Mortality of New-born Infants, 1867.

† Becquerel and Vernois, Milk of Nursing Women in Health and Sickness, Paris, 1853.

Chemists.	Density.	Dry residue.	Casein.	Butter.	Sugar.	Extractive matter and salts.	Observations.
Simon	1.030	11.1	2.57	1.8	5.25	0.2	Female A. Violent passion; the child had convulsions; milk of the first month.
Becquerel and Vernois	1.03	11.51	5.04	2.99	3.31	1.75	Average in acute diseases.
Ibid............	1.03	11.42	3.71	3.26	4.34	1.50	Average in chronic diseases.

[5] It has been remarked that the milk first drawn is the poorest; that of the middle of the milking offers an average composition, and that of the end is more creamy. If then the intervals of suckling are too wide apart, the mamma is gorged with milk, and as the infant does not empty the breast completely, it may only remove the aqueous part, and thus have insufficient nourishment.*

[6] COMPOSITION OF 100 PARTS OF COW'S MILK.

Chemists.	Density.	Dry residue.	Casein.	Butter.	Sugar.	Extractive matter and salts.	Observations.
GENERAL MEAN.....	1.031	13.5	3.6	4.05	5.5	0.4	
Boussingault and Lebel	"	12.3	3.0	4.0	4.7	0.4	Milk of 200th day, 5 quarts a day. Fed on hay.
Ibid............	"	12.9	3.4	4.0	5.3	0.2	Same cow. Milk of 210th day, 5 quarts a day. Beets.
Ibid............	"	13.2	3.4	3.6	6.0	2.2	Same cow. Milk of 302d day, 3 quarts a day. Hay and oil cake.
Playfair........	1.034	13.5	5.4	3.7	3.8	0.6	A cow pastured in a rich field. Milked in the stable after long driving.
Ibid............	1.030	13.0	3.9	5.6	3.0	0.5	Same cow. Milk of the next morning. No exercise. No feeding.
Ibid............	1.031	14.3	4.9	5.1	3.8	0.5	Same cow. Fed in the stable. Milk of the evening.
Simon..........	1.034	14.3	7.2	4.0	2.8	0.623	
Doyere.........	"	12.4	4.2	3.2	4.3	0.7	Average of several analyses.
Poggiale	"	14.15	3.8	4.38	5.27	0.7	Mean of ten analyses.
Filhol........ Joly..........	1.027	17.39	4.25	8.25	4.75	0.144	Seven years old cow, Entire milking. Milk of sixth month.
Chevalier..... Henry........	"	13.33	4.2	3.08	3.08	0.75	Cow fed on carrots.
Ibid............	"	13.13	3.75	2.75	2.75	0.68	The same fed on beets.
Gorup-Besenez.	"	14.29	3.4	4.8	4.0	0.548	Mean of several analyses.
Marchand......	1.031	"	2.38	3.34	5.08	0.728	Average composition of the milk of a cow from Caux.

* Kobeyner, Considerations on the Suckling of New-born Infants. (Bull. de Thérap., Jan., 1879.) Grangé, On the Regulation of the Periods of Lactation (Jour. des Connaissances Médicales, Feb. 1876.)

COMPOSITION OF 100 PARTS OF ASSES' MILK.

Chemists.	Density.	Dry residue.	Casein.	Butter..	Sugar.	Extractive matter and salts.	Observations.
Doyere,....	1.033	13.54	3.99	3.15	5.6	0.8	
Quevenne ..	"	9.64	1.88	0.5	7.26	..	
Gorup-Besenez ..	"	8.976	2.018	1.256	5.702		
Filhol and Joly......	1.033	9.2	1.6	2.5	5.1	..	Fed at a stable with French hay and bran.
Ibid........	"	9.53	1.65	1.65	6.23	..	Same animal and same feed. Entire milking, 2 qts. in 24 hours.

The general average of goat's milk, according to Chevalier and Henry, is as follows: Density, 1.302; Dry residue, 12.4; Casein, 3.7; Butter, 4.2; Sugar, 4.0; Ext. matter and salts, 0.56.

[7] According to Prof. Parrot, 300 grammes (10 ounces) of milk per day for the first month; 600 grammes (20 ounces) for the 2d, 3d, 4th and 5th months; 800 (26$\frac{2}{3}$ ounces) for the 6th and following months, represent in all cases a quantity of milk which suffices for infants brought up on a bottle, it being understood that the milk be pure, and of good quality, and that if it be diluted, as many practitioners advise, a quantity of sugar shall be added in the following proportion: 30 grammes (1 ounce) for the 1st month; 40 grammes (℥ j and ʒ ijss) for the four following months, and 50 grammes (℥ j and ʒ v) after the 6th. At this period of the child's life it will do to begin to accustom it to other kinds of food, such as gruel made with milk and flour, bread pap, meat broths or stews made with lean meat, etc. These articles, if added to the infant's daily rations, should take the place of a portion of the milk, and the fare of the infant will then be composed of: milk, 700 grammes (23$\frac{1}{3}$ ounces), starch, farina, or bread, 107 grammes (3$\frac{17}{30}$ ounces), sugar, 50 (1$\frac{2}{3}$ ounces). According to Grangè, sugar should not be added to the milk of the infant. He bases himself on the experiments of Lussana, who has shown that in the infant the saliva is deprived of ferment. If sugar is used at all, preference should be given to sugar of milk, which can be absorbed without undergoing transformation.*

[8] Objections have been made to these rubber nipples; besides the inconvenience that they soon become softened, and consequently must be often changed, it has been shown that the mode of fabrication of vulcanized rubber may cause harm to the infant. In Germany, as has been remarked, some kinds of rubber material contain as much as 50 per cent. of a mixture of oxide of zinc; others 18 per cent. of carbonate of lead; and 28 per cent. of chalk. In still other preparations, the presence of arsenic has been detected. Fauvel has also detected by frequent analyses impurities in the rubber used for nursing bottles.

* Parrot, Report on the Artificial Alimentation of Infants (Union Med., 1874). Grangè, On Artificial Lactation (Jour. des Connaissances Médicales, 1879).

In a report to the French Society of Hygiene on Nursing Bottles, René Blache considers as preferable the bottle without suction tube. The glass mouthpiece may be replaced by one of pure caoutchouc. The bottle should be held in the hand while the baby is sucking.*

[9] The evolution of the first twenty teeth (milk teeth) which fall about the seventh year and are replaced by the permanent teeth, ordinarily takes place in groups, with periods of lull, and in the following order: 1, the two central incisors of the lower jaw; 2, the two upper median incisors; 3, the two upper lateral incisors; 4, the two lower lateral incisors and the four first molars; 5, the four canines; 6, the four posterior molars.

The first tooth generally appears at the age of six and one half months.

According to Trousseau, the evolution of the lower median incisors is accomplished in a space of time comprised between 1 and 10 days; the four upper incisors take from 4 to 6 weeks; the lower lateral incisors and the four first molars require one or two months more. The canines are two or three months in making their appearance, and the last molars require an equal time.†

[10] This is Liebig's formula; Make a mixture of 16 grammes of wheat flour, 16 grammes of malt flour, and 0.375 grammes of sodic bicarbonate. Add, stirring, 32 grammes of water, then 166 grammes of cow's milk. Heat at a moderate temperature, stirring constantly, till the mixture begins to thicken; remove from the fire and continue to stir for five minutes. Finally bring the whole to the boiling point, then strain through a fine sieve. You thus obtain a gruel twice as concentrated as woman's milk, which can well be given in the nursing bottle. After being boiled, it keeps well for twenty-four hours. The savor is largely that of flour and malt; children very readily take to it, and generally thrive on it. [Mellins' Food, the Imperial Granum, Liebig's, Ridge's, and Horlick's Food, are malted preparations much in use in this country. Trans.]

Husson claims wonderful results in the alimentation of infants from the following preparation: Oatmeal and arrowroot, of each 500; sago, 400; cocoa, 50; sugar, 500; precipitated phosphate of lime, 50; vanilla, 1. A tablespoonful of this preparation [which must first undergo thorough cooking] in a cup of milk, makes a very substantial meal for a twelve months' old baby.

[11] In their researches on oatmeal, Dujardin-Beaumetz and Ernest Hardy showed that this cereal has the following composition:

Water,	8.7
Fatty matters,	7.5
Starch,	64.00
Azotized matters, gluten,	11.7
Mineral matters,	1.5
Cellulose, etc., (matters not dosed)	7.6
	100

According to Liebig's method of judging the nutritive value of a food, by dividing it into plastic and respiratory elements, it is found that oatmeal contains:

Plastic elements,	10
Respiratory "	35

* René Blache, Étude sur les Biberons, 1879.

† Trousseau, Clin. Méd., Vol. III.

This proportion is nearly the same as that of woman's milk, where the two elements are represented by the following figures:

Plastic elements,	10
Respiratory "	38

Oatmeal has more iron than any other cereal. In their experiments made in Foundling Hospitals, Dujardin-Beaumetz and Hardy, and still more recently, Marie of Versailles, have obtained most satisfactory results with oatmeal as a nutrient for young infants.

[12] The following instructions to mothers and nurses, prepared by a commission of which the author was a member, have been issued by the head of the Department of Public Charitiés (administration general de l'Assistance Publique).

1. Till the appearance of the first teeth (between the 6th and 7th months), the only food of the infant should be milk; that of the mother especially, which is always preferable if she be in good condition, or contrariwise, that of a wet nurse. It is in fact very dangerous to give an infant during the first months solid food, (bread, cakes, meat, legumes and fruits).

2. The child should be given the breast every two hours (or thereabout) and less often in the night.

3. In the event of inability to provide woman's milk, the milk of the cow or goat may be substituted; this should be given warm, diluted with one fourth part pure water, and slightly sweetened. At the beginning of the fifth month the milk may be taken pure. All other liquids employed to dilute the milk (thin gruel, bread water, barley water, etc.), are injurious.

4. In feeding the infant, glass nursing bottles should be employed; these, especially the tubing and the mouthpiece should be cleaned every time they are used. Never allow nurses to resort to the "sugar teats" with which some mothers seek to appease the cries of the infant, and which are sure to produce canker and disorder the digestion.

5. It is not till the beginning of the sixth or seventh month, that one should begin to give farinaceous substances with milk; such as bread and milk, baked flour gruel, rice, arrowroot, etc.; toward the end of the first year it is always a good plan to give these supplementary articles in order little by little to accustom the child to weaning. Weaning ought not to take place till after the first twelve or sixteen teeth have pierced the gums, while the infant is in a good state of health, and during the lull which follows the eruption of a group of teeth.

6. Every morning the toilet of the little one should be made before it is suckled or fed; this toilet consists: 1, in washing the child's body and especially the genitals, which ought constantly to be kept clean; 2, in scrubbing the head on which it will not do to let dandruff or scurf accumulate; 3, in changing the linen at least every second day; 4, in giving a warm bath in which the infant should be held five or six minutes. The bellyband ought to be kept on during the first month.

7. Swaddling clothes which cause compression of the body, should be absolutely rejected; the more freedom the infant has in its movements, the more robust it becomes, and the better its development. All swathing which compresses the neck and head should be discarded, as being likely to cause disorders in the health or the intelligence.

8. The child should be protected against the injurious effects of excess

of cold and heat, whether out of doors or in the house; within doors the air should be renewed several times a day.

9. It is not prudent to carry the infant into the open air before the fifteenth day, unless the temperature be very mild.

10. It is very dangerous to allow the infant to sleep in the bed of its mother or nurse.

11. The bed of the infant should be composed of fresh oaten straw, soft thatch or husks; the cradle should have curtains during the first months of infancy, and especially during the cold seasons to avoid currents of air, but these curtains should never be completely closed. The babe ought not to be rocked.

12. There should not be undue haste in teaching the infant to walk; it should be allowed to creep on the floor and get up alone; walking carts and baskets should be discarded.

13. The least indisposition on the part of the young babe, (colic, diarrhœa, frequent vomiting, cough), should be at once attended to.

14. As pregnancy has for effect to render the milk less nourishing, in case of pregnancy every nursing woman should cease to give the breast to her child.

15. It is a good plan to vaccinate the infant in the first three months which follow birth, or even in the first few weeks if an epidemic prevails. Vaccination is the only prophylaxis against small-pox.

[13] Heiden made an experiment on twelve little guinea pigs, all of the same litter; four were vigorous, four less strong and four were very feeble. They were divided into series, four in each; two strong guinea pigs being associated with two weak ones. To one strong and one weak one was given phosphate of lime mixed with the ordinary food; to the two other pigs of the series only food was given. The experimentation lasted 43 days, and the sole result obtained appeared to be augmentation of the phosphate of lime in the excrements. Heiden concludes from these experiments that phosphate of lime is not assimilated.

The same conclusions may be drawn from the experiments of other German observers, Weiske, for instance, who has shown that phosphate of lime added to the feed of milch cows not only is not assimilated, but is not even eliminated in the milk. Sanson, professor of the school of Grignon, has repeated these experiments and arrived at the same conclusions; viz., phosphate of lime added to the daily rations of animals is not absorbed, and passes out in its entirety in the fæcal matters and urine. Hence Sanson advises to give to animals instead a more abundant feed, and feed of better quality, such as the young shoots of grasses or grains, the leguminous and oleaginous cereals etc. Chery-Lestage shows also by his experiments on guinea pigs, that the best means of introducing phosphates into the economy is to make use of plants which contain these salts in notable quantity, and the following table representing the different weights obtained, shows that the advantage is in favor of the guinea pig that takes only its bran.

	May 27.	July 15.	Difference.
Glycero phosphate of lime,	207	315	108 grammes.
Lacto " "	248	260	12 "
Chlorhydro " "	191	308	109 "
Phosphate of lime, . .	175	280	105 "
Pure bran, . . .	213	380	167 "

According to Dr. Caulet, the biphosphate of lime (soluble phosphate), is neither decomposed nor absorbed in the stomach; it arrives unchanged in the intestine where, in an acid medium, it is decomposed and precipitated under the form of ordinary phosphate of lime; it acts then as a mechanical absorbent.

The insoluble phosphate of lime does not behave in the same way. In contact with gastric juice it is decomposed into a soluble salt of lime (lactate or chloride), and biphosphate of lime; now the lactate and chloride are soluble, and absorbable; hence, according to Caulet, the insoluble phosphate of lime yields to the organism a part of its lime.*

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* Heiden, Fahling's Landwirthsch. Zeitung, xxiii., Jahrg. 1 Heft, Jan., 1874. Sanson, Memoir on the Theory of the Precocious Development of Domestic Animals, Gez. hebd., 1874. Dusart, Mineral Inanition in Diseases, 1874. Caulet, On the Therapeutic Rôle of Biphosphate of Lime (Progres Méd., 1873). Chery Lestage, Experimental and Clinical Researches on Certain Preparations of Phosphate of Lime (Thèse de Paris, 1874). Dujardin-Beaumetz, Soc. de Thérap., Session March 14th, 1875.

LECTURE XVI.

TREATMENT OF ULCER AND CANCER OF THE STOMACH.

SUMMARY.—Ulcer of the Stomach—Symptoms—Pharmaceutical Treatment—Nitrate of Silver—Perchloride of Iron—Bismuth—Chloral—Opiates—Lavage—Dietetic Treatment—Milk Diet—Cancer of the Stomach—Difficulties of Diagnosis—Treatment—By Lavage—Therapeutic Indications According to Seat of the Cancer—Surgical Intervention in Cancer of the Stomach — Gastrotomy — Gastrectomy—Gastrostomy.

THE lengthy developments into which I have entered in the previous part of my work pertaining to the dyspepsias will oblige me to be much more brief in the therapeutic considerations which I am about to present relative to simple ulcer and cancer of the stomach. You know that these affections are characterized by symptomatic dyspeptic troubles, and that the treatment of these symptoms is the same as that of the different dyspepsias studied in the foregoing chapters. Hence I shall here set forth only the more important points in the therapeutics of these two affections.

Let us begin with ulcer of the stomach. Notwithstanding the numerous works on the subject of simple ulcer of this organ since the time of Cruveilhier, we are still ignorant of the exact pathogeny of this affection; so all our treatment is directed, not to the first cause, which escapes us, but to the symptoms determined by the loss of substance of the walls of the stomach.

The symptoms which result from the presence of the ulcer are as follows: vomiting, and often vomiting of blood, due to the opening of more or less important blood-vessels; attacks of pain, sometimes very severe; lastly, perforation of the walls of the stomach, and the fatal consequences that result therefrom. Such are the three principal points in the pathological history of ulcer. Add to this brief description, that the ulcer, if it may cause death, is likewise susceptible of cure, and this in one half the cases.*

What can the physician do to alleviate these symptoms and hasten cicatrization of the ulcer? He can employ both a pharmaceutical and a dietetic treatment; and although the latter constitutes the best and

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* In Brinton's 100 cases, there was cicatrization in 56, perforation in 12, 4 died of hemorrhage, 2 of consumption, and 25 of undetermined causes.

perhaps the only means of cure, permit me first of all rapidly to set forth the pharmaceutical means of which you may make use. Two ends are to be accomplished; one set of remedies acts locally on the ulcer to bring about its cicatrization; another set is given principally to combat the pain which is so characteristic a symptom.

The local modifiers are the most numerous, and the first place must be assigned to the salts of silver, and particularly the nitrate. Struck by the good effects produced by cauterizations effected with lunar caustic on cutaneous ulcers, some medical authorities have supposed that this salt might modify advantageously the surface of the gastric ulcer and bring about cicatrization; hence it is that we see Trousseau, Gros, Schützenberger and others, recommend the usage of pills of nitrate of silver of one centigram, the dose of which is progressively raised till ten pills a day are taken. Fleming has even gone farther and advised to inject a solution of nitrate of silver directly into the stomach by means of the œsophageal sound.*

I am quite of Brinton's opinion with regard to this treatment by the silver salts. Brinton believes this medication to be quite inefficacious, and affirms that if he has observed patients to get well while taking nitrate of silver, it was simply because they were on the milk diet at the same time, which is known to be of itself curative. Moreover, it is difficult to limit the action of nitrate of silver to the surface of the ulcer.

Luten, basing himself on the good results obtained in the treatment of ulcers of bad nature by the profoundly modifying action of perchloride of iron, has counselled this medicament in round ulcer of the stomach. He administers three or four times a day ten drops of the tincture of perchloride of iron in a little sweetened water.

For the same reason Bonnemaison of Toulouse has recommended the subnitrate of bismuth in large doses. He has himself been in the habit of giving two to three ounces of this medicament during the twenty-four hours.†

I shall only mention sulphate of iron, proposed by Abercrombie, and the strong scented lettuce (lactuca virosa), which Cazin of Boulogne has administered in these cases, and I come now to the treatment of ulcer of the stomach by chloral.

Hertzka of Buda-Pesth was the first to advise the employment of

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* Trousseau Clinical Medicine, Vol. II, Gros. Union Méd., 1857. Schützenberger, Gaz. Méd. de Strasbourg, 1856. Fleming, A New Mode of Treating Severe Dyspepsias and Chronic Inflammation of the Stomach, (Med. Times and Gaz, 1859).

† This was in accordance with the important labors of Monneret. Vide Bonnemaison, On the Treatment of Simple Ulcer of the Stomach, Toulouse, 1874,—Luton, Nouveau Dict. de Méd. et Chir. Art. Estomac—Luton, On Ulcer of the Stomach, (Bull. de la Soc. Méd. d'Observation, 1858, Hertzka, Bull. de Thérap., t. xciv., p. 193, 1878).

chloral in the treatment of ulcerous gastritis, taking as his basis the results which I had obtained by the external application of chloral in the treatment of ulcerations of bad nature.

Unfortunately chloral is itself an irritant, and I have already told you that its prolonged use is a cause of catarrhal inflammation of the stomach; for this reason this medication in many cases cannot be counselled. And what I say of chloral also applies to all the irritant local modifiers which have been advised in the treatment of simple ulcer of the stomach.

Be then very reserved in the employ of these topical modifiers; you can be less so in the usage of opiate preparations, which attain a triple end: they combat the painful paroxysms which are often so violent in the course of the disease, they allay vomiting, and they subdue the sensation of hunger, and thus enable us to keep the patient fasting for some time.

Brinton, and more recently Gallard,* have shown the good effects of opiates. You can prescribe the English "black drops," or the French "white drops," or pulverulent mixtures of morphine with inert powders, of which I spoke to you when on the neuroses of the stomach. But the hypodermic method is assuredly the best means of introduction of morphine, being the least irritating to the stomach. We have also seen advised, in order to combat the pain and vomiting, the employment of energetic revulsives: vesicatories, issues, the actual cautery, etc. I think that one ought to be very chary in the employ of these means, the favorable action of which, moreover, is not absolutely demonstrated. For the vomiting and the hæmatemesis, make use of ice, and the different means which I mentioned under the head of vomiting. I cannot too much insist on the benefits of ice used internally and applied in the form of ice-bags to the epigastrium.

Quite different is the end proposed by Debove in the treatment of ulcer of the stomach. Basing himself on the fact that ulcerations of the stomach are aggravated by the secretion of gastric juice, it occurred to Debove to employ in the treatment of *ulcus rotundum* the alkalies in large doses, as these substances have for their end to neutralize completely the acidity of the gastric juice, and thus compel the alimentary bolus to be digested in the intestines. Cases of cure by this therapeutic method are as yet too few to enable us to judge of its value, but one may well ask if the introduction of a great quantity of alkaline salts into the economy (an ounce or more a day) may not do serious harm?

But before touching upon the dietetic regimen, which constitutes the most active mode of treatment of simple ulcer of the stomach, we must discuss the value of lavage of the stomach in the therapeutics of this affection. Here we meet with two quite opposite opinions; some authori-

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* Gallard, Du Traitément de l'Ulcere Simple de l'Estomac, (Bull. de Thérap., t. xcii., 1877).

ties thinking that the practice of lavage in simple ulcer of the stomach is highly beneficial, affirming that by this means cicatrization of the ulcerated mucous membrane is favored, others absolutely condemning this practice because that, in their view, it excites contractions of the stomach, and favors hemorrhages by the movements which it imposes on the ulcerated surface.

I believe, for my part, that the truth lies between these extreme opinions, and that lavage at certain periods of ulcer of the stomach may give good results, while at other times it may be injurious. I will explain—when the ulceration is just beginning, and no hemorrhage has as yet taken place, and there only exists the extreme pain complicated with vomiting, one may usefully perform lavage, and especially if use is made of the milk of bismuth of which I have before spoken.

It is especially in the terminal periods of the ulcer, when cicatrization is going on, and the hemorrhages have ceased, that lavage may render great service. By such cleansing of the mucous membrane and the surface of the ulcer, you prevent the sojourn of alimentary particles, which by their presence hinder cicatrization, and irritate the surface of the ulcer. And just as we see ulcerous wounds of the skin get well under the influence of lavages or dressings often repeated, so also the ulcerations of the mucous membrane of the stomach undergo favorable modifications by the same means.

But lavage becomes dangerous when performed immediately after hæmatemesis; it is to be feared that by this means one may provoke new vomitings of blood, whether by detaching too promptly the occluding clots, or by provoking new contractions of the stomach. For several years I have repeatedly practiced lavage of the stomach in cases of ulcer, and I have always derived advantage from it when I have followed the rules here laid down.

I might particularize cases where the result has been truly marvellous; instances, in all probability, of the nature of those ulcerous gastrites which are still poorly understood from the point of view of their pathological anatomy, and characterized by absence of those deep ulcers which cut the different layers of the stomach like a punch; cases, in fact, where the lesion consists in simple erosions of the mucous membrane, accompanied with but little hæmetamesis, and where the presence of blood is indicated only by a slightly darkish discoloration of the vomited matters.

Lavage of the stomach has also another advantage, in that it enables us to feed the patient. In fact by means of the syphon, after having cleansed and dressed the mucous membrane of the stomach, you can introduce a certain amount of milk, and if you fear the injurious effects of too large a quantity, you can make use of a mixture of milk and milk powder, such as Debove uses, for by so doing you considerably augment the nutritive value of the milk, and avoid the inconvenience of too great a bulk.

But let us return to the hygienic treatment. As I have already said, the dietetic regimen deserves the first place, and Cruveilhier made a good completion of his discovery, when, after having shown the evil and its march, he pointed out the remedy with which to meet it. This remedy is milk; it is necessary to support the patient while giving the stomach the least possible work to do, and milk well fulfills this indication. The milk diet then is absolutely indispensable, and all authorities, Schützenberger, Brinton, Wade, Leube, etc., are unanimous on this point.*

It is here that the milk treatment ought to be most rigorously followed out, and you must take the utmost pains in your directions. Karell of St. Petersburg has justly maintained, that the physician ought not to say to his patient simply: "Drink milk, as much as you can," but he ought to indicate and limit the quantity, the kind of milk and the hours at which it should be ingested. You will then order your patient to take, four times a day, at carefully prescribed periods, from two to eight ounces of milk. If he cannot take this quantity all at once, follow the advice of Gallard, and give it to him in small quantities at a time, even if he has to get his cupful down by slow sips. Karell † counsels skim milk; for my part I prefer the milk fresh from the cow. You can add lime water to it, or alkalies; Luca of Naples pretends that lime water is the unique remedy in ulcer of the stomach. These substances have no great efficacy; they simply favor the regular and speedy digestion of the milk.

It is necessary to be very careful in the return to solid food, and this transition will be facilitated by the use of the alimentary powders. What we must avoid, I have said, is to impose too arduous a task on the stomach, and we can accomplish our end by employing the meat powders, by reason of their rapid peptonization. Then when, as a result of your endeavors, the mucous membrane of the stomach shall have succeeded in easily digesting these alimentary powders incorporated in beef tea, you will be able to return gradually to ordinary fare, beginning of course, with articles of food most easy of digestion, and you will do well to take as your guide the directions which I have given you in previous chapters on the diet in dyspepsias, having due regard to the likes and dislikes of your patient.

There is a last point on which Brinton insists, which is to recommend rest and to forbid violent exercise. You understand well the value of this prohibition; its object is to avoid perforation of the stomach, and to favor the protecting adhesions which prevent such perforation from opening into the peritoneal cavity. The same reason should make us careful about examining the region of the stomach in persons affected with ulcer;

* Wade, On the Treatment of Simple Ulcer of the Stomach, (Brit. Med. Jour. 1859). Leube, in Ziemsen; Brinton, On the Pathology, Symptoms, and Treatment of Simple Ulcer of the Stomach, London, 1857.

† Karell, on the Milk Treatment (Arch. gén. de Méd., 1866).

for under the influence of pressure the adhesions may give way and grave hemorrhage or fatal peritonitis result.

These hæmatemeses, which are among the characteristics of simple ulcer of the stomach, merit a particular treatment. When they are not very abundant, ice, perchloride of iron, and especially subcutaneous injecions of ergotine, (or ergotinine in the dose of $\frac{1}{120}$th to $\frac{1}{60}$th of a grain) suffice to arrest them. In other cases on the contrary, the hemorrhage takes on an alarming character; sometimes it is so copious as to cause the death of the patient; sometimes it is so often repeated that death supervenes as the result of gradual and increasing exhaustion. In the event of profuse hemorrhages, we can do little; the ulcer, in fact, has invaded one of the important branches of the cœliac axis, and the loss of blood is enormous. In the case of more moderate repeated hemorrhages entailing exhaustion, we can interfere advantageously with transfusion, which fulfills several indications, acting as a hæmostatic and sustaining the patient at the same time that it spares the stomach; it also raises the pulse and the action of the heart.

In a case of ulcer of the stomach where by reason of repeated and abundant hemorrhages, the patient then pale, cold, with imperceptible pulse, was brought to death's door, I have been able by means of a transfusion of five ounces of blood, effected with the apparatus of Roussel and with his aid, to bring back the patient to life and (what is better still) to health, his hemorrhages ceasing from that moment.*

Transfusion then is a means which it will not do to neglect in such cases, and you should always resort to it, taking care not to inject too great a quantity, not more, for instance, than 150 gms. (five ounces), for when you exceed this amount, you produce a plethora of the arterial system which may lead to a giving way of the arterial clot, or even to rupture of other blood-vessels in the vicinity, and a return of the hemorrhage. It is well understood that while the hæmatemesis is going on, you should avoid the introduction of food into the stomach, and in order to sustain your patients, you will have to make use exclusively of the rectum and employ peptonized lavements.

Such, gentlemen, are the therapeutic rules which should preside over the treatment of ulcer of the stomach; let us now take up the study of cancer of the stomach.[1]

Cancer of the stomach, despite its incurability, should be made the subject of special therapeutic indications, and this for many reasons; first, because we ought to treat incurable diseases like those that are curable, and if the physician can not cure in all cases, he is always in duty bound to do his utmost to alleviate the pains of the patient. The other dominant reason is that the diagnosis of cancer of the stomach is one of the most difficult problems of clinical medicine, and one may affirm that if

* Roussel, Transfusion. (Progres Méd., Oct. 1884.

exception be made of the presence of an appreciable tumor of this organ, there exist no positive signs of cancer of the stomach.

That would be a curious chapter of internal pathology which would give the history of false cancers of the stomach. In a communication to the Medical Society of the Hospitals, I have shown all the difficulties of this clinical problem, and you will find in the thèsis of my pupil Dr. Deschamps, a complete study of this so much controverted question of gastric cancer.

There is, in fact, a disease, the recent knowledge of which, has profoundly modified the very basis of this diagnosis. I allude to chronic gastritis with dilatation of the stomach. This affection, in which we find the stomach dilated with notable thickening of its walls, is accompanied with symptoms almost identical with cancer; the age of the patient, his cachetic state, the vomitings, the hæmatemesis, the pain in the region of the stomach,—all, unless it be the absence of the tumor, suggest cancer of the stomach, and even the tumor itself may not be wanting. The thickening of the walls of the stomach, or even the peristaltic contractions which this organ undergoes, give to the hand of the explorer a sensation of well defined hardness, surprisingly like that of a real tumor. In presence of such difficulties of diagnosis, several means of extrication from this embarrassment have been proposed, and I wish to call your attention to two of them.

Rommelaere of Brussels has maintained that the diagnosis of cancer of the stomach may be made certain by the examination of the quantity of urea excreted in the twenty-four hours. Whenever the figure is below ten grammes (150 grains) and this lasts for several consecutive days, you may affirm that you have to do with a malignant affection of the stomach. Rommelaere affirms, in fact, that malignant tumors in general, are characterized by a viciation of the intimate nutrition, and that this viciation is not met with in benign tumors.

I have put in practice the method of Rommelaere in my service, and the results to which I have arrived justify in part the affirmation of the Belgian physician, in so far that in cases of cancer of the stomach, or presumably such, we have always found the proportion of urea excreted in twenty-four hours less than ten grammes, while on the contrary, in cases of ulcer of the stomach, or of dyspepsia with dilatation, this figure of ten grammes has always been exceeded.

At the same time it will not do to conclude that the test of Rommelaere is infallible; in one case in fact where we found all the symptoms of cancer of the liver and stomach, and where the figure of urea had not exceeded three or four grammes a day, which enabled us to affirm the diagnosis of cancer, the autopsy revealed a hydatid cyst of the liver with greatly thickened walls.

I think then that Rommelaere's method, while sometimes furnishing us suggestive information, can not give us definite indications, for, as our colleague Albert Robin has well shown, the figure of urea may vary in a cancerous individual according to the period of the disease when he is examined. At the outset when the diagnosis is often most difficult, if alimentation is still well performed, the figure of urea may be relatively considerable, while in the cachetic periods it is extremely small.[2] Use then the test but do not place too high a value on it.

In Germany it has been proposed to base the diagnosis on signs drawn directly from the stomachal digestion, and two orders of signs have been especially invoked; the presence or absence of acidity of the gastric juice, and the digestibility of certain aliments.

As for the diagnostic value of the acidity of the gastric juice, Leube, basing himself on the results obtained by Van der Velden, who pretends that as soon as a neoplasm is developed in the walls of the stomach, the hydrochloric acid of the gastric juice disappears from that secretion, Leube, I say, has sought by the same methods which I have already described to you under the head of pituitous dyspepsia, to ascertain the degree of the acidity of the gastric juice.

As concerning the diagnostic value of the digestibility of aliments, this same physiologist, in comparing the rate of digestion in cases under consideration, with artificial digestions made concurrently, has drawn up a list of foods whose rate of digestibility enables one to determine the diagnosis of the affection of the stomach which one has before him; you will find, moreover, in the thesis which I have just cited, that of my pupil, Dr. Deschamps of Riom, all the details pertaining to this method of diagnosis. I have repeated these experiments, and I recognize the fact that in certain circumstances these methods may add confirmation to other signs, while having only a relative value by themselves; hence it is that we see Leube associate them with other clinical data, and base his diagnosis solely on the sum of signs observed.[3]

I have elsewhere made a communication to the Medical Society of the Hospitals concerning this subject, and have shown all the uncertainties of the process recommended by Leube.*

Pardon me this long digression on the diagnosis of cancer and other affections of the stomach, but it had become necessary that I should enter thus minutely into these clinical details, in order that you might be able intelligently to treat cancer of the stomach when you meet it, as well as all doubtful cases that simulate cancer.

Admitting that you may arrive at a precise diagnosis of cancer of the stomach, the prognosis is different according as the cancer is seated in this or in that part of the stomach. One patient, for instance, shall have

* Dujardin Beaumetz, On the Diagnostic Value of the Clinical Processes Employed to Test the Acidity of the Gastric Juice, Gaz. hebd., Dec. 6th, 1884.

a malignant growth of trifling extent which is situated about the pylorus or cardia, and life is soon compromised, owing to the interruption of alimentation; another on the contrary, may live a long time with cancerous lesions of much greater extent, which invade portions of the stomach less necessary for digestion. This is not all; the variety of cancer has also an influence; certain neopolasms develop with extraordinary rapidity, and I have seen patients go through all the phases of their disease and succumb in a space of from one to two months, while others, on the contrary, live for years with cancerous lesions of the stomach whose progress is very slow.

These, you see, are clinical points of the utmost importance, and which you should always have in mind when you are in presence of a man affected or supposed to be affected with cancer of the stomach.

Your therapeutic path, then, is plain. Are there only vague surmises of cancer? You ought to employ remedies addressed to the disease which has the greatest resemblance to cancer: I refer to chronic ulcerous gastritis. Here, all the rules which I have laid down under the head of dilatation of the stomach are applicable; lavage and medication of the gastric mucosa, alimentation by milk and meat powders; such will be the bases of your therapeutics. But, you may say, in the event of the case being one of genuine cancer instead of chronic ulcerous gastritis, may not your treatment do harm? None at all, and the lavage and dressings of the stomach cannot but be beneficial. According to the real nature of the lesion, you will see gradual and sure amelioration under the influence of your treatment—supposing the patient to be affected with simple ulcerous gastritis, and that he rigorously follows your directions. If the disease be cancerous, you will often have the good fortune to note an improvement which will last a certain time, but it will be but temporary, and despite all your efforts, the individual will succumb.

We will now examine what are the therapeutic means to be employed when the cancer is situated at the pylorus, then when it is seated at the cardia, and lastly, at some part of the walls of the stomach, occupying a greater or less extent of surface.

Cancer of the pylorus is much the most frequent.[1] By reason of the obstacle which it presents to the passage of alimentary substances from the stomach into the intestine, it is certain to cause dilatation of the stomach and rapid emaciation. The dilatation, despite the presence of cancer, is tributary to lavage, which enables us to cleanse the mucous membrane, and free it from sources of irritation which result from the prolonged sojourn of aliments; lavage, therefore, should be practiced in most cases of cancer of the pylorus. As for the troubles of nutrition, you can in a certain measure remedy them by alimentary lavements, and the only lavements which can serve for nutrition are, as I shall show you farther on, peptonized lavements; it is then to these that you should have recourse, and by their means, and frequent lavages, you will be able to prolong the life of your patients.

The cancer may be seated at the cardia, and here the conditions are different. The stomach, instead of being dilated, has its walls in close contact and it is the inferior part of the œsophagus which is dilated. We have at our disposal in order to overcome this barrier which opposes the descent of the alimentary bolus into the stomach only two therapeutic means: first, the administration of liquid food, and here the meat powders render us great service, owing to the homogeneous mixture which they make with liquids, and secondly the peptonized lavements of which I have just spoken.

Catherization and dilatation of the stricture by bougies of progressively increasing size have also been advised. It is necessary to be very prudent in the employment of these manœuvres; it has often happened that in the attempt to force the œsophageal sound through the stricture, the œsophagus, thinned at its lower extremity by the dilatation of which it is the seat, as well as by the carcinomatous lesions affecting its substance, has been perforated. At the same time I make exception of the method recommended by Krishaber, who has proposed to employ in such cases, and especially when the cancer is seated at the upper part of the œsophagus, a permanent sound, and who by this means was able for a year to keep alive several patients who, without this instrumentality, would have infallibly succumbed.

This œsophageal sound which is introduced by the nares, may be of a relatively small calibre, since by means of these handy alimentary mixtures of meat and milk powders we can feed the patient through quite narrow tubes.[*]

When the cancer is seated in other parts of the stomach, our therapeutic indications will depend on the phenomena which are presented. When the vomiting is lacking (and here you should not forget the fact that there are great many cases of cancer of the stomach, even with the presence of tumor which have never been attended with vomiting, even at the most advanced periods of the disease), you ought to employ articles of food which demand the least digestive action on the part of the stomach. First milk, then certain farinaceous powders, such as the flour of lentils, cooked or malted, mixed with an equal quantity of meat powder. When the attacks of pain are very severe, use injections of morphine, and if the abuse of these injections is to be feared in persons who do not present any grave lesion of the organism, I do not see that it is any great harm if a cancerous patient becomes a morphiomaniac. Thanks to this incomparable anodyne, life is renewed, the pains disappear, and you see after each injection a sort of resurrection effected in these cachetic subjects.

Recall to mind that patient who remained so long in our hospital, occupying No. 21 Ward St. Charles. This man had arrived at the last degree of cachexia due to cancer of the stomach; he was veritably dying of starvation,—the animal heat failing little by little,—and finding no relief except in injections of morphine, which he said, restored his temperature and his pulse, and gave him every day a new lease of life. You saw in this case a clear example of the tonifying action of hypodermic morphia; do not hesitate then to practice these injections, and make them often enough to allay the pains, and do not fear to employ pretty large doses.

Other modes of treatment have been proposed for cancer of the stomach. The preparations of conium have been particularly vaunted, cataplasms of the leaves being applied over the epigastric region, and pills of the extract given internally. All these means have been tried, and they have never to my knowledge cured, or even ameliorated a single case, and therefore are hardly worth trying. I may say as much of other pretended specifics, such as cundurango, and Chian-turpentine.

It remains for me to say a few words about surgical intervention in the treatment of cancer of the stomach.

Emboldened by the unlooked for success which modern surgery has obtained in abdominal affections, certain surgical authorities have proposed to interfere in malignant disease of the stomach, and have practiced successively, gastrectomy, gastrotomy, and gastrostomy.

Gastrotomy consists, as you know, in opening the stomach, and this operation has been performed of late, especially in order to remove from the cavity of this organ foreign bodies, and you are familiar with the interesting cases of Labbé and Felizet. It has also been lately proposed to practice this operation in order to penetrate the stomach and gain access to the pylorus for the purpose of dilating it with the fingers, and thus overcoming fibroid thickenings of this orifice, or cicatricial bands causing stricture. This digital dilatation has never been performed in France, and the most serious objection which can be made against it is the difficulty of accurately diagnosticating the pathological condition requiring the operation.

Practiced for the first time in France by Pean,* then in Germany by Billroth, Rydygur, Esmarch, Kitajewski, etc.; in Italy by Torelli, Gavazzini, and in Brazil by Fort, resection of tumors of the stomach, or GASTRECTOMY, despite several successful cases, seems to me to be a hazardous and very questionable operation in cancers of the stomach, and this, for a number of reasons. Without expatiating on the difficulties of the operation, I will mention the two prominent causes of failure: the state of physiological depravement in which patients affected with cancer of the stomach necessarily are, and which militates against their rallying well after so severe and prolonged an operation, and secondly, the impossibility of affirming that there do not exist other tumors of a like kind in the deep parts of the abdomen. These are, I repeat, conditions which ought to render us little enthusiastic in advocating the extension of gastrectomy.

It is not so with GASTROSTOMY, that is to say, the establishment of a permanent opening in the walls of the stomach. This is a much more feasible operation, and one which has given numerous successes. Gastrostomy may be performed for two conditions—the operation being somewhat different in the two cases: when there is a stricture of the œsophagus and cardia, and again when there is an obstacle at the pylorus.

In strictures of the œsophagus, and when this tube is impervious, gastrostomy is imperative, and you well understand how life may be prolonged thereby through the establishment of a gastric fistula. The curious observation of Verneuil who performed this operation on Marcelin, shows us all the advantages which may be derived from gastrostomy, and if in fibrous constrictions it does not always give good results, it is because the operation was performed at too late a period, and the patient, exhausted by prolonged abstinence, could not rally from the effects of the surgical traumatism.

I believe this operation perfectly indicated in cases of cancer of the cardia and œsophagus. These are in fact cancerous affections which become grave, not by reason of extension of the lesion, but because they constitute an insurmountable obstacle to performance of function in organs indispensable to life. A cancer of very trifling extent situated at the pylorus or cardia will cause death by inanition, and you understand how easy it must be, by creating a new passage for the introduction of food, to prolong for several years the life of the patient.

When the obstacle is seated at the pylorus, surgical intervention of a different character is required, and gastrostomy consists in establishing an new outlet for the stomach which shall open not externally, but into another part of the intestine.

Surmay of Ham has advised to make the opening into the duodenum, and he has performed this operation in my service on a young woman twenty-four years of age affected with cancer of the pylorus.[7] The operation proposed by Billroth seems to me to constitute a notable advance on the preceding.

This operation consists in attaching a loop of intestine nearest the duodenum to the wall of the stomach, and in establishing there a communication between the two cavities, so that the stomach shall open into the intestine by a new pylorus. This operation does not involve the risk of loss of those fluids so necessary to intestinal digestion, the bile and pancreatic juice, which continue to flow into the upper part of the intestine. This is the operation which you ought to perform whenever there exists an obstacle at the pylorus effecting or nearly effecting closure, and for my part I have very much regretted that I did not resort to it in two cases where I had diagnosticated non-malignant stricture of the pylorus; the autopsy having shown my diagnosis to be true. I believe, moreover, that in certain forms of cancer of the pylorus, without any cachectic symptoms, this operation is indicated; for leaving intact the tumor, it does not involve the grave risks of gastrectomy. Unfortunately, as in stricture of the œsophagus, we do not propose this surgical procedure except in the last stages of the disease, when the vital powers are low and the patient is ill able to withstand the sequels of the operation.

There remains, in order to complete my subject only the consideration of the treatment of a "bilious" condition called "*embarras gastrique*," but this which is a sort of acute indigestion is commonly associated with a general febrile condition, and properly belongs to the therapeutics of fevers.*

As you see, the treatment of stomach affections in general makes heavy demands on the physician: it claims of him profound clinical knowledge, in order that he may be able to appreciate and to group the different symptoms presented by the patient, and to understand their origin and their march; it requires also an extensive acquaintance with pharmacology, in order that he may be able to vary and change the different medicaments and appropriate them to each state; it demands, finally, a complete and thorough study of hygiene in order that he may establish in a scientific and rational manner the bases of a regimen suited to each of the forms of dyspepsia. Add to all this, the perseverance, the energy, and patience indispensable for carrying out the prescribed treatment, and you will understand how necessary in the therapeutic management of affections of the stomach are the knowledge, talent, and art of the physician.

In another series of lectures I propose to complete the study of the treatment of affections of the stomach by that of the therapeutics of diseases of the intestine.

NOTES TO LECTURE XVI.

[1] Cancer of the stomach is the most frequent of cancers. According to Virchow the ratio of cancer of the stomach to cancer elsewhere, is as 34.9 to 100. According to Wyss, it is very nearly the same, 35.6 per 100.

According to Espine and Lebert, cancer of the stomach is rare before the age of thirty (1 per cent.), as also after the age of seventy (4 per ct.); it is frequent from the age of 31 to 70 (34.6 per 100). This frequency attains its maximum from 41 to 60 (60.7 per 100).

Heredity seems exceptional, according to Lebert, in cancer of the stomach; and women are more liable to this disease than men.

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* See "Clinical Therapeutics," Part III., "On the Treatment of Fevers."

Chesnel has studied the clinical forms of cancer of the stomach; he has shown that truly latent cancer is rare, as he was able to collate only six cases. The dyspeptic form is much the most frequent, and the dyspepsia presents only gastric troubles. In fine, in other cases, cancer of the stomach takes different forms; it may simulate Bright's disease, (dropsical form), tuberculosis (thoracic form), a disease of the heart (cardiac form).*

² Rommelaere has examined the quantity of urea eliminated in the twenty-four hours in cases of cancer, of simple ulcers, and of dyspepsias of the stomach. These are his results: In eight cases of cancer of the stomach the quantity of urea varied between six and eleven grammes, with an average of nine grammes. In the cases where the cancer had invaded at the same time the liver and the stomach, there was an average of ten grammes; in cases of cancer of the liver, the average was eight grammes; while in cancer of the uterus the average was 9.29 grammes. In examining comparatively patients affected with dyspepsia and with simple ulcer of the stomach, he found on the contrary, a figure varying between 11 and 35 grammes.

Dujardin-Beaumetz in his service, arrived at the following results:

PROBABLE CANCERS.

Names of patient.	Duration of observations.	Mean of urea.
Auguste D.,	9 days.	6 grammes.
Pierre D.,	10 "	7 "
Louise G.,	10 "	4 "
Macellin T.,	5 "	5 "

ULCEROUS GASTRITES.

Joseph B.,	19 days.	35 grammes.
Emile D.,	5 "	20 "
A—— B.,	5 "	22 "
Isidore J.,	15 "	24 "
Nellie T.,	7 "	26 "

But one observation of ulcer of the stomach was taken; in this case the average quantity per diem for five days was twenty grammes.

Albert Robin opposes this way of looking at the subject. According to him, the figure of urea is in direct relation with the state of nutrition, and when the latter is enfeebled, from whatever cause, the proportion of the urea diminishes. Thus it is that he has found in individuals who take very little nourishment, a very small proportion of urea, while on the contrary the amount is considerable in patients affected with malignant tumor, but able to take food. All depends then on the period when one analyzes the urine.†

* Dujardin Beaumetz, On the Diagnosis of Cancer of the Stomach, (Soc. Méd. des hôp., July 25th, 1884). Louis Deschamps, On the Diagnosis of Cancer of the Stomach, (Thèse de Paris, 1884). Lebert, Arch. f. Klin. Med., 1877. Ferd. Chesnel, Clinical Study on Cancer of the Stomach, Inaugurel Thèsis, Paris, 1877.

† Leube, On Gastrectasis, and its Relations with the Presence or Absence of pre-Hydrochloric Acid in the Gastric Juice, (Dutsch. Arch., f. Klin. Med., xxiii., 4). Rommelaere, On the Diagnosis of Cancer, 1883, in Ann. de l'Université libre de

[3] Leube employs the stomach sound for the diagnosis of gastric affections, and he studies by this means two points: 1, the duration of the digestion; 2, the intensity of the secretion of gastric juice.

1. To ascertain the duration of the digestion, he performed lavage seven hours after the meal; in a person who digests well, the water of the lavage ought to return clear, without admixture of mucus.

2. To judge of the intensity of the secretion of gastric juice, he determines the acidity of the gastric juice and its digestive power.

To obtain gastric juice, he introduces a litre of liquid at the ordinary temperature into the stomach, then he removes it ten minutes after; this is the liquid with which he experiments.

To judge of the acidity of the gastric juice, he makes use of the test of tropœoline; to test digestion, he immerses little portions of albumen in the liquid, and the complete solution of this albumen is regarded as determining the duration of the digestion.

All grave dyspepsias are characterized by slowness of digestion.

[4] Gussenbauer and Winiwarter have shown that out of 903 cancers of the stomach, 542 were limited to the pylorus. Of this number, 223 were without glandular engorgements, and 122 without adhesions to neighboring parts. Ledderhouse has given similar statistics. Out of 60 cases, 39 were of the pylorus, and in 25 there were cancerous nodules in other organs.*

[5] Krishaber introduces by the nares a rubber or gum catheter. When the stricture is very close, he begins by passing a firm gum sound, which he replaces in a few days by one of caoutchouc. Moreover, he shows that the œsophagus tolerates well the presence of a permanent catheter, and has published a series of observations of cases of cancer of the œsophagus where this sound has remained 305, 165, and 251 days.†

[6] Resection of the stomach was first attempted in animals. Merrem in 1810, first conceived the idea of extirpating the pylorus, and Gunther practiced it on two dogs.

In 1876 Gussenbauer and Winiwarter took up anew these experiments, and resected the pylorus in 8 dogs. Kayser repeated these experiments and proved that one can in the dog resect the pylorus without death following the operation. Since then the operation has been 18 times performed in man.

Case 1.—Torelli, Boulogne, 1876. Man aged 42; hernia of the stomach; resection, cure.

Case 2.—(Des tumeurs de l'abdomen, 1880, p. 79). Man affected with cancer of the pylorus; death the fifth day.

Case 3.—Rydygier, 1881. Man æt 63; cancer of pylorus; death 12 hours after.

Case 4.—Billroth, 1881. Woman of 43; carcinomia of pylorus; first cure, then return of disease after 4 months and death

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Bruxelles, etc., etc. Dujardin-Beaumetz, On the Diagnosis of the Cancer of the Stomach, Gaz. hebd., July, 1884. A. Robin, On the Diminution in the Figure of Urea as Diagnostic Sign of Malignant Tumors (Soc. Méd. des Hôp., Aug., 1884, Deschamps, loc. cit.).

* Gussenbauer, Arch. de Langenbeck, Bd. xix., p. 347.

† Krishaber, On the Œsophageal Sound Permanently Left in Place (Annales des maladies de l'oreille et du larnyx, 1882).

Case 5.—Billroth. Woman of 46; cancer of pylorus; death after 36 hours.

Case 6.—Billroth. Woman of 38; cancer of pylorus; death at the end of 10 hours.

Case 7.—Billroth, 1881. Woman of 25; cancer of pylorus; recovery.

Case 8—Gavazzini. Woman of 57; chondrofibroma of stomach; recovery.

Case 9.—Esmarch. Ulcer of stomach and gastric fistula; recovery.

Case 10.—Bardenheuer, 1881. Cancer of pylorus; death the second day.

Case 11.—Kitajewski, 1881. Woman æt 52; cancer of pylorus and lesser carotid; death at the end of 6 hours.

Case 12.—Ledderhose, 1882. Woman of 33 years; cancer of pylorus; death at end of 10 hours.

Case 13.—Czerny, 1882. Man of 27 years; cancer of pylorus; cure.

Case 14.—Rydygier 1882. Woman of 30 years; chronic ulcer with dilatation; recovery.

Case 15.—Hahn, 1882. Dilatation of stomach, resection; death at end of 8 days.

Case 16.—Langenbeck 1882. Cancer of pylorus, which was adherent to pancreas; death after the operation.

Case 17.—Gussenbauer. Cancer of pylorus; death.

Case 18.—Fort, 1882. Female; cancer of stomach; first laparotomy, then six months after ablation of cancer; death a few hours after.

[7] Surmay has indicated the operative manœuvres which enable one to reach the third part of the duodenum, to open this portion and fix it to the walls of the stomach. By this intestinal orifice peptonized aliments may be introduced into the intestine. This operation was performed June 19th, 1879, on a young woman of 26, who presented a mobile cancerous tumor of the pylorus. The patient succumbed the next day, and the autopsy showed that the sound which had been introduced by Surmay was well placed in the first portion of the small intestine.*

* Academie de Médicine, 1878.

PART II.

Treatment of Diseases of the Intestine.

LECTURE XVII.

THE INTESTINE FROM A THERAPEUTIC STANDPOINT.

SUMMARY.—Anatomy and Physiology of the Intestinal Mucosa—The Intestinal Glands—Functions of the Intestinal Mucosa—Absorption, Secretion, Elimination—Functions of the Mucosa of the Large Intestine—Experimental Researches—Lavements of Meat Broths and Milk—Their Inefficiency—Peptonized Lavements—Their Nutritive Power—Their Preparation—Administration of Medicaments by the Rectum—Medicinal Lavements—Suppositories — Muscular Coat of the Intestine—Movements of the Intestine—Influence of the Nervous System.

GENTLEMEN: The therapeutic study of diseases of the intestine is the necessary complement of the study of the treatment of diseases of the stomach. From the point of view of anatomy and physiology, as from that of clinical medicine and therapeutics, we cannot separate the stomach from the intestine, and the bond that unites them is so close that to be strictly logical we ought to comprehend their affections in the same description, rather than to treat them under separate categories.

Before entering upon the subject of the treatment of intestinal diseases, which by their frequency, and especially by the therapeutic considerations connected therewith, present the greatest interest, I desire first to sum up in a few words the anatomical and physiological data which we possess concerning the intestine, in order that our therapeutics may be abreast of even the most recent physiological acquisitions.

I shall be brief on the anatomy of the intestine, and shall refer you under this head to your text-books.* You know all the divisions, the relations and the configuration which characterize the small and the large intestine; you know also the considerable extent of the mucosa of this organ, and the multitudinous folds which increase almost two fold its length; you know also those numerous villi which cover the mucous membrane of the small intestines, and their variable forms.[1] As for the glands which line the mucosa, they belong, as you are aware, to three groups: the tubular or Lieberkuhnian glands, the racemose or Brunner's glands, and the closed or agminated follicles which constitute Peyer's

* See especially the recent work of Herbert Watney on the Minute Anatomy of the Alimentary Canal, London, 1877.

patches; you will find moreover in a recent work by Dr. Garel of the school of Lyons some new views respecting these glands.*

But while histological progress enables us to explore this mucous membrane even in its most minute crypts and folds, physiology, it must be admitted, has not marched with equal pace, and despite the ardor of researches in this direction, all the points of this physiological study are far from being elucidated. To those who pretend that therapeutics cannot make any advance except so far as depending exclusively on experimentation and physiology, the study of the treatment of intestinal affections gives a formal contradiction. Take, for instance, the case of purgatives; for ages they have been of daily administration, and yet, as you will find in the course of these lectures, we do not even yet know exactly the intimate action of these simple, useful medicaments. So, as we pursue this study, you will be continually realizing that clinical observation and even empiricism have gone ahead of physiological experimentation.

The mucous membrane of the small intestine discharges three great functions; it is a medium of absorption, secretion, and elimination. All these functions are utilized by the therapeutist.

Absorption is one of the most important functions; it is destined to make the products of digestion enter the economy, and while the peptones and the emulsified fatty matters penetrate by the lacteals, the water and salts are rapidly absorbed by the venous system. It is by the latter system of vessels that we cause the most of our medicaments to enter the blood.

As a secreting organ, the small intestine has been less studied, and much discussion is still going on relative to the properties of the intestinal juice. I have already alluded to this subject while speaking of intestinal dyspepsia, and despite the recent affirmations of Leven,† who asserts that the intestinal juice is acid, I affirm that in man this juice is neutral, and even generally alkaline. What singularly complicates this question is the difficulty which we find in separating the secretions of the divers intestinal glands from the liquids furnished directly by the capillary network. However this may be, you will see that it is by augmenting this intestinal secretion that most of our purgatives act. This intestinal mucosa, by reason of its extent of surface and its abundant secretions, enables therapeutics thereby to practice revulsions of considerable importance, revulsions moreover, which, by the enormous flow of serosity which they entail, produce a most intense antiphlogistic effect, and you

* J. Garel, Researches on the General Comparative Anatomy and the Morphological Signification of the Glands of the Gastric and Intestinal Mucosa of Vertebrate Animals, Paris, 1879.

† Leven asserts that his researches have shown the intestinal juice always to be acid, and that what has been considered as intestinal juice is not such. See Maladies de l'Estomac, 1879, p. 52.

will see how in certain inflammatory affections this revulsive action may render signal service.

The office of the intestine as an eliminating organ is one of great significance. Medicaments introduced into the economy by the skin, or by any other channel, are eliminated chiefly by the kidneys and by the intestine. The experiments on the alcohols which I have made with Dr. Audigé have given us a good illustration of this elimination; in fact in animals which succumb to the consequences of the introduction of alcohol under the skin, one always witnesses disorders constituted by hemorrhagic softening of the mucous membrane of the duodenum, and we have shown that this lesion is due to the elimination of alcohol on the surface of the intestine. You are not ignorant, moreover, that when the functions of the kidney or of the skin are suppressed, there is an elimination of excrementitious products from the surface of the intestinal mucosa, which provokes diarrhœa and often ulcerations, as is the case in uræmia or extensive burns.

This question of absorption, of secretion, and elimination, which seems so plain with reference to the small intestine, deserves a thorough investigation in its relation to the functions of the large intestine, and this especially from a therapeutic standpoint, for the rectal mucosa is often utilized for the introduction of medicaments.

This mucous membrane, as you know, is clearly differentiated from that of the small intestine by the following points: it has neither villosities nor valvulæ conniventes.[2] As for its physiological rôle from the point of view of digestion, this has been well studied the past few years by Albertoni of Padoua, Garland[3] of Boston, Marckwald of Heidelberg, Czerny and Latschenberger of Fribourg.[4] These experimenters, who have all arrived at the same results, have studied the digestion of the large intestine both on individuals the subjects of artificial anus practised on the cæcal extremity of the large intestine, and on animals, and it results from their experiments, that the secretions of the large intestine are incapable of themselves of modifying aliments, of peptonizing albuminoid substances, or emulsifying fats, and scarcely at all act on starchy matters. The mucous membrane of the large intestine, then, from the point of view of digestion, has but the one function of absorption, and this pertains almost exclusively to water and salts.

The large intestine, then, has no direct digestive office, and it is a mistake to suppose that patients can be fed and sustained by lavements of meat broths or of milk, the water and salts of these substances being alone absorbed; and notwithstanding the recent facts cited by Fort, Dumas of Cette, Thermes, etc., I am persuaded of the utter insufficiency of these lavements for purposes of nutrition, and here I base my opinion on the experiments of Carville and Bochefontaine.[5]

Note that among the observations related by Fort and others, one pertained to a child recalled to life by a lavement of broth containing a large quantity of Bourgogne wine and extract of cinchona; all the others concerned hysterical patients the subjects of incoercible vomiting, but cases of this sort are worth nothing as demonstrating the nutritive value of alimentary lavements, for we can match them with a considerable number of instances of hysterical persons who, notwithstanding an almost total abstinence from all food for several months, have been able to maintain life without serious impairment of the forces, although no nutritive lavements were employed. Briquet, Charcot, Mesnet, Brouardel, Joseph Michel, and ourselves have often observed such cases, which show by daily analysis of the urine, that under an influence not well understood, hysterical patients do not disassimilate.

The experiments which I have made in examining, as Bouloumié recommends, the temperature and the quantity of urea excreted each day, have convinced me that the only way of using the rectum for purposes of alimentation is to employ peptonized lavements;[a] my pupil Dr. Chevalier has embodied most of these facts in his inaugural thèsis.*

The large intestine being incapable of itself of modifying fatty or albuminoid matters, it is readily understood that lavements of beef tea, milk, or even blood serum or defibrinated blood (according to the recommendation of Dr. A. H. Smith) cannot serve for nutrition.

It is not so, however, with peptonized lavements, and Daremberg by his results in human subjects, and Catillon by his experiments on animals, have shown that nutrition may be maintained by lavements of peptones. At the same time, lavements of meat broths and of milk give considerable relief to patients, but this results from the fact that the water and the salts, in penetrating the economy, allay to a certain extent the intense thirst which certain patients experience. The objection has been made that these salts and other substances associated with them, may be peptogenous, and the experiments of Schiff alluded to in Lecture III. (page 40), have been alleged in proof. I am free to admit that the peptogens and dextrine may be absorbed by the rectum, but it is a sorry advantage to tantalize the stomach by making it secrete gastric juice when it is no longer a receptacle of food.

It is understood that I make here no reference to spirituous lavements; the latter in fact, are rapidly absorbed by the intestine and by their stimulating and waste-restraining action may play a considerable rôle in the case of enfeebled patients who cannot tolerate food by the stomach.

Hence then, alimentation by the rectum, aside from the use of peptones, is a therapeutic delusion, and as long as it cannot be shown that by lavements of broth or milk the temperature can be raised or the daily

* Chevalier on Alimentation by the Rectum (Thèse de doctorat, 1879), Dujardin-Beaumetz, on Alimentation by the Rectum, (Bull. de Thérap., Jan. 1879).

amount of urea augmented, I think myself warranted in denying all nutritive value to these lavements. In a word, lavements of broth or milk relieve patients but do not nourish them.

Moreover this view of the subject was long ago defended by a physician who made a special study of alimentary lavements. I refer to Regnier de Graaf, who in 1688, published a Latin treatise calling in question the utility of nutrient clysters.*

But it is not enough to know that only peptonized lavements can serve for nutrition, you must know how to prepare them, and how to make the mucous membrane of the rectum with alkaline secretion tolerate peptones whose reaction is decidedly acid. This is how I proceed in such cases: I precede each peptonized lavement by a copious injection of warm water to clear the rectum, then I throw up the following clyster, which the patient is to retain:

Into a tumblerful of milk to which is added the yolk of an egg, I introduce two dessertspoonfuls of solid peptones, or two tablespoonfuls of liquid peptones, then five drops of laudanum, and lastly a pinch (7 or 8 grains) of bicarbonate of soda if the peptones are acid. You know, in fact, that there are to-day acid peptones and neutral peptones, and as the secretion of the large intestine is alkaline, it is important that the nutritive lavements be either neutral or alkaline to counteract irritation of the intestinal mucosa, an irritation which it is very difficult to avoid, despite all the precautions which one may take for this purpose when forced to continue for a long time the administration of these nutrient injections.

But there is another condition which it is necessary to fulfill in order to render the nutritive lavements absorbable, namely to carry them up as far as possible in the intestine, and this you can attain by making use of the process by enteroclism. When I come to speak of rectal irrigations, I will describe at length this method which is counselled by Cantani. It is sufficient for me to tell you now that the best way to carry these nutritive mixtures well up into the colon, is to make use of the Debove tube, which this time you will introduce, not by the mouth, but by the anus. By the rigidity and the suppleness which its extremity presents, you can make this tube penetrate very high into the intestine, and according to the height which you give to the funnel, you can augment the intensity and force of the current.

Despite all the improvements which have been made in feeding by the rectum, it must be admitted that it is an exceptional procedure, and that it is difficult to continue it for a long time.

* R. de Graaf, Tractus de Clysteribus, La Haye, 1688. [He expresses himself doubtfully on the subject of these clysters, which he thinks cannot be absorbed, while lavements of spirits, may, he thinks, do good.]

But if the large intestine cannot suffice for prolonged alimentation, it must be admitted, on the other hand, that it is a useful channel for the administration of medicines. First Briquet,[7] then Demarquay[8] in France, and Savory in England, have shown us the rapidity of absorption for certain substances which the rectal mucosa presents, and which may even in some cases surpass that of medicines given by the mouth.

Clinicians have even gone farther, and have proposed to make use of the rectum, and of the facility of absorption of its mucous membrane, for the practice of anæsthesia.

Recommended for the first time by Pirogoff in 1847, anæsthesia by the rectum has been studied anew by Mollière of Lyons, who has shown all the advantages pertaining to this new anæsthetic method, which presents, however, a serious inconvenience in not enabling us to test the quantity of ether absorbed. Despite this drawback, the greater part of French and foreign physicians who have experimented with rectal anæsthesia, are unanimous in admitting the advantages which it presents when operations are to be performed on the head or trachea.

It is on this property of absorption by the rectal mucosa that are based two modes of administration of medicines; medicinal lavements and those excellent and often employed therapeutic agents, suppositories. Already, while speaking of chloral, I have told you of the advantages presented by the rectal administration of this hypnotic, and you will see as we go on that other medicaments are advantageously administered the same way. As for suppositories, they daily render us great service, especially those that have opium or belladonna for their basis.[9]

Thus far we have studied only the intestinal mucosa. Do not forget that this is only one of the component structures of the intestine; there is also a muscular layer which plays an important part in the intestinal functions, and which is the seat of the peristaltic movements with which the intestinal mass is animated, movements which in the normal state are unconscious, but which in pathological states become painful, and thus constitute what is known as colic. Legros and Onimus have given us a good study of this intestinal peristalsis.[10]

The intestinal movements are under the dependence of the nervous system, but the temperature and especially the circulation have a marked influence. Horvath of Kiew, has shown that in animals a low temperature paralyzes the intestinal movements, and that the latter are the more intense the more active the intestinal circulation is. The intestinal nervous system is quite complex. The intestine receives not only filaments from the pneumogastric, but also nerves from the great sympathetic and lumbar cord. These nerves are first distributed to two plexuses; the one is situated under the submucous coat, this is the plexus of Meissner; the other is situated between the muscular planes, this is the plexus of Auerbach; thence branches are supplied to the muscles, glands and blood-vessels.

Some of these branches preside over the peristaltic movements; others have under their dependence the intestinal secretions. Already Moreau had shown that it suffices to cut all the nerves which supply an intestinal loop to see a notable quantity of liquid accumulate there, but it is to Vulpian that we owe the most complete study of the action of the nervous system on the secretions of the intestine; he has put in clear light not only the important fact that the intestinal secretion and circulation are under the control of the ganglionic and medullary systems, but also that certain parts of the encephalic nervous centres have a marked influence on the functions of the intestine.

The intestine, moreover, is the seat of very important phenomena to which numerous physiological treatises have recently called attention; I refer to intestinal putrefaction and the absorption of toxic substances resulting therefrom.

It is to-day proved that fæcal matters contain toxic substances which Bouchard in 1882 was one of the first to isolate.[11] These toxic substances have the reaction of alkaloids, and belong to the great group of ptomaines and leucomaines of Selmi and Gautier.

Fæcal matters, moreover, contain products such as indol, phenol, and skatol, which originate in the putrefaction of animal substances. They contain, besides, leucin and tyrosin, which result from the action of the pancreas on pepsin, and finally all the derivatives, such as stercorine, excretine, etc., which are due to successive decompositions of the bile. But of these substances the most important by far are the first, by reason of their extreme toxicity. These alkaloids have a triple origin; they arise from the putrefaction of animal substances, whether from modifications effected in the constitution of the peptones, or from the presence of bacteria, which are the more numerous the nearer you approach the anus, as the curious experiments of Miquèl and Mariè Davy have shown. Let us examine each of these points. I shall not devote any more time to the first (alkaloids of putrefaction), for I have already under the head of "Putrid Dyspepsia" given sufficient attention to this subject.

Alkaloids arising from modifications effected in the peptones present the greatest interest, and it is to Tanret that the merit belongs of having first shown us, in 1881, that it suffices to place an alkaline substance in the presence of the peptones to obtain a body having the reaction of an alkaloid. Since then Brieger has obtained toxic alkaloids by the action of gastric juice on fibrin. Hence then, in the physiological state, as soon as the peptones pass from the stomach into the intestine, they *there* undergo modifications which transform certain of their elements into ptomaines or leucomaines.[12]

In fine, the micro-organisms contained in such great numbers in fæcal matters play a not doubtful part in the production of these alkaloids. To the axiom formulated by Bouley: "Every virulent disease is the function of a microbe," the following has been added: "the organic alkaloids are functions of microbes;" and pathologists have pretended that it is by the production of these alkaloids that the microbes possess toxic properties.

In support of this affirmation complete scientific proof is lacking, but what I can assure you is that these micro-organisms exist in great numbers in our digestive tubes, and that they are derived from several sources. They may come from the food which we eat, and from the air which we breathe, and which contains bacteria in prodigious numbers, or from the water which we drink, which is by no means free from them as the researches of Proust show.[13]

Hence then, as you see, in the physiological and normal state the intestine contains a certain quantity of toxic products, but these substances have no injurious effect on the economy, owing to their daily elimination by the stools, or by the different emunctories, and in particular by the urine. But let some untoward circumstance interrupt the harmony of these functions, and we see then supervene a series of symptoms which result from poisoning by these toxic alkaloids. These untoward circumstances arise either from disturbances produced in the functionating of the digestive tube, or from the penetration in excess of infectious micro-organisms, or from the non-elimination of the ptomaines.[14]

As you see, gentlemen, very important clinical deductions follow all these facts, deductions to which I cannot too much call your attention, but there are also therapeutic consequences which pertain to the necessity of regulating or of arresting these putrid intestinal phenomena. Such indications we can fulfill by the direct introduction of medicaments by the intestine, or by their administration by the mouth.

The first mode of antiseptic medication consists of disinfectant lavements, and when we come to speak of the treatment of typhoid fever, we shall see how useful they are.* It has been attempted to accomplish the same object indirectly by antiseptic medicines given by mouth, and here good results are attributed to the salts of bismuth, given in large doses, charcoal powder, phenic acid, especially iodoform, of which Bouchard has vaunted the antiseptic properties, and finally the bisulphide of carbon, which I have recommended. This latter medicament seems to me much superior to iodoform, which determines always, even in feeble doses, a marked irritation of the digestive tube. I use always, be it understood, water charged with sulphide of carbon to which, as I have already told you, I have given the name of carbon bisulphide water. This sulphide of carbon solution has no toxic property, and in the dose of from four to eight spoonfuls a day, it produces almost complete disinfection of the stools. I shall have more to say about antiseptic intestinal medication when I come to the treatment of infectious diseases in general and typhoid fever especially.

* See Clinical Therapeutics, Am. Ed., pt. III.

Having finished these brief anatomical, physiological, and clinical considerations, I come to the therapeutics of diseases of the intestines, and I propose to limit myself almost exclusively to the study of the treatment of two chief symptoms which you will often have to combat; constipation and diarrhœa. The next lecture will be devoted to the consideration of the first of these symptoms.

NOTES TO LECTURE XVII.

[1] The valvulæ conniventes are formed by a fold of the mucous membrane, and contain a great number of arterial ramusculi, veins, lymphatics, and loose cellular tissue. These folds appear first in the second portion of the duodenum; at this point they are but slightly conspicuous, and acquire their largest dimensions in the third portion of the duodenum, to disappear in the last convolutions of the ileum. Prof. Sappey was able, in a female, to count 556 in the first half of the small intestine, and according to this able anatomist, the total number of these folds is from 800 to 900.

The length of the small intestine varies from 8 to 9 metres; that of the mucous membrane (owing to folds just mentioned) from 13 to 14 metres, and the superficial extent of this membrane is about 10,125 square centimetres, representing two thirds of the total surface of the body, which in a man of average size, is equivalent to 13,350 square centimetres. (Sappey.)

The intestinal villosities present themselves under two principal types. The prevalent form of the villi is that of minute flattened triangular processes; others are conical or cylindrical, or even clubbed at their free extremity. The number of these villi is considerable, and according to Sappey, there are 12 to 14 villi to every square millimetre, which would make, for the whole extent of the intestine, a number equal to 101,125,000.

A cylindrical epithelium covers these villosities. Brestauer and Steinach in 1857, were the first to point out the ciliary prolongations which the epithelial cells of the villi present. Heidenhain, Erdmann, Ralogh, Eimer, and Basch, are also agreed on this point, and Thanhoffer has given a good description of these cilia. The bile accelerates the movements of these vibratile cilia, which play a very important part in the absorption of fatty substances.

Many histologists maintain that these vibratile cilia do not exist, especially in man.

Moreover, the villosities are the subject of movements which are produced by a double muscular layer, the one longitudinal, the other transversal. Prof. Robin has given a very complete description, which is worthy of consultation, respecting the question of the termination of the lymphatics in the intestinal villosities.

Brunner's glands are so called from the Swiss anatomist who (according to Wepfer) first described them, and whose name was not *Brunner*, but *Brun Von Hammerstein.**

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* J. Garel, Researches on the General Comparative Anatomy and the Morphological Signification of the Glands of the Gastric and Intestinal Mucosa of

[2] The mucous membrane of the large intestine is thicker, firmer, and less colored than that of the small intestine. It has neither valvulæ conniventes nor villi, but possesses vesicular glands or shut follicles, and tubular glands. These tubular glands are longer than those of the small intestine, and are often bifurcated at their deep extremity, which rests on the muscular layer to which it is adherent. The closed follicles are seated chiefly in the colon; in the rest of the intestine they are few in number, and of variable dimensions.

Albertoni had under observation a woman with false anus situated in the upper part of the ascending colon, and this is what he noticed: The secretion of the large intestine is a mucous liquid, of a white color, decidedly alkaline for 48 hours or more; its digestive properties are of little importance. Eggs, cooked albumen, meat, introduced by the false anus, were not modified, even after a long sojourn. As for milk, the aqueous part was absorbed, the caseous part expelled, the sugar was absorbed.

The same writer has made a great number of experiments with nutritive lavements on animals, and these are his conclusions:

1. Solid albuminoid substances do not undergo in the large intestine any digestive modification.

2. The liquid albuminoids of milk, of eggs, etc., are not modified in the large intestine. If they are absorbed they pass wholly or in great part into the urine, and consequently are not utilized by the organism.

3. The juices of the large intestine may emulsify fatty bodies, at the same time oil introduced into the last portion of the intestinal canal is in part expelled.

4. Crystallizable sugar disappears in the large intestine after having been transformed into glucose, and then perhaps into lactic and butyric acids.

5. Starch undergoes no modification there.

6. Undigested aliments which sojourn in the large intestine, take on there the character of fæcal matter, minus the color.

7. The juice of the large intestine does not change the color of tincture of iodine, as does the alkaline saliva, the serum, and other alkaline humors.

[3] Garland of Boston has studied the intestinal juice in dogs by the method of Thiry; these are his results:

"1. The intestinal juice transforms starch into sugar.

2. It acts in a doubtful manner on the albumen of coagulated egg, but it dissolves fibrin, and this solvent action is more active when hydrochloric acid is added.

3. The action of hydrochloric acid alone also produces, but more feebly, the transformation of fibrin into peptone.

[4] Max Marckwald also utilized a patient with artificial anus at the junction of the cæcum with the ascending colon, (an operation which had been performed by Simon of Heidelberg). His experiments have shown

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Vertebrate Animals, Paris, 1879. Sappey, Traité d'Anatomie, t. iv., p. 220. Defois, Anatomo-Physiological Studies of the Blood Vessels of the Small Intestines, Th. de Paris, 1874. Charles Robin, article Lymphatique in Dictionnaire des Sciences Médicales. Thanhoffer in Pflüger's Archiv., Bd. viii., 1873, p. 381-443. Milne Edwards, Leçons de Physiologie, t. vi., p. 104.

that the juice of the large intestine contains no glycogenic ferment, and that it digests neither fibrin nor albumen. As for absorption, the large intestine absorbs water largely, and peptones in small quantity, and especially when the latter are formed in the intestine; but masses of concentrated peptones irritate the intestine; albumen, introduced into the large intestine does not enter the blood, whether chloride of sodium be added to it or not. Marckwald concludes from these experiments that, save in the case of peptonized lavements, which cannot however suffice for nutrition, alimentary lavements are a therapeutic mistake.

These are the conclusions of Czerny, Latschenberger and de Fribourg:

1. The large intestine of man, and the liquids which it secretes, have no digestive action, either on coagulated albumen, on soluble albumen, or on fat.

2. In the normal state, soluble albumen (dissolved in water) is resorbed by the large intestine without being modified (digested). The longer the sojourn in the intestine of the albuminous substance, the larger the quantity absorbed, and any irritation of the intestine either hastens absorption, or suppresses it altogether.

Chloride of sodium also diminishes absorption, but is itself absorbed, even when the intestine is irritated, and the absorption of albumen is suspended. It is known that in the hen's egg, albumen exists in a form little favorable for absorption.

3. The large intestine absorbs fat in emulsion; the absolute quantity which passes into the organism is proportional to the degree of concentration, and to the time during which the liquid is in contact with the absorbent surface.

4. Sometimes cooked starch is absorbed, but it is not known whether it is absorbed as starch, or after transformation into sugar.

[a] Carville and Bochefontaine took two dogs and subjected them to rigorous abstinence from all food; to the one they gave only water, to the other two lavements of meat broth,—500 grammes—per day. The dogs both died at the same time.*

[4] Here are the different modes of preparation of peptonized lavements:

Leube uses the fresh pancreas (sweet bread) of a hog; Flint that of an ox. Their directions are as follows: Mince finely eight ounces of fresh meat, mix with one third part as much of fresh lean minced pancreas, pour on the whole eight fluid ounces of warm water, bruise the whole in a mortar to a soupy consistence, and inject in the rectum. To avoid any irritant effect on the lower bowel of substances not absorbed, Prof. Meyer proposes the following method: Crush the fresh pancreas of an ox in a mortar with warm water at 98° F., then squeeze the pulp through a linen strainer. The liquid thus obtained is triturated in a mortar with hashed lean meat and the yolk of an egg; all fibrous parts are rejected. The product is kept at a blood heat for two hours, and is then injected into the rectum which is previously emptied by a clyster of sweet oil.

This is Henniger's preparation employed by Daremberg:

Put one pound (500 grammes) of finely hashed lean meat into a glass

* Albertoni, in Lo Sperimentale, 1874; Garland, Intestinal Digestion, Bost. Med. and Surg. Jour., 1874; Max Marckwald, Arch. für path. anat.-physiol., t. xliv., p. 505, 1875. Czerny and J. Latschenberger, Arch. für path. anat.-phys., t. ix., liv. ii. Carville and Bochefontaine, Soc. de. biologie, 1874.

flask and pour on 3 quarts (litres) of water. Add 30 cubic centimetres of hydrochloric acid, density 1.15. Tinned receptacles, or such as are lined with copper or other metal must not be used. Add 2.5 gms. pure pepsin of full strength, *i.e.*, capable of digesting 200 times its weight of moist fibrin. Digest 24 hours at a temperature of 113° F. Bring to ebullition, then add of a solution of sodium carbonate (containing 250 gms. per litre of the crystallized salt) enough to give the whole a feeble alkaline reaction. To attain this result it is necessary to add from 155 to 170 cubic centimetres of the solution of carbonate of sodium. Pass the boiling liquid through a fine linen strainer and express. The liquid should then be concentrated in a sea-bath to 1500—1800 cubic centimetres, of which one half should be injected per diem. If you make use of peptones already prepared, you should dissolve in a cupful of warm water two or three teaspoonfuls of these peptones, and add five drops of laudanum to favor their retention by the rectum.

Daremberg in a case of stricture of the œsophagus kept a patient alive fourteen months by peptonized lavements; the figure of urea was kept at 15 to 20 gms. per day. In a case of ulcerous pharyngitis he obtained the same result; the figure of urea before using the lavements was 10 gms. rising to 17 gms. after the lavements were employed.

Catillon takes a dog weighing 10 kilogrammes, and feeds it on two lavements a day, each composed of 3 eggs peptonized by the addition of 6 gms. pepsin dissolved in glycerine. At the end of 37 days it had kept its temperature and its weight; (9.250 kilogrammes). The pepsin was then omitted from the lavements, and at the end of a fortnight the dog had lost 2.750 kilogrammes, with a fall of 2 degrees in the temperature. Then three lavements a day of blood (100 gms. each) were given. The effect was deplorable; the animal kept on losing weight, the temperature fell, and death ensued from starvation.*

[1] Briquet in a memoir to the Academy has studied the absorption of sulphate of quinine by the rectum. These are his conclusions:

1. The liquid which constitutes the lavements may easily be made to pass as far as the cæcum, and consequently be brought in contact with a very extensive absorbent surface.

2. The mucous membrane of the large intestine, and the liquids which bathe its surface have no chemical action upon the substances introduced into the large intestine, where nothing is absorbed but what is first in solution.

3. When soluble salts of quinine are administered in lavements in doses below 15 grains, a little more than a third of the quantity administered is absorbed.

4. When doses of more than 15 grains are administered, they are badly supported, and only a fifth or sixth of the quantity is absorbed.

5. It is only after an hour that traces of elimination in the urine (and consequently of absorption) are noted.

6. The duration of elimination is in general quite short, and ordinarily two to three days at the most.

7. The greater or less dilution (within certain limits), the more or

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* Brown-Séquard on Alimentation by the Rectum (Gaz. hebd., 1879), Daremberg, Alimentation by Peptones, (Gaz. hebd.), Mayet, Alimentary Lavements, (Gaz. hebd., Dec., 1879), Catillon, Comptes Rend. de la Soc. de Thérap, 1879.

less viscous nature of the liquid, and finally, the addition of salts of morphine to the alkaloids of the cinchonas, do not sensibly modify the absorption.

8. Young people absorb better than adults; old people absorb badly.

9. The cinchona alkaloids administered in lavement in doses below 15 grains may render all the service which can be looked for from these alkaloids when given in small doses by mouth.

10. It is not so, however, in the case of massive doses; these are never absorbed in sufficiently large quantity to produce stupefying or energetic effects.

11. The large intestine can not generally be made to tolerate more than 75 grains of quinine at once.

[9] Demarquay gave lavements of 200 gms. containing one gramme of iodide of potassium, and then sought for iodine in the liquids of the economy. Absorption was always more speedy by the large intestine than by the stomach, and at the end of about five minutes the iodine appeared in the saliva after an iodide lavement.

Savory studied in animals the absorption of strychnine, KCy, HCy, and nicotine, administered both by the mouth and by the rectum. These are his conclusions:

1. Strychnine in solution has a more rapid action by the rectum than by the stomach; KCy and HCy act with the same activity by both ways; nicotine is more active by the stomach.

2. The presence of food in the stomach does not in any thing modify the energy or rapidity of action of strychnine.

3. If strychnine be given in powder it is absorbed better and more quickly by the stomach than by the rectum.*

[9] A good suppository is made as follows:

Take of:

Opium	$\frac{1}{3}$rd grain.
Ext. belladonna, ...	$\frac{1}{4}$th "
Cacao butter, ...	75 grains.

Mix, for one suppository. [The suppositories of morphia and tannic acid (U. S. P.), are among those most in use in this country.—Trans.]

[10] The muscular coat of the intestine is composed of two planes; the one, superficial, is constituted of longitudinal fibres, the other, deep, is formed of circular fibres; the latter is two or three times the thickest.

In the large intestine, the layer of longitudinal fibres does not form a complete lining to the intestine, and constitutes three longitudinal bands which all start from the appendix vermiformis, and here form the thickest

* Briquet, Bulletin, de l'Acad. de Méd., t. xii., p. 237. Demarquay, Researches on the Absorption of Medicaments by the Rectum (Union Med., 3d series, 1877). Savory, *Lancet*, March, 1864. [With regard to anæsthesia by the rectum, to which the author devotes a short footnote, this process, for a while tried in this country, has completely gone out of vogue, being found to be not unattended with danger, while being certainly inconvenient. The ether is introduced into the rectum through a small tube which is in communication with a flask containing the ether, and which is kept in warm water at a temperature (about 120° F.) sufficient to set free the anæsthetic.—Trans.]

layer, while, on the other hand, the circular fibres are so thin that their existence is denied by some authorities.*

[11] Bouchard in 1882, found certain alkaloids in fæcal matters; these alkaloids are numerous; some are soluble in ether, some insoluble, and all are eminently toxic.

In 1883, Arnold also extracted toxic alkaloids from fæcal matters.

In fæcal matters are found substances which result from putrefaction; these are indol, phenol, and skatol.

Indol is a substance which, under the influence of chlorine takes on a rose color. Tiedmann and Gmelin discovered it in 1826 in matters contained in the duodenum. Claude Bernard noticed it in the pancreas. Kuhne showed that it is a product of putrefaction, and in 1878 Radziejewski pointed out that indol is a constant constituent of the stools. Two opinions have been put forth as to the origin of indol in the intestine. Hoppe Seyler and Salkowski maintain that it is due to the action of pure pancreatic juice. Kuhne, Neneki, Brieger, Hufner, claim that indol is the result of the action of bacteria in the intestine. Indol passes out in the urine under the form of indican. In fact, Jaffé in 1872 showed that indican is augmented in the urine under the influence of subcutaneous injections of indol, and it seems clear that this indican in the urine represents the indol absorbed from the intestine, and oxidized in its passage in the blood.

As for phenol, Baumann was the first to find it in the stools; it can also be detected in the urine, as the investigations of Stoedeler show.

Miquel and Mariè Davy have sought for micro-organisms in different parts of the organism, but have found bacteria only in the lungs and intestine. In the intestine, microbes are the more abundant the nearer the anus they are sought for.†

[12] Tanret has shown that the peptones are transformed into alkaloids; it suffices for this to treat peptone by neutral carbonates, or by caustic potassa and to add ether. Ether dissolves a small quantity of a volatile liquid with alkaline reaction, which presents all the reactions of the alkaloids. If these peptones are left to putrefy, there is formed besides a notable quantity of a non-volatile alkaloid. Tanret thinks that these alkaloids do not exist ready formed in the peptones, but are produced there by the action of alkalies.

In 1883, Brieger extracted certain alkaloids from these peptones. Gastric juice is made to act on 200 gms. of fibrin, and the whole evaporated to a syrupy consistence and subjected to amylic and butylic alcohol; an amorphous body is thus obtained which has the reactions of alkaloids,

* Sappey, Traité d'anatomie descriptive; Legros and Onimus, Experimental Researches on the Movements of the Intestines (Journal de Robin, 1866, p. 187).

† Bouchard, Soc. de biol., August 3, 1882. Arnold on Ptomaines, in Arch. Pharmacie, 1883. Tiedmann and Gmelin, Researches on Digestion, 1828. Claude Bernard, Memoir on the Pancreas, 1856, etc. Kuhne, Erfahrungen und Bemerkungen über Euzyme und Fermente, 1877. Radziejewski (in Arch. f. Anatomie, 1870). Hoppe Seyler (in Zeit. für Physiologische Chemie). Staedeler, Annaler der Chemie und Pharmacie, xc. Marié Davy, Annuaire de l'Observatoire de Montsouris, 1882, p. 494, etc., etc.

and kills frogs in the dose of from 5 to 10 centigrammes, and hares in the dose of one gramme.*

[13] Proust and Fauvel, by their process of gelatine culture, have studied the development of the proto-organisms in potable waters, and in particular, those of the Seine. By means of glass slides with cut squares having sides of 2 millimetres, they have been able to measure the number of culture colonies and have found from 8,000 to 242,000 bacteria to each cubic centimetre. A resident of Paris drinking Seine water from the Vanne, will swallow in each tumblerful (the tumbler being of the capacity of 250 centimetres) 2,750,000 microbes.†

[14] Humbert in 1873, called attention to the intestinal septicæmias, but at this time nothing was known of the existence of microbes or of ptomaines in the intestine. Humbert divides these septicæmias into two groups, according as there is or is not retention of matters in the intestine. (*Humbert, Des Septicæmias intestinales, Th. de Paris,* 1873). In the first group he places constipation, strangulation of the bowel, and acute indigestion; in the second, typhoid fever, and suppurations of the mouth and pharynx.

Bouchard considers the intestinal poisons as the principal cause of uræmic accidents. The accumulation of a considerable quantity of ptomaines in the blood is due to the four following conditions: 1, Want of elimination by the kidneys; 2, Want of destruction by the liver; 3, Excess of absorption by the intestine; 4, Excess of production of the ptomaines in the intestine.‡

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* Tanret, Peptones and Akaloids, Comptes Rend. de l'Acad. des Sc., 1881. Brieger, Zur Kentniss der aromatischen substanzen, 1883.

† Proust, Academie de Médecine, Session of Oct. 21, 1884.

‡ Proust, Académie de Médecine, Séance du 21 October, 1884. Humbert, Des septicémies intestinales, Th. de Paris, 1873. Bouchard, Du rôle pathogénétique de la dilatation de l'estomac (Soc. méd. des hôp., June, 1884). Comby, Du rôle pathogénique des alcaloïdes qui se forment dans le tube digestif (Progrès Kédical, 31 May, 1884). Netter, Des poisons chimiques qui apparaissent dans les matiéres organiques en décomposition et des maladies qu'ils peuvent provoquer (Arch. gén. de méd., September et October, 1884, p. 477). Ckiandi-Bey, Sur les propriétés antiseptiques du sulfure de carbone (Comptes rend. Acad. des Sc., t. xcix., nº 12, 1884, p. 509). Sapelier, Sur les propriétés physiologiques, thérapeutiques et toxiques du sulf. de carb., Th. de Paris, 1885.

LECTURE XVIII.

THE HYGIENIC TREATMENT OF CONSTIPATION.

SUMMARY.—Definition of Constipation—Course of the Alimentary Bolus —Intestinal Calculi—Defecation—Fæcal Matters, Composition—Dangers of Constipation—Hygienic Treatment of Constipation—Influence of Alimentation—Vegetable Diet—Fruits—Beverages—Water—Climate—Exercise—Gymnastics—Influence of Habit—Moral Influences—Hydrotherapy—Applications of Cold Water—Douches—Lavements, their History and Origin—Modifications in the Instrument—The Age of Lavements—Action of Lavements, their Advantages and Disadvantages.

CONSTIPATION is characterized by the absolute scantiness or insufficiency of fæces, and the dryness and hardness of the matters expelled. In the present study I shall leave one side the symptomatology and diagnosis of constipation, but I shall dwell on the pathogeny and etiology, and this because these two divisions of our subject belong especially to therapeutics, for the old adage: *sublata causa, tollitur effectus,* is here especially applicable. But in order well to know the pathogeny and etiology, we must have recourse to physiology, and obtain an exact notion of the course of the alimentary bolus, and of the modifications which it undergoes in the intestine; this will enable me also to apply certain practical data which I gave you in the foregoing chapter.

The alimentary bolus, after having been in the stomach subjected to impregnation by the gastric juice, and after the conversion of the albuminoid matters into peptones, passes into the duodenum. There the medium changes; it was acid in the stomach, it becomes alkaline at the ampulla of Vater, and this alkalinity is due to the action of bile, which at this point is poured into the duodenum; then the alimentary bolus by reason of the lubrifaction of the intestinal walls, and the incessant movements of the intestine, descends little by little to the ileo-cæcal valve (Bauhin's valve), through which it passes, and penetrates the large intestine.

It is there, as Spring has remarked, that capropoiesis commences, that is to say, the formation of fæcal matters properly so called, which become moulded to the walls of the intestine, so as to reproduce in certain animals the exact form of the intestines.[1]

As soon as the alimentary bolus has cleared the ileo-cæcal valve, it enters a diverticulum of the large intestine, which, if it does not play an important part in digestion, at least in man, offers nevertheless, from the point of view of constipation, a great interest; I allude to the cæcum. Fæcal matters may in fact accumulate there, and if the muscular contractility of this reservoir is enfeebled, their presence may determine grave inflammations, which have been described under the name of typhlitis and perityphlitis.

This accumulation of fæcal matters in the cæcum is attended with another feature of interest, namely, that owing to the declivous position of this reservoir, which is placed below the mouth of the small intestine, the prolonged sojourn of these matters does not necessarily entail constipation, since the liquids constantly secreted by the small intestine find a free vent in the large intestine.

It is also chiefly in the large intestine that intestinal calculi are found; these are rare indeed in man, where Laboulbène has nevertheless discovered them, but frequent in animals, the horse for instance.[2]

Impelled onwards then by the peristaltic movements of the large intestine, the fæcal matters traverse the large intestine, becoming drier in their transit, sojourn some time in the sigmoid flexure, then descend to the rectum. By their presence here they determine at the lower outlet a special sensation which reflexly calls into play that complex mechanism in which the abdominal muscles concur with the intestinal muscles in forcing the sphincter ani, and in the expulsion of the fæces by the act of defecation.

O. Beirne, of Dublin, has maintained that the fæces always stop at the sigmoid flexure, and do not sojourn in the rectum; this view is also held by Johnston.* I believe, however, that it is a mistake, and the gynæcological touch suffices to show how often fæcal matters accumulate in the rectum, pressing forward more or less the posterior wall of the vagina.

What do these fæcal matters consist of? They are the residue of aliments; they are composed in great part of substances which are not utilized in nutrition; cellulose of vegetables, and cartilaginous substance, epidermic tissue, and animal fats. There was a time when one of these products was employed in therapeutics; I allude to *album græcum*, a veritable fæcal residuum.[3]

The quantity of these matters is variable, and is largely dependent on the food that is eaten. They have an alkaline reaction, and their color as well as their odor depends, in great part, on modifications undergone by the bile which is poured into the intestine; you will find, in fact, in the fæcal matters all the principles which are derived from the biliary elements, cholinic, fellinic acids, dyslysine, excretine, etc.[4] They contain also, as we have seen in the last chapter, certain products of putrefaction,

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* Pepper's System of American Medicine, vol. ii., p. 638.

such as indol, skatol, phenol, etc., then microörganisms, and lastly, ptomaines and leucomaines.[5]

Now that we have considered the course and nature of the alimentary bolus in its transit to the lower extremity of the digestive tube, let us study the pathogeny of constipation.

Scantiness of the stools owns different causes:[6]

1. It may result from a mechanical obstacle to the passage of the fæcal mass; this is constipation by obstruction, to which I shall devote a special chapter.

2. In other cases, constipation is of alimentary origin. Already in the chapters on Aliments and Regimen, I have given due consideration to the facts adduced by Voit which show that the quantity of fæcal matters varies according to the diet, and that the more substances useless for nutrition predominate, the more abundant are the fæces, and that, conversely, the more assimilable the food, the less in quantity are the stools.

3. In a third group enter the constipations which depend on want of secretion of the intestinal juices. The bile on the one hand, the intestinal juices on the other, aid the passage of the alimentary bolus; if the one or the other is deficient, the march of the former is stayed, and there is constipation.

4. Lastly, the muscular coat plays a considerable part in the progress of the alimentary mass; the peristaltic movements favor the transit of the fæcal bolus, but let anything diminish the contractility of the unstriped muscle, and there is arrest of the descent of the excreta, and constipation.

5. In a last group there is no obstacle to the course of the fæcal matters, but at the moment when defecation ought to be accomplished, one of two things may take place: either the patient, as frequently happens in persons affected with medullary spinal disease, fails to experience that peculiar sensation which is the starting point of the reflex action which brings about expulsion of the excreta, or else he suffers at the moment of defecation so severe a pain that he makes an unconscious effort to avoid dilatation of the anus, and thus prevents expulsion of the fæces; this is what happens, as you are aware, in fissure of the anus.

Such, gentlemen, are the causes which produce scantiness of the stools; you see that each group claims a special mention, and that each requires a particular treatment. But before entering upon the study of each of these divisions, I desire to present certain hygienic considerations upon the treatment of constipation. Hygiene, in fact, plays an important rôle, and I shall sum up for you the principal precepts applicable to such cases.

The first place should be assigned to diet. When I spoke to you of the regimen applicable to diseases of the stomach (Lecture IV.), I alluded to the copiousness of stools which result from substances not absorbed, and I mentioned the facts related by Voit. I shall not spend any more time on them now, only recalling to your mind that the more an individual subsists on albuminous and easily assimilable food, the more scanty become the stools, while, on the other hand the more vegetable the diet, the more abundant are the fæces.

Hence when called to prescribe for persons that are constipated, you should insist on the use of a vegetal diet, and surely the repute which such substances as spinach have in costiveness results from the fact that they contain a great deal of cellulose, which augments the fæcal residue. Thus it is that the employment of bran bread, Graham bread, or rye bread oftentimes regulates the bowels in persons that make use of it.

You see that some aliments more than others predispose to stools, and may thus combat constipation. In this group you will place ripe fruits, and in particular prunes, which often serve for the preparation of purgative ptisans and electuaries. Grapes have the same effect, as I have told you in a previous chapter. In the same group certain fatty bodies enter, which being poorly or incompletely absorbed by the stomach, determine a purgative action. I shall return to this subject under the head of oily purgatives; lastly certain saccharine matters, such as honey and molasses, have, as you know, a laxative action. But the use of potable water has not a little to do with the scantiness or abundance of the stools. In this respect the drinking waters ought to be considered from the three following points of view: temperature, quantity and quality.* The temperature of the water has in fact, a great influence on intestinal troubles, and in the chapters on diseases of the stomach I showed you that the use of ice water often speedily causes diarrhœa. As for the quantity, the less one drinks, the more scanty are the stools, and *vice versâ*. As regards quality, those drinking waters that are *hard*, *i.e.*, impregnated with calcareous principles are apt to cause obstinate constipation; if, on the other hand, they contain considerable azotized ingredients they produce diarrhœa, and we find here an explanation of how it is that persons changing locality or climate are often subject to diarrhœa or constipation. People from the provinces who come to reside in Paris almost always experience purgative effects from the usage of the waters of the Seine, which are rich in organic matters, while the Parisian experiences the contrary effect when he goes to the country and drinks the hard water of the wells or springs.

Other drinks may also cause diarrhœa, and without speaking of sweet wine, I may mention perry and cider, which act in this way in persons not habituated to their use; the same may be said of beer. Milk has been also accused of provoking laxative effects; this can only be exceptionally

* See the remarkable thesis of Armand Gautier on Potable Waters. Thèse, Inaugural, 1862.

the case, and there are abundant observations which prove that properly carried out, a milk diet does not produce diarrhœa, but constipation. Nevertheless coffee in which milk largely enters is apt to favor free action of the bowels, and some persons are regularly purged thereby.

I will join to the alimentary hygiene the use of tobacco, which is laxative in some individuals. Many smokers will assure you that when they leave off smoking, they become constipated, and that smoking after meals promotes regularity of the bowels.

Exercise in the open air has also an incontestable influence on constipation, and it may truly be said that it stands next to diet as a remedy for this morbid state. Intestinal inactivity, and torpor of the muscles of defecation attend general muscular enfeeblement, and the less exercise one takes, the more he is disposed to constipation. Hence it is that we almost always see constipation in persons of sedentary habits, and it may be affirmed that the habitual constipation from which so many women suffer is the result of the inactive life which they lead. Order exercise then, such as walking and gymnastics. While hardly going so far as to advise abdominal gymnastics (to which I have previously alluded), there is certainly much that you can do to favor the regular movements of the diaphragm and abdominal muscles, and you cannot too much insist on the corporeal exercises which increase the force of the muscular group which enters into play in the act of defecation.

There are certain special movements which favor diarrhœa, such as the trembling motion of railroad cars and carriages; horseback riding and yachting, however, predispose to constipation. These are I know individual peculiarities, but they deserve to be noted.

Habit plays also a great part in the pathogeny of constipation. There are persons—and females especially—who can remain without inconvenience from a week to a fortnight without having a stool. These are, I know, exceptional cases, but it may be stated that ordinarily women do not go to stool oftener than every two days, while men, on the other hand, find themselves constipated if they do not have one or two stools a day.

The period of defecation is another important point; some persons have the habit of going to stool at a regular hour every day. Utilize this fact, and if you have to do with patients that are constipated, recommend them to go to stool at a fixed hour every day, and the early morning is the better time; they should solicit an evacuation, even though for a time they may not succeed in these daily attempts.

Mental and emotional states have a marked influence on constipation, and without speaking here of neuroses, such as hysteria, or of mental perversions, such as insanity, which are so often accompanied by obstinate constipation, I must call your attention to the reciprocal influence of the moral affections on constipation, and of constipation on the moral affections, an influence still badly understood, but which is none the less a reality, and what

Voltaire has written about it is and always will be true.' Moreover, Vulpian, by the experiments which he has made, and to which I alluded in the foregoing chapter, has pointed out the action of certain parts of the encephalon on the intestinal circulation, and put in clear light the close bond which unites the cerebral functions to those of the intestine.

The influences of external circumstances both in the development and cure of constipation is quite as unquestionable, and it is a trite observation that changes of climate produce either constipation or diarrhœa, oftener the latter. Diarrhœa is a frequent accompaniment of acclimatization in warm countries.

The influence of cold moisture on the abdomen being one of the most ordinary causes of diarrhœa, you well understand why this means has been advised in the treatment of constipation; wet cloths, or cold water in the form of douches being applied over the abdomen of constipated persons. Hydrotherapy is of undoubted utility in constipation. Sauvages in his Medical Nosology mentions cases of obstinate constipation thus treated by Chaptal; Schedel relates also a case of cure which once made considerable noise, and contributed not a little to the reputation of Priestnitz; it was that of the only son of a prince of Lichtenstein, who, affected with a constipation rebellious to all kinds of treatment, was cured by the application of cold water.*

How does cold act in combating constipation? It is by increasing the peristaltic movements of the intestine, and this increase is not due directly to the fall of the temperature, which, on the contrary, would have an opposite effect, as we have seen, but to the fact that this chilling of the periphery entails without doubt a greater circulatory activity of the intestine, and thereby an augmentation in the intestinal contractions.

Every vaso-motor cause, moreover, which can bring about this active intestinal congestion, will produce this effect, and it is thus that we can explain certain curious facts like, for instance, that of the Duke of Ferrare, who could never have a stool unless he went to the water-closet walking with his bare feet on the cold flagstone floor.

Besides the application of cold and cold water, I will mention another means which may render good service. I allude to perineal, anal, and rectal douches, which act directly, not only on the muscular wall of the rectum, but also on the congeries of muscles which take part in the act of defecation, and this leads me to speak of lavements which play so great a part in the treatment of constipation. Permit me to sum up in a few words the history of this useful therapeutic agent.

The origin of the clyster has been carried far back into antiquity, and if we may believe the fable, it is to the stork or the ibis that we owe the

* Sauvages, Nosologie Médicale, t. iii. Schedel, Examen Critique de l'Hydrothérapie, p. 34.

invention of this therapeutic means. One of these birds, so says the story, suffering from constipation, was seen to take up in its beak a quantity of water and spurt it in the anus, thus relieving itself of its distress.[8] Hippocrates, Celsus, Galen, Oribasus and Asclepias without hesitation adopt this legend as of historical validity. These ancient physicians were much in the habit of prescribing lavements, which they administered by means of a hog's bladder filled with water and adapted to a tube made from a twig of elder; the latter was introduced into the anus, and by pressures more or less energetic on the bladder, the liquid was made to penetrate the intestine; this was the clyster bag so long in fashion.

Even in our day, in some parts of the world yet little abreast of the progress of civilization, the inhabitants make use of an apparatus still more primitive, namely, the horn of a ruminant, the little extremity of which is pierced with a hole; and the liquid to be injected is turned into the cavity of the horn and made to penetrate the rectum by gravity. The natives of South Africa use a large hollow gourd for this purpose; the little extremity is introduced into the anus, the gourd is filled with water, and an assistant, applying his mouth over the large extremity, forcibly blows the liquid into the intestine.

The clyster bag has undergone a notable evolution in modern times; already in 1496 the syringe, which may be called classic, was in use, and the invention is ascribed to Guatinaria, whose instrument was, however, soon perfected. One of the most important modifications is that which originated with De Graff, and in the translation of the Treatise on Clysters, a translation which is the production, we are told, of one of our most learned and brilliant colleagues, we see the immense importance which De Graff attached to the improvement which he introduced, and which consisted in adapting to the syringe, instead of the rigid tube in use, a flexible tube of considerable length. Then it occurred to some clever contriver to give a right angular curve to the extremity of the long delivery canula, so as to enable the patient to give himself the injection.[9] Lastly a suction and force-pump was made; this was the *clyso-pump;* and since then all these instruments have disappeared to give place to the irrigator of Eguisier, who has invented, it must be acknowledged, one of the most handy apparatuses for the administration of lavements.[10]

The communication of René de Graff to Plempius, professor of the Academy of Louvain, in which he announces his invention of the flexible tube, and the difficulties which he had overcome in bringing about this improvement, bears date March 14, 1669.

All physicians from the most remote ages have counselled the employment of clysters, and used this remedial agency. In the Middle Ages the lavement was in vogue, and Guy de Chauliac never went out without his clyster bag under his arm. But the epoch in which the clyster reached its maximum of popularity was the reign of Louis XIV., which may truly be called the age of clysters.

It is difficult to imagine the extent to which the infatuation for lavements was carried at this epoch. To get an idea of it, you must read the private journals of the times, and you will find recorded the fact, which seems to-day so improbable, that on the occasion of a royal reception, the Dauphiness caused an enema to be administered surreptitiously to herself by a chamber-maid. Moreover the physicians of the great king have carefully registered all the clysters given to their august client, and the number of them is considerable.[11]

There has come down to us, relative to this mania for clysters, a very curious document; it is a suit brought against a canon of Troyes, François Bourgeois, by a nurse Étiennette Boyeau, who having administered 1190 clysters to this canon in the course of two years, demanded of her patron the sum of two sous six deniers per lavement.[12]

Molière has, moreover, given us a very correct picture of this infatuation for lavements in his immortal comedy the "Malade Imaginaire" and the account of the apothecary Fleurant is in perfect conformity with what we find in the treatises of medicine of that period.[13]

What does physiology teach us about the administration of clysters? Notwithstanding their aversion to lavements, it is to English authors that we are indebted for the most complete information on this subject. Christison, Anthony Thomson, Denman, Graves, and Marshall Hall have given us very interesting facts in this connection, which show that during life lavements cannot go beyond the ileo-cæcal valve; the name of "apothecary's barrier" is then applicable to this valve, as René De Graaf long ago maintained. These experiments show us that with the ordinary means of injection, lavements penetrating the rectum hardly reach the sigmoid flexure of the colon, and the quantity that can be thrown up does not habitually exceed from one to two pints.[14]

Bear in mind that I am not speaking of injections forced into the large intestine under great pressure. When I come to speak of the treatment of intestinal obstruction, I shall show you that the lavement may by appropriate means be carried much further, and made to penetrate a considerable extent of the large intestine, and possibly, as Cantani believes, the small intestine.

Cantani, in fact, by the method called enteroclism, believes that he has made fatty substances, as oil, pass the ileo-cæcal valve. He pretends that in three cases he has seen lavements of oil, introduced by his method, cause vomiting of the oily matters which were introduced by the anus. Despite the scientific rigor with which his observations have been taken, I believe nevertheless that these facts are exceptional, and that the rule generally holds good that the ileo-cæcal valve constitutes an impassable barrier to liquids introduced by the rectum.

What are the advantages of simple lavements? What are the disadvantages? There has been much said about the abuse of clysters, and it has been asserted that they cause inactivity or paresis of the muscular fibres of the rectum, and that their prolonged use is harmful.

I am of opinion that these evils have been greatly exaggerated; you can easily avoid this muscular enfeeblement so often referred to as a consequence of too frequent lavements by using the water cold instead of warm. Cold water, in fact, by the reaction which it produces, excites contraction of the muscular fibres, breaks up the fæcal matters, and favors their expulsion.

It is then a good means to combat constipation, but do not forget this important point, that if the constipation has long lasted, the lavement alone cannot overcome it, for it does not penetrate the rectum; the canula introduced by the anus lodges in the fæcal matters which close the orifice and thus prevent the water from passing into the intestine. In these cases you will have to assist directly by the aid of a spoon handle or the finger in breaking up the fæcal mass and removing it piecemeal. These are procedures to which it is often necessary to resort in old people.

Such, gentlemen, are the different hygienic means at our disposal for the cure of constipation. In the next chapter I shall take up the subject of the pharmaceutical treatment.

NOTES TO LECTURE XVIII.

[1] In England in jurassic strata at Lyme-Regis have been found the coprolites of the ichthyosaurus; these coprolites present spiral impressions which have enabled naturalists to establish the structure and the form of the digestive tube of this antediluvian animal.*

[2] The intestinal calculi which have been found in animals, chiefly ruminants and solipeds, have been called bezoards.

Bezoards used to be considered as possessing great medicinal virtues; two species of them were described; the first called *orientals* came from the stomach of the goat or gazelle; those called *occidentals* were brought from America, and were found in the stomach of llamas. Finally, under the name of German bezoards, were designated those that were met with in the stomach of goats and of cattle.

In animals there is often found within these calculi a central nucleus formed of hairs. All these bodies have been analyzed and are constituted almost exclusively of carbonates and phosphates of lime. Ambergris is an intestinal concretion found in the stomach of the spermaceti whale. In the horse, these concretions sometimes attain to a large size, so as to weigh as much as 14 pounds.

Bouley has recently presented to the Academy an intestinal calculus found in a horse, and weighing somewhat more than five pounds. Accord-

*Buckland, On the Discovery of Coprolites on Fossil Fæces in the Lyme-Regis and other Formations.

ing to Colin these calculi are developed in only one region of the intestines, called diaphragmatic or gastro-diaphragmatic, and may sojourn in these pouches without producing harm.

In man the intestinal concretions have often for their point of departure a foreign body, such as a fruit stone, a seed or a gall stone; they are constituted by calcic carbonates or phosphates, or by fatty substances. Sometimes these foreign bodies are of a gritty nature called intestinal gravel, which is constituted by silica, and surrounded by ammoniaco-magnesian phosphates. This intestinal gravel results from a dietary almost exclusively vegetal. Huss and Mossonder found a human calculus with a diameter of 16 centimetres (about 6½ inches). Finally in the human intestine have been found magnesian calculi; instances have been observed by Blondeau and others.*

[3] A stercoraceous matter from dogs fed exclusively on the bones of sheep, and deprived of drink. A medicament long gone out of use, though sanctioned by the ancient Codex.

[4] Wehsarg, who has made a particular study of the fæces, has shown that in man the total quantity of excrements voided daily varies between 67 and 306 grammes (2 and 10 ounces), with an average of 131 grammes (4½ ounces); the solid matters contained in the fæces vary between 16 and 57 grammes (½ ounce to 2 ounces), with an average of 30 grammes (1 ounce). As for the quantity of alimentary substances not digested, the extremes were 8 grammes (ʒ ii) a day, and (the minimum) 0.8 gms. (12 grains.)

Valentin has shown that the precipitate furnished by human bile in decomposition gives off the odor of fæcal matters; at the same time the kind of food has an influence on this odor.

Choleic or taurocholic acid gives rise in decomposition to taurin and cholalic acid, which itself forms a neutral substance, *dyslysine*, which was discovered by Berzelius. Marcet has found in the fæcal matters of man a special substance which he has described under the name of *excretine*. This substance, which has for formula: $C_{78}H_{78}S_1O_2$ comes from the decomposition of taurin.†

[5] According to Netter, Leuwenhoeck noted microörganisms in the fæcal matters; he observed them under two states, corpuscular and eel-shaped. Frerichs described five forms of fungi found in the digestive tube: 1. The baccal alga; 2. The yeast fungus; 3. A fungus with mycelium; 4. The cryptococcus guttulatus (which causes pustules); 5. The sarcinæ.

Nothnægel describes five species: 1. Round and rod-shaped bacteria. Every stool contains millions of them. The rods are most abundant in liquid stools, the cocci in thick fæces; the latter may be arranged in necklaces, or agglutinated into a gelatinous stroma; 2. Bacillus subtilis of

* Blondeau, On an Intestinal Calculus, Soc. de Thér., 1879. Laboulbène, On Intestinal Gravel, Arch. Gén. de Méd., 1873. Vaquelin, On the Formation of Bezoards, Ann. de Chem., 1812, etc., etc.

† Wehsarg, Mikroskopische und Chemische Untersuchungen der Fæces gesunder erwachsener Menschen, Giessen, 1853. Valentin, Lehrbuch der Physiologie des Menschen, 1847, t. i., p. 369. Marcet, An Account of the Organic Chemical Constituents or Immediate Principles of the Excrements of Man and Animals. Philo. Transac., 1854, p. 265.

Cohn; 3. The saccharomyces, or yeast plant; 4. Clostridium, or elliptical organism, rod or lozenge-shaped, colored blue by iodine, and resembling the butyric ferment of Prasmowski; 5. A smaller organism, also stained by iodine, and which is, perhaps, the mycoderma Pasteuri.

Quite recently M. Stahl has announced to the Congress of German physicians that he has noted and cultivated 25 species of bacteria normally present in the digestive tube.*

[6] These are the different divisions which have been proposed for constipation: Piorry admits three kinds,—one, due to alimentation: *sterco-renterectasis;* the second due to a mechanical obstacle to defecation: *dyscoprotis;* a third, arising from intestinal paralysis, *rectonervia.*

Colomb has also three groups: in the first are ranged those causes which have their point of departure in the intestine itself; in the second, the alterations of the intestinal walls; in the third all causes which are apart from the intestine.

Spring's divisions of constipation are as follows: 1. Saburral constipation, due to alimentation; 2. Toxic constipation, caused by medicines or poisons; 3. Cholestatic constipation, due to absence of biliary secretion. 4. Gastric constipation, which accompanies affections of the stomach; 5. Spasmodic constipation, observed in the great neuroses; 6. Paralytic constipation, from paralysis of the intestine or abdominal walls; 7. Hyperæmic constipation, from chronic hyperæmia of the intestines; 8. Hypocrinic constipation, due to dryness of the intestine; 9. Cerebral constipation, observed in affections of the brain; 10. Stenotic constipation, the result of mechanical obstacle.†

[7] Voltaire, "*Romans, Les Oreilles du Comte de Chesterfield et le chapelain Goudman,*" Chap. VII. "Those persons who are in good condition, * * * whose bowels are freed by an easy, regular peristaltic movement every morning as soon as they have breakfasted, * * * "those who are thus favored by nature, are meek, affable, gracious, kind. A *no* from their mouth comes with more grace than a *yes* from the mouth of one that is constipated."

[8] Guy de Chauliac: "The enema or clyster dates from the stork, which once on a time having pains in its belly, took up sea water in its bill and squirted it into the rectum, as Galen relates in the introduction to his work on Medicine.

According to Mondiere, the inhabitants of the Gold Regions of Africa use for syringe a dried hollow gourd, having the form of a flask with long curved tube; they introduce the small extremity into the anus and cause the liquid with which the gourd is filled to penetrate the intestine, either by pressure of the hand, or by the help of an assistant, who, applying his mouth to the large extremity, forces the liquid into the rectum by the blast of his breath.

[9] It is in Ambroise Paré that we find the first description of this modi-

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* Netten, On Chemical Poisons which Appear in Organic Matters in Process of Decomposition. Archiv. Gen. de Méd., Sept. and Oct., 1884. Leuwenhoeck, Letter to Hook, Leyden, 1787. Frerichs, in Wagner's Handworterbuch des Physiologie. Nothnægel, Zeitschrift für Klinische Medizin, 1881, iii.

† Spring, Symptomatologie, t. i., p. 177.

fication in the clyster syringe; these are his words: "Now there are certain women who from a sense of shame and modesty could on no account be persuaded to receive a clyster from the hands of a man; for this reason I have devised this instrument by which they can administer to themselves a clyster, placing the apparatus in front of them, with the hips a little elevated, and the canula in the anus; then the liquid is poured into the bag (which is manipulated by the hand).*

[10] According to Colson, it is not to Guatinaria, who died in 1496, but to Avicenna (960) that we owe the discovery of the classic syringe, of which the latter has given a complete description in his works.

[11] Here are a few of the formulæ of lavements ordered for King Louis XIV., by the physicians in ordinary, Fagon, Vallot and Aquin:

CALMATIVE LAVEMENT FOR THE KING, A.D. 1652 (Vallot).

Oil of sweet almonds, ...	30 grammes.
Honey, ...	45 "
Lenitive electuary, ...	15 "

Dissolve in a decoction of barley, and make a clyster, to be taken in the morning.

PURGATIVE LAVEMENT FOR HIS MAJESTY, A.D. 1653 (Vallot).

Manna, ... 30 grammes.

Boil slightly in a sufficient quantity of decoction of barley and linseed meal. Add, after straining:

Honey, ...	45 grammes.
Lenitive electuary, ...	15 "
Oil of sweet almonds, ...	20 "

Make a clyster to be taken in the morning.

LAXATIVE LAVEMENT FOR THE KING, A.D. 1673 (Aquin.)

Manna, ...	60 grammes.
Lenitive electuary, ...	30 "
Honey, ...	120 "
Oil of sweet almonds, ...	60 "

Mix, and dissolve in a decoction of barley and linseed meal.†

[12] Writ in favor of Étiennette Boyeau, nurse, against Master François Bourgeois, canon of the mighty collegiate and papal church of St. Urbain of Troyes: Seigneur Bourgeois was for a long time suffering from a warm intemperateness of the viscera, and that kind of acrimony of the blood which causes the red part to extravasate. Having consulted members of the faculty about his disease, he was ordered the frequent usage of a kind of lenitive medication known commonly under the name of clyster. The Faculty having spoken, there was nothing to do but find

* M. Guatinaria, De Curis Ægretudinum Particularium, etc., Lyons, 1852. L'instrument de Moliere trad., du Traité de Clysteribus, par Regnier de Graaf, Paris, 1878. Colson, De la Methode Intestinale. Th. de Paris, 1867. R. de Graaf, Treatise on Clysters, La Haye, 1688. A. Paré, Works, t. iii., p. 557.

† Journal de la Sante de Louis XIV., 1647 to 1711, by Vallett, d'Aquin and Fagon, Physicians in Ordinary, with Introduction, Notes and Critical Reflections by J. A. LeRoi.

some one provided with the necessary ability to carry out the ordonnance. The party might have applied to Seigneur Gentil, the veteran apothecary of the city, but the aforesaid Gentil was doing a lucrative business in his shop, which he could not leave to accommodate Seigneur B——. Étiennette enjoyed then a most brilliant reputation; she had the honor of serving persons of quality in the city, who praised equally her zeal and her dexterity. Moreover, although she was not rich, yet by a rare species of self-denial she demanded only 2 sous 6 deniers for each service performed.

Seigneur Bourgeois applied to this lady; he prayed her to come and see him; he confided to her his malady, the advice of the physicians and the services of which he had need. Étiennette having given him a sample of her skill, he overwhelmed her with praises, and besought her to take charge of his case.

Two entire years passed in this way, that is to say, Seigneur Bourgeois always a little heated in his bowels, and always becoming refreshed; Etiennette always obliging and always ready to refresh him; and thus she kept on, once a day, and sometimes six times.

At the same time she had need of money, and Seigneur Bourgeois was not willing to accede to her demands. Three hundred times, in moments the most interesting, and in a posture the most suppliant, she besought him to have regard to her necessities and he had no pity upon her.

Finally after all persuasion had proved unavailing, she brought a suit against him and the writ was issued on the 5th of May 1776.

"She asks for the modest sum of 150 pounds both for having put in place 1200 lavements, and for having furnished the syringe and contents."

After having shown by the highest authorities what a monstrous wrong it is to defraud the hireling of his or her wages, the advocate continues:

"If ordinary services ought to be followed by a prompt recompense, how much more promptly should be the recompense of secret services, of those services which are repugnant to people in general, those services in fact which are not rendered face to face?

"What will Seigneur Bourgeois say in defense of himself? Will he deny the services of Étiennette? All his neighbors and friends are ready to testify to their performance. Will he say that Étiennette acquitted herself maladroitly of her duty? The voice of all decent people will be raised against him.

"Will he presume to say that the sum of 150 pounds is exorbitant; that lavements, as well as other things, ought to be less dear in gross than in detail, and that he who takes them every day, and oftener six than one, ought to have them at a cheaper rate than a person who only uses one occasionally? It is easy to show the fallacy of this view of the case.

"Étiennette has served Seigneur Bourgeois for two consecutive years; the fact is undeniable; each year is composed of 365 days, making 730 days for two years; now Monsigneur was in the habit of taking one injection a day, and often six; hence if we make an average valuation of three lavements a day (which is not excessive), we shall have a total sum of 2,190 lavements for 730 days, which at 2 sous 6 deniers a piece, which is the current price, will give a total of 273 pounds 15 sous.

"Étiennette does not, however, ask for this sum; she is willing to reduce the 2,190 lavements to 1,200, and instead of 273 pounds 15 sous, which she might justly have asked, she reduces her demand to 150 pounds. How then does Seigneur Bourgeois dare to complain, and can Étiennette carry her disinterestedness and moderation farther?

"The proper interest of Seigneur Bourgeois ought to engage him to do justice to Étiennette, for he is not yet perfectly well of his disease, and if he does not satisfy Étiennette, who henceforth will be willing to render him services which he is known so badly to recompense? Who will render them with as much zeal and dexterity?

"Let him repent of his wrong, and Étiennette will forget the past. One is attached to people by benefits; she is attached to him by the benefits she has rendered him. Let him do justice and he will see her return to his bedside with more zeal than ever."

This writ was composed by the advocate Grosley, as a part of that memorable suit.

[13] This is the passage in the immortal comedy of Molière relative to lavements. "Next, a small clyster, insinuative, preparative, emollient, to soothe, moisten, and refresh the entrails of Monsieur—Next, a good detersive clyster, composed of double catholicon, rhubarb, honey of roses, and other things, according to the ordonnance, to clear, wash, and cleanse the entrails of Monsieur—30 sous—Next, a carminative clyster to expel the flatus of Monsieur—30 sous."

[14] Some authorities have, however, maintained that lavements and even suppositories may be rendered by mouth. Kerkringuis claims that the valve may be cleared; Regnier de Graaf asserts that this cannot be, and he cites the observations of Galen, Sennert, Paré, Bartholin, and Colson, in support of this belief.

Hall has made a series of experiments to ascertain what quantity of liquid the large intestine may hold, and to what height injections may be made to ascend. In the cadaver he has been able to throw up from 4 to 8 pints of liquid and fill the entire cavity of the large intestine, and even get past the ileo-cæcal valve. On the living subject he has thrown up 5 pints of an oily liquid, and percussion has enabled him to recognize the presence of the liquid in the entire extent of the intestine.

In another experiment made on a young man who was placed horizontally on the left side, he succeeded in getting 3 pints to be retained; then not succeeding in throwing the injection any farther, he found that the liquid had penetrated to the junction of the transverse and ascending colon. The subject was then placed on the right side, and it was found by percussion that the liquid had passed into the ascending colon, and he was then able to inject three pints more of liquid.

LECTURE XIX.

ON SALINE PURGATIVES.

SUMMARY.—Purgatives—Classification of Purgatives—By their Effect—By their Physiological Action—Physiological Experiments with Purgatives—Processes of Experimentation—Researches on Saline Purgatives—Experiments of Colin, Moreau, and Vulpian—Interpretation of the Facts—Action on the Muscular Coat—Physiological Division of Purgatives—Saline Purgatives—Different Toxic Actions of the Salts of Soda, Magnesia and Potash—Salts of Soda—Sulphate of Soda—Salts of Magnesia—Sulphate and Citrate of Magnesia—Salts of Potassa—Purgative Waters—Sodic Chloride Waters, and Magnesian Sulphate Waters.

IN the previous chapter I have shown the hygienic means at the disposal of the physician to combat constipation; I shall now pass in review the pharmaceutical agents in use for the same object.

These means are derived from an order of medicaments which form a natural group in therapeutics—viz., purgatives. And since this interesting question of purgatives is now before us, allow me to treat it somewhat at length, and tell you on what bases we should found the study and classification of these precious medicinal agents.

Purgatives have always had an important office in therapeutics, and authorities, in order to study them more completely, have endeavored to group and classify them after a methodical manner. There are two great bases to these classifications: the one, already ancient, is established on the different purgative effects obtained by these medicaments; the other, more modern and more scientific, takes for its point of departure the physiological action of these substances. Alibert, Hartmann, Tomasi, Trousseau and Pidoux, Bouchardat and other authorities have classed purgatives according to their effects after a manner almost identical, and you will find a clear and methodical resumé of these classifications in the thèsis of Requin published in 1839.[1]

Purgatives, according to these authorities, are divided into three classes. In the first are reckoned laxatives, that is to say, the mild purgatives, called also lenitives; this class includes manna, cassia pulp, tamarinds, and prunes. The second class comprises the mild cathartics, represented by calcined magnesia; the moderate cathartics, of which rhubarb and senna are good examples; finally the quasi-drastic cathartics, such as jalap and scammony. In a last division are ranged the irritant purgatives, the drastics properly so called, such as colocynth and croton oil.

The other basis of classification is established upon the physiological action of these purgatives, which I must first explain to you, reminding you of the experiments which have enabled us to make this study—experimental researches which have been performed in France by Colin (1854), by Moreau (1868–1870), and by Prof. Vulpian, in England by Lauder Brunton (1874), in Germany by Thiry (1864), by Radzeijewski, and by Brigier (1878). But before setting forth the results to which these experimenters have arrived, I must describe the processes employed.

These processes are of two kinds: that of Thiry, called Thiry's fistula, and that of Colin. Thiry's procedure is very complicated; it consists in separating by two perpendicular sections a portion of the intestine, while leaving it adherent to the mesentery, then in closing one of the extremities of this isolated loop, and in applying the other to an opening made in the abdominal wall. You have thus a blind pouch or cæcum opening externally, and obtaining the same vital supply as the rest of the intestine, by reason of the portion of the mesentery to which it is attached; then the two cut ends of the intestine are carefully stitched together, so as to maintain the continuity of the tube. In introducing into this *cul de sac* irritant medicaments, or in administering the same by the stomach, you observe what takes place in the portion of intestine under experiment.

Colin's method is much simpler and greatly to be preferred; it is that which is employed by Vulpian, Moreau, Lauder Brunton and Breiger. It consists in placing on a loop of intestine two spring forceps, which prevent this portion from communicating with the rest of the digestive tube; care is taken before applying the forceps to press out all the contents of the portion isolated. Into this intestinal loop a purgative liquid is now injected, and the whole is returned to the abdomen; the animal is shortly afterward killed, and an examination made of what has taken place in the loop under experimentation.

Do not forget also that in order to judge of the intestinal movements and their intensity, you can make use of the graphic method (which has given so great precision to our experimentations) by introducing into the intestine, as Legros and Onimus have done, a rubber bag filled with air, communicating with the registering apparatus of Marey.

It is by these procedures that the action of certain saline and drastic purgatives, as well as that of certain of the solanaceæ, has been studied; the researches on the saline purgatives have been much the most numerous, and this is what has been observed. If, after the example of Moreau, you inject from twenty to twenty-five cubic centimetres of a 20 per cent. solution of sulphate of magnesia into a loop of intestine separated by Colin's process, you will observe that, at the end of from 6 to 24 hours, this loop will contain (according to the time that has elapsed), from 70 to 336 cubic centimetres of a liquid containing mucus, leucocytes, and intestinal juice.[2]

This experiment you will find always to succeed, and this *first* fact of an augmented secretion of liquid under the influence of saline purgatives compels us to reject the exclusive view of Thiry and Radziejewski, who think that the action of purgatives is explained solely by the exaggeration of the intestinal movements. This increase of intestinal movements does not exist, as Legros and Onimus have shown in their experiments, when saline purgatives are administered, and we are obliged to attribute the purgative effect to the great abundance of liquid secreted by the intestinal mucosa.

But what is the mechanism of this secretion? There was at first found an explanation which seemed to be the most natural and physiological; it was maintained that there takes place between the saline substance introduced into the loop of intestine, and the intestinal glands and numerous blood-vessels distributed to this portion of the digestive tube, a double osmotic exchange. This view was the more probable from the fact that the very exact experiments of Rabuteau, of Jolyet, of Fremy and Vulpian, had shown this important principle, that when you inject a purgative solution in the veins of a dog, instead of this having a purgative effect in the intestine, as Claude Bernard maintained, constipation, on the contrary, results. As you see, the explanation was, so to speak, complete, and physiologists said: "When you introduce certain salts into the intestine, you determine the osmotic passage into the intestine of the serum of the blood-vessels, whence results the purgative effect; while on the other hand, when you inject the solution into the veins, the osmosis takes place in the contrary direction, whence results diminution of the secretion and constipation."*

Permit me to stop a moment at this point of the action of purgative substances introduced by the veins or by the skin. They give in large doses negative results, but this is said not to be the case with small doses. According to Vulpian, in the dog little doses of sulphate of magnesia injected under the skin produce diarrhœic stools. Luton has already maintained the purgative effect in man of subcutaneous injections of sulphate of magnesia.[3] Despite the concordance of these researches, I avow that I

* Legros and Onimus, Experimental Researches on the Movements of the Intestine. Journal of Robin, 1869, p. 187. Rabuteau, Soc. de Biol., 1869. Jolyet and Fremy, Arch. de Phys. de Brown Sèquard, 1869. Claude Bernard, Lessons on Toxic and Medicinal Substances, 1857. Colin, Physiologie Comparée, t. i., p. 649, 1854. Moreau, Memoirès de Physiologie, 1847–1854, p. 126. Vulpian, Appareil Vaso-Moteur, t. i., p. 483. Brunton, On the Action of Purgative Medicines, Practitioner, 1874. Thiry, Ueber eine neue Methode der Dunndarm zu isoliren, Feb. 25, 1864. Radziejewiski, Zur Physiologischen Wirkung der Abführmittel, 1876. Brieger, Zur Physiologischen, etc., 1878.

have often employed these means and have never obtained certain results, and I believe that till some new discovery is made, we cannot be said to possess a single therapeutic agent which, introduced under the skin, can combat constipation and produce purgation.

But let us return to the question of the osmotic exchange of saline solutions introduced into the intestine. Already Vulpian, while showing that the salts of magnesia are absorbed and pass out in the urine, had insisted on the state of the mucous membrane as being always one of congestion, and had urged that the examination of the liquid secreted shows that saline purgatives act principally in determining a temporary catarrh of the intestinal mucosa. The recent experiments of Moreau[4] have shown that the osmotic action is but transient, and can only exist at the onset of the action of saline substances. We have then to admit that saline purgatives determine a veritable intestinal catarrh, and it is thus that we are to explain their action, the intimate mechanism of which Vulpian has so well described.[5]

With saline solutions we have seen that the mucous membrane alone is affected, while the muscular coat presents no modifications in its functions. It is not so when the drastic purgatives are given. These purgatives, whose local action is much more intense, and which produce a veritable inflammation of the intestinal mucosa, determine also, as Vulpian has shown, exaggerated contractions of the muscular coat, and thus augment the movements of the intestine.

Lastly, certain medicaments rightly ranged in the group of purgatives limit their action to this coat alone, and without speaking of the strychnias and other tetanizing medicaments, permit me to point out some very interesting facts about the action of the solani.

Oulment and Laurent have shown that hyoscyamin and daturine in small doses energize the contractions of the intestines; Legros and Onimus have obtained the same effects with atropine, which acts directly on the great sympathetic, and augments the intestinal contractility, which enables us to explain clearly the purgative action of the members of the solanum family.*

Such, gentlemen, are the physiological experiments according to which we are enabled to establish a scientific classification of the different purgatives,[6] and this is the classification which I propose:

In a first group I shall examine purgatives, which act by augmenting the intestinal secretion without increasing the peristaltic movements.

In the second group (intermediate group) I shall place purgative substances, which both augment the intestinal secretion and the peristaltic movements. Here we shall have two subdivisions to consider, the one acting

* Oulmont and Laurent, A Study of Hyoscyamin and Daturine, Arch. de Phys., 1870. Legros and Onimus, Jour. d'Anatomie et de Phys., de Ch. Robin, 1869.

especially on the intestinal secretion proper, viz., the drastics, the other having a special action on the liver, viz., the chologogues.

The third group is constituted by medicaments, which produce a purgative effect by acting exclusively on the muscular coat; they may be called muscular purgatives, and include atropine and strychnia.

There is, finally, a last group, in which enter substances which act by a mechanical effect; these are mechanical purgatives.

I shall begin with the first group, *i.e.*, purgatives which augment the intestinal secretion without increasing the peristaltic contractions. There are in this group three orders of purgatives: 1, the saline purgatives; 2, the saccharine purgatives; 3, the vegetal, non-drastic purgatives.

The saline purgatives have soda, magnesia, or potash, for their basis. Before glancing at the various members of this group, permit me to remark that from the point of view of deleteriousness of action, there is a great difference between the salts of these three metals, as the experiments of Grandeau, Jolyet, Cahours, Rabuteau and Moreau go to show. The salts of soda introduced into the blood are not toxic. One may inject as much as five drachms of sulphate of soda into the veins of a dog without producing any toxic results, while one tenth to one third that quantity of sulphate of magnesia or of sulphate of potash causes fatal effects in the animal; and if we were to class these salts in the order of their toxicity, we should assign the first place to the salts of potash, the next to the salts of magnesia, and the last to the salts of soda.

The salts of sodium furnish a great number of purgatives; we have the sulphate, tartrate, citrate, and phosphate, which may be utilized. But that which is the most employed and the best is the sulphate of soda, called *Glauber's salt.* It is an excellent purgative, which in the dose of half an ounce to two ounces gives marvellous results without provoking too intense colic.[7]

Often when making our morning visits you have heard me order a purgative draught which I call the *purgative water of St. Antoine Hospital,* and which has the following composition:

Take of:

Sulphate of soda, . .	of each ℥ v.
Rochelle salts, . . .	
Cream of tartar, . . .	

M. Dissolve in a quart of water. Dose—one or two tumblerfuls every morning. This is a cheap and useful laxative which you may often have occasion to prescribe.

Poton and Guichon have vaunted the citrate of soda,[8] but this salt is little given on account of its slowness of action. Delioux of Savignac has advised the tartrate of soda, but this salt has also gone out of vogue.[9] The same may be said of phosphate of soda, which used to be given in doses of one or two ounces, and is a mild and excellent laxative.[10] The sulphovinate of soda, introduced into therapeutics in 1870 by Rabuteau, is now abandoned on account of its instability. This salt undergoes transformation into the bisulphate, a highly acid and irritant salt.

Chloride of sodium[11] ought to be ranged in this group, for solutions of common salt, and even sea water are recommended as purgatives. Rayer even went farther, and believed that sea water, besides its purgative action, was curative in cancer, and to render this water more supportable, he proposed to charge it with carbonic acid. Lebert has also recommended sea water rendered gaseous by charging it with carbonic acid, as a laxative. However this may be, in our seaports it is quite common to see the sailors resort to sea water for a prompt purgative effect.

Magnesia,[12] like soda, furnishes to therapeutics numerous purgatives. First of all, we have the calcined magnesia, which Fonssagrives has so thoroughly studied, and which, from a pharmaceutical point of view, presents itself under two states: either as a light powder deprived of water and called French magnesia, or as a heavier substance which goes by the name of Henry's or Howard's magnesia.

Magnesia is an excellent purgative, especially for young children, and may be given in the dose of one or two teaspoonfuls; it may be also administered to adults, but its effect soon wears out, and you sometimes see its free use as a purgative followed by a more or less obstinate constipation, and even in certain cases the abuse of this magnesia may cause intestinal calculi. In pharmacy there are two popular preparations of magnesia, Mialhe's magnesia and the milk of magnesia.[13]

By the side of these preparations you will place the carbonate, or better still the subcarbonate of magnesia described under the name of white magnesia; it is, however, little used as a purgative, but is often resorted to to combat acidity of the stomach.[14]

Magnesia furnishes the salt which is most employed as a purgative; I refer to the sulphate of magnesia, known as Epsom salts. It is with this salt dissolved in water and charged with carbonic acid that the artificial Seidlitz water is made, which contains 30 grammes (one ounce) of sulphate of magnesia to 650 grammes (or about an imperial pint) of water. The quantity of salt in this preparation can be augmented at pleasure; the dose must, however, be made to correspond with such increase.[15]

Sulphate of magnesia was long the salt most in use, but in 1847 citrate of magnesia[16] was introduced into pharmacy by Rogé of Aisné, who has thereby acquired quite a renown, and since then the citrate, being pleasanter, has tended to supersede the sulphate.

There are several preparations of this salt, which is employed in the same dose as sulphate of magnesia, and serves as the basis of a very pleasant purgative lemonade. This salt, when it is poorly prepared, is slow in its action, so that often the patient, not obtaining the desired effect, eats shortly after taking his purge, and suffers in consequence a veritable hyperpurgation. It has been proposed to substitute the tartrate for the citrate, and Chevalier has highly vaunted the advantages of this salt, but it has not come into general use.[17]

Dorvault has undertaken some interesting experiments demonstrating the different purgative results obtained, comparatively with the salts of magnesia, and has shown that, all things being equal, it is the sulphate of magnesia which produces the most intense purgative action.[18]

Finally, according to the experiments of Laborde, the chloride of magnesium, like the chloride of sodium, ought to be classed among the purgatives, with this difference, however, that the chloride of magnesium has a marked action in exciting and energizing intestinal contractions, and this gives it a place by itself in the group of saline purgatives.

The salts of potassium are very toxic, as I told you, which explains the fact that they are so little used as purgatives. The sulphate of potash or *sal-de-duobus*, was formerly prescribed in the dose of one to two drachms,[19] the tartrate in the dose of five drachms; but they have been abandoned, and the only salt (with the exception perhaps of the bitartrate)[20] which has kept its place, and deserves to remain in general use, is a double salt of potassa and soda, which goes by the name of Rochelle salt, which was very much vaunted by Trousseau, and is an agreeable and excellent purgative in the dose of from half an ounce to an ounce.[21]

The English, who, as you know, are not much in favor of clysters, have perfected the usage of saline purgatives, and we owe to them the popular purgative preparation known as the *Seidlitz powders*, with whose composition and mode of administration you are well acquainted.

Such, gentlemen, are the saline purgatives in common usage, purgatives of a high utility, and on which you will have continually to rely to combat constipation, and obtain derivative effects by the digestive tube. In the course of these lectures I shall have to return to these salts, which have the advantage of being well tolerated by the stomach and of determining a diarrhœic flux without too much irritation of the intestinal mucosa, and the production of too severe griping pains.

Of all the salts which I have enumerated, the most employed are the sulphate of soda, the sulphate and the citrate of magnesia, and the double tartrate of potassa and soda. But these pharmaceutical preparations have been of late years somewhat left in the shade by their formidable rivals, the purgative mineral waters—natural waters which offer all the advantages which the foregoing purgatives present, and which may be given in minimum dose, and at a relatively low cost, by reason of the ready railroad communications to all parts of Europe.

I must give you a cursory view of these purgative waters, and if, contrary to my usual habit, I have not appended this description to the end of the chapter on hygiene, it is because I thought it more rational to take up the consideration of these waters after the examination of the action of saline purgatives, from which they borrow their medicinal elements.[22]

The purgative waters are arranged in three principal groups: 1, waters which borrow their active principle from the chlorides; 2, those which owe their properties to sulphate of soda—these are the sodic sulphate waters; 3, those whose active ingredient is sulphate of magnesia, the magnesian sulphate waters. If I were called upon to class these waters according to their purgative activity, the first place would belong to the magnesian sulphate waters, the second to the sodic sulphate, and the third to the chloride waters.

I will begin with the latter. The sodic chloride waters are quite numerous in France; such are the waters of Balaruc, Bourbon-Lancy, Bourbonne les Bains, Salies-de-Bearn, Salins (Jura), Bourbon-l'Archambault, Salins Moutiers and Niederbronn in Alsace. All these mineral waters, cold or warm, contain from two to three up to twenty grammes per litre of chloride of sodium.

The sodic chloride waters of Germany, if not more active, are at least better known, such are Kreuznach, Nauheim, Kissingen, Wiesbaden.

The sodic sulphate waters are less numerous in France. I will cite but two: Miers, which contains two grammes of sulphate of soda to the quart, and of which several tumblerfuls a day may be drank, and the waters of Brides-en Savoire, which Philbert has so much vaunted in the treatment of obesity; they are similar to the foregoing and contain one gramme of sulphate of soda to the quart. Visitors to these spas are in the habit of drinking five or six glasses a day. By the side of these waters we must place two French spas, that of Aulus and that of Châtel-Guyon, which have a manifest purgative action. The first, probably owes its laxative effect to the sulphate of lime which it contains; the second, according to Laborde, to the chloride of magnesium which enters into its composition.

Austria, however, is ahead of France in the possession of two unrivaled springs, Carlsbad and Marienbad. The Sprudel Spring at Carlsbad is one of the most prized; it contains sulphates of potash and soda. It is a thermal spring of high temperature. It must be borne in mind that the great reputation of these waters is due both to their purgative action and the severe regimen to which the patients are subjected at the springs. Marienbad and Franzensbad are springs containing sulphate of soda in large quantity, three to four grammes per litre, and a little sulphate of potash. The purgative waters of Tarasp-Schuls also belong to this group.

But all these sodic sulphate waters are surpassed by a new spa discovered in Spain near the French frontier; I allude to the Rubinat water, which contains almost 100 grammes sulphate of sodium per litre.

The magnesian sulphate waters are the true purgative waters; they are rarely drank at the springs, but are much exported. These cold spas are found chiefly in Hungary and Bohemia. There is near Buda-Pesth a subterranean stream of purgative water of a very active nature, which owes its properties to the clayey magnesian strata through which it passes, and all that is necessary is to sink wells to the level of this underground stream to obtain this water, which is here so abundant.

These bitter waters have for their type: Pullna, Seidlitz, Saidschütz in Bohemia, Hunyadi Janos, Rakoczy of Buda-Pesth, Royale Hongroise in Hungary, Friederichshall in Germany, Birmenstorff in Switzerland. In France we have but one solitary specimen of these bitter waters in the green water of Montmirail-Valgueyras (which has gms. ix. of magnesium sulphate, and gms. v. sodium sulphate per litre.) All these waters have as their active ingredients more or less of sulphate of soda and magnesia, and one of the most purgative is the Hunyadi Janos of Hungary, which contains in each litre 22.55 gms. sulphate of soda and 22.35 gms. sulphate of magnesia.*

These waters are convenient and easily taken, are well supported by the stomach, and render, it must be confessed, real service in therapeutics. When imbibed in small doses, their purgative action is soon over, and they constitute one of the best means employed to combat constipation.

The bitter waters in moderate doses cause a stool in about an hour after being taken; they do not produce constipation when their administration is discontinued, and acting always in relatively feeble doses they fulfill all the conditions which one could wish for in an habitual purgative. In their employment you will be governed, on the one hand by the degree of constipation, and the greater or less resistance of the patient to the action of these waters, and on the other hand by the purgative power thereof. You will give, for instance, a large tumblerful of Pullna on an empty stomach while you will not prescribe but half a glass of Biemenstorff, and if you use the Hunyadi-Janos, a Bordeaux wine gobletful is sufficient, while of the stronger Rubinat a less quantity still suffices. But do not forget that you must persevere in the administration of these bitter

* We give below a table which shows the composition of the different magnesian sulphate mineral waters (according to Gasot.)

Spas.	Sulph. Magnesia.	Sulph. Soda.	Chloride Magnesium.	Bicarb. Magnesia.	Chloride of Sodium.	
Rakoczy	25.03	20.82	....	....	21.14	Grammes per litre.
Hunyadi-Janos	22.35	22.55	....	...	17.04	
Birmenstorff	22.91	7.03	0.46	0.03	"	
Seidlitz	20.80	5.10	"	"	"	
Pullna	12.61	10.70	2.49	0.30	"	
Saidschutz	10.94	6.08	0.28	0.95	"	
Valgueyras-Montmirail	9.31	5.06	0.83	0.16	0.18	
Friedrichshall	5.14	6.05	3.93	0.4	7.94	
Epsom	2.58	"	"	"	"	

waters, repeating the aperient draught every morning for a fortnight or a month. If, on the other hand, you want a purgative rather than an aperient effect, you must order several tumblerfuls to be drank.

But, I repeat, in the treatment of constipation, it is rather in the number of the doses and in their repetition than in the quantity that you will find the remedy of the evil to combat. When I cannot avail myself of a natural purgative water, as at the hospital, I employ an artificial water which resembles the natural, such as the solution of sulphate of soda in carbonic acid water, of which I have before spoken.

I have now finished the purgative waters, and in the next chapter I shall take up the saccharine, drastic, and cholagogue purgatives.

NOTES TO LECTURE XIX.

[1] Giacomini classes purgatives in the group of enteric hyposthenisants.

Trousseau and Pidoux have divided purgatives into two great classes: those which are derived from the vegetal kingdom, and those which are derived from the mineral kingdom.

Bouchardat in his Formulary adopts the classification into drastic cathartics and laxatives. In his Materia Medica he divides them into purgatives of vegetable origin, into saline purgatives, into emollient and into chemical purgatives.

Fonssagrives admits the following classification of purgatives: 1, Alkalino-salines; 2, Salines; 3, Antimonials; 4, Mercurials; 6, Resinous purgatives; 7, Saccharine purgatives; 8, Acidulated purgatives; 9, Convulsivant purgatives; 10, Mechanical purgatives; 11, Composite purgatives.

[2] We give below Moreau's table, showing the quantities of liquid found by him in the intestinal loop of a dog to which he had administered a 20 per cent. solution of Epsom salts. We give also the time that had elapsed between the injection and the examination.

Quantity of solution injected.	Time elapsed.	Quantity of liquid found.
20 c.c.	6 hours.	7 c.c.
30 "	6 "	70 "
30 "	21 "	72 "
20 "	5 "	125 "
20 "	32 "	130 "
20 "	22 "	166 "
35 "	16 "	275 "
20 "	24 "	336 "

[3] Luton has observed on himself, then on patients in the Hôtel Dieu of Rheims, that a subcutaneous injection of 10 centigrammes of Epsom salts provokes diarrhœic stools.

In a dog Vulpian injected 10 centigrammes of Epsom salts in 2 or 3 grams of distilled water; the dog had diarrhœa during the night which followed the injection. The experiment repeated twice gave the same results. When much larger quantities of sulphate of magnesia are injected (10 grammes, for instance), no purgative effect is noticed.*

[4] Into a loop of intestine prepared as indicated above, Moreau injected sulphate of magnesia, then the yellow ferro-cyanide of potassium, a salt the traces of which may be found in the urine. The presence of this salt in that excretion demonstrated the fact that if there is a double exchange, it takes place at the beginning of the experiment, and soon ceases.

Colin replies that this fact is not a positive demonstration, because at the end of a little time the intestinal mucosa becomes inflamed, and no longer presents the normal conditions for absorption. (Moreau, Bull. de l'Acad. de Méd., 1879. Colin, loc. cit., 1879.)

[5] Vulpian in his work on the Vaso-Motors thus sums up the results of his observations:

"Purgatives introduced into the digestive passages, act as irritants to the mucous membranes:

"This irritation determines modifications in the intestinal epithelium and an excitation of the peripheral extremities of the centripetal intestinal nerves. This excitation is carried to the inferior thoracic nervous ganglia, and the intra-abdominal ganglia (ganglia of the solar and mesenteric plexuses, ganglia of the plexuses of Meissner and Auerbach); then it is reflected by the vaso-motors upon the vessels of the intestinal walls, and by the secretory nerves upon the anatomical elements of the mucous membrane, among others those of the glands of Lieberkuhn. There results a congestion more or less intense of the intestinal mucous membrane (reflex vaso-dilator action), an epithelial desquamation, with rapid and abundant production of mucus, diapedesis, or not, of leucocytes, and an active secretion of intestinal juice, with which are mingled, without doubt, in certain cases, the products of a profuse transudation, formed especially of water and of certain salts of the blood, and due to an exaggerated and vicious process, of which the elements of the membrane are the seat.

"Here we have, it seems to me, what there is that is essential in the mechanism of the action of purgative substances.

"In a certain number of cases, the reflex action, due to the irritation determined by purgatives, is not effected solely by following the diastaltic arts which I have indicated. The excitation may be sufficiently strong to be transmitted to the spinal cord, and to provoke pain. Such is the mode of production of colics; it is known that they are manifested with greater frequency and intensity when certain purgatives are used, such as drastics, than when other purgatives such as salines are used."

[6] Germain Sèe has proposed to divide purgatives into two great classes: 1, evacuant purgatives; 2, true purgatives.

The evacuants are subdivided into two kinds: those which act mechanically and those which act by causing contraction of the intestinal muscles.

The purgatives, properly so-called, are subdivided into five genera: 1, the neutral salts; 2, substances containing *cathartic acid* (senna, rhubarb);

* Luton, On the Purgative Effect of Subcutaneous Injections of Sulphate of Magnesia, Bull. de la Soc. Méd. de Rheims, 1873.

3, the anhydrous glycosides (colocynth and aloes); 4, fatty substances (castor oil); 5, the mannites (sugars and especially sugar of milk).*

[7] Sulphate of soda (Glauber's salt) crystallizes in white efflorescent prisms which are very soluble in water, insoluble in alcohol; the taste is bitter and disagreeable. It exists in a great many mineral waters and in certain marine plants; is obtained by evaporation of the saline waters of Lorraine.

In small doses of 1 to 3 gms. sodic sulphate acts as a diuretic. In larger doses of 30 gms. (1 ounce) it acts as a purgative, and causes serous stools. Constipation sometimes follows a prolonged usage of this purgative.

Sodic sulphate enters into the composition of many preparations, such as the *royal ptisan and black physic* of the Codex. Purgative lavements are constituted by dissolving from half an ounce to two ounces in a pint of water.

[8] Neutral citrate of soda is colorless, inodorous, of salty taste; crystallizes in six-sided pyramids; is efflorescent; very soluble in water. Dose —one to two ounces. The smaller dose is purgative to young subjects.

[9] Tartrate of soda is in transparent permanent crystals and is very soluble in water, insoluble in alcohol. The neutral tartrate has little taste, and a solution sweetened with lemon syrup makes an agreeable laxative. The dose is about an ounce.

[10] Phosphate of soda crystallizes in rhomboidal prisms, terminated by a four-sided pyramid; it is quite an agreeable purgative, acting without nausea or colic, and provoking serous and bilious evacuations like sulphate of soda. Dose—from 1 to 2 ounces.

[11] Chloride of sodium or common salt is obtained from its solution in sea water, from mines, where it goes under the name of rock salt, and from salt springs. It crystallizes in cubes, is soluble in water; insoluble in absolute alcohol.

Common salt is a stimulant diuretic in small doses, and purgative in large doses; is often employed as lavements in the quantity of 1 teaspoonful to a pint. Many mineral waters (notably that of St. Leon, Canada) owe their efficacy to the common salt they contain.

[12] Magnesia, or the oxide of magnesium, is obtained by calcining the carbonate; it is too well known to require description; when quite calcined, it is wholly insoluble in water.

Two kinds are in use: the heavy or white magnesia (English magnesia); Henry's magnesia, which presents itself as little hard grains; and the light or French magnesia, the ordinary calcined magnesia, which may be given to children in the dose of 5 to 15 grains, to adults in the dose of a drachm or two.

It may be given in tablets, in chocolate, in syrup, or in potion, or granulated, under the form of the granular effervescent magnesia, prepared chiefly in England. There are numbers of these preparations in the market, which constitute agreeable laxatives in doses of about a table-

* Vulpian, Appareil Vaso-Moteur, t. i., p. 516. G. Sée, Des Dyspepsies Gastro-Intestinales, Paris, 1881, p. 312.

spoonful. The precipitated hydrate of magnesia has been often exhibited as an antidote in arsenious acid poisoning.

[13] Mialhe's magnesia is made as follows:

Take of:

Calcined magnesia,	. . . . .	8 grammes.
Water,	. . . .	40 "

Boil 22 minutes and add:

Sugar,	. . . .	50 grammes.
Orange flower water,	. . . . . .	20 "

This medicine acts 5 or 6 hours after having been taken; it should be given in the morning on an empty stomach, and be followed by a glass of cold water.

Milk of magnesia is made as follows:

Take of:

Calcined magnesia,	. . . . .	10 grammes.
Pure water, .	. . . . . .	80 "
Orange flower water,	. . . . . .	10 "

M. For one dose.

After the administration of this laxative a cup of sweetened water should be drank.

[14] Carbonates of magnesia. There are three carbonates in use, a neutral, a bicarbonate and a subcarbonate, called also white magnesia. The most of the carbonate of magnesia in use is made from the bittern of salt works, and it is manufactured in Baltimore from the sulphate. The British Ph. directs it to be made from the sulphate by precipitation with carbonate of soda. It is very insoluble in water, but somewhat soluble in carbonic acid water; Dinneford's magnesia is a solution of this nature. Carbonate of magnesia is given in doses of from 10 grains to a drachm and a half. It is a mild laxative and antacid.

[15] Epsom salts, so well known as a popular cathartic, crystallizes in quadrangular prisms, terminated by a four-sided pyramid. It is efflorescent in air, is very soluble in water and insoluble in alcohol. The dose is half an ounce to two ounces, dissolved in a large quantity of water. The natural mineral waters (Freiderichshall, Pullna, Seidlitz, Birmenstorff), contain it. The most agreeable form for its administration is a solution in carbonic acid water with lemon syrup. Dr. Henry of Dublin recommends it with dilute sulphuric acid. To seven ounces of a saturated aqueous solution of this salt he adds an ounce of diluted sulphuric acid, and gives a tablespoonful of the mixture for a dose in a wineglassful of cold water. It is said that an ounce of this salt in a pint of water boiled for two or three minutes with a couple drachms of roasted coffee is entirely deprived of bitterness.

An aqueous solution of 100 grains of this salt should yield, when completely decomposed by a boiling solution of carbonate of soda, 34 grains of dry carbonate of magnesia. (U. S. Dispensatory.)

[16] This salt is destitute of the bitter, disagreeable taste of Epsom salts, and is a very gentle and at the same time quite efficient purgative. The dose is the same as that of the sulphate. There are several granular effervescent preparations in the market which are called citrate of mag-

nesia; the most of them, however, are composed of a little citrate mixed with tartrate and sulphate.

[The effervescent citrate of magnesia is made according to the German Ph. as follows:

Take of:

Carbonate of magnesium,	25 parts.
Citric acid,	75 "

Mix, form into a thick paste with distilled water and dry at or below 86° C.

Take of:

This mass,	14 parts.
Bicarbonate of sodium,	13 "
Citric acid,	6 "
White sugar,	3 "

Mix, moisten with sufficient alcohol, pass through a sieve to form a coarse, granular powder and dry.]

[17] The tartrate of magnesia is crystalline and little soluble. The bitartrate is most employed; this is more soluble, and enters into the composition of various lemonades. Garnier has proposed the following preparations:

Take of:

Carbonate of magnesia,	15 parts.
Tartaric acid,	22 "
Water,	600 "

Dissolve, filter, and sweeten with 60 parts of syrup. Flavor with orange peel.

[18] Dorvault's experiments were made on seven young men of the same age, and in a good state of health.

Each one of them took with intervals of ten days, a dose of calcined magnesia (about two drachms), a dose of citrate of magnesia ($\frac{1}{2}$ ounce), and a dose of sulphate of magnesia (an ounce and a half). These purgatives were administered in five ounces of water, and the parties were placed in the same conditions of preparation and of regimen.

The results noted were as follows:

1. Relatively to the number of stools, there was an average of 2.83 with the calcined magnesia; 3.28 with the citrate and 4 with the sulphate.
2. Relatively to the duration of the purgative action, this was 18.83 hours for the calcined magnesia, 11 hours for the citrate, and 8.60 for the sulphate.
3. Relatively to the weight of the evacuations, this was 1.017 kilogrammes for the calcined, 1.771 for the citrate, 2.200 for the sulphate.
4. Relatively to the nature of the stools, these were feculent with the magnesia, semi-serous with the citrate, serous with the Epsom.
5. Relatively to the effects produced, the nausea was very marked with the sulphate, less with the magnesia, none at all with the citrate, and the sulphate produced considerable tenesmus. There was burning thirst with the sulphate, less with the calcined, and none with the citrate.

[19] Sulphate of Potash (sal-de-duobus) is white, inodorous, of bitter taste, crystallizes in short hexagonal prisms, is soluble in water, insoluble in alcohol.

The dose as a laxative is from 1 to 2 teaspoonfuls in a pint or more of water. It gripes considerably. There have even been fatal cases of poisoning from the free use of this salt. It formerly went by the name of *sal polycrestus Glaseri.*

[20] [The bitartrate of potassa, or cream of tartar, is the only tartrate of that base used in the United States. It is too well known to need description. It is soluble in 184 parts cold and 18 of boiling water. It is a good cooling aperient in doses of a drachm or two, producing copious watery stools. The *Confectio Sulphuris*, and the *Pulv. Jalap Co.* contain this salt. It may be given stirred in sweetened water, and forms an agreeable purgative drink. The beverage called *Imperial* is made by dissolving half an ounce of this salt in 3 parts of boiling water, and adding 4 ounces of white sugar and half an ounce of fresh lemon peel. Cream of tartar is much given as a domestic laxative mixed with an equal quantity of sulphur and taken in molasses.]

[21] The tartrate of soda and potash or Rochelle salts (Seignette salt) was discovered by Seignette, a pharmacist of Rochelle, in 1672. It crystallizes in prisms which are efflorescent when exposed to the air. It is very soluble in water, and is an admirable, excellent purgative in doses of from half an ounce to an ounce. The Seidlitz powders so well known in the United States and England contain Rochelle salts as their basis.

[22] The principal purgative waters of the old world are mentioned in the text; the lengthy notes pertaining to them in the French edition are omitted, as being undesirable in the American translation.

Among the purgative mineral waters of this country we may specify:

1. The Irvine Spring of Estell Springs, Estell Co., Ky. This water is highly impregnated with purging sulphates, and is taken in doses of one or two tumblerfuls in the early morning.

2. The Crab Orchard Springs; location Crab Orchard, Lincoln Co., Ky.—7 grs. sulphate of soda and 25 of sulphate of magnesia to each pint. These waters are largely used for the manufacture of the Crab Orchard salts, which are obtained by boiling down the water. These salts are much used in the Western States; when taken in small and repeated doses they give rise to copious serous and biliary evacuations.

3. Harrodsburg Springs. In Harrodsburg Springs, Mercer Co., Ky. These waters are mildly magnesian sulphate.

4. The Bedford Springs. In Bedford Co., Pa. These waters are mildly *purgative chalybeate.* Every pint contains 10 grs. sulphate magnesia, and traces of carbonate of iron. These springs, which are quite a favorite resort, are beautifully situated in a valley of the eastern range of the Alleghany Mountains.

5. The Midland Well. In Midland, Midland Co., Mich. This water is potassic sulphate ($8\frac{1}{2}$ grains to the pint), and is of considerable local repute as a laxative.

6. Elgin Spring. In Addison Co., Vt. This water contains sulphates of magnesia and soda, and is a good cathartic.

Among other springs, much resorted to for laxative effect are the St. Leon, near Montreal (sodic chloride); Cooper's Well in Hinds Co., Miss.; the Salt Sulphur Springs of Monroe Co., W. Va. (purging sulphates and free sulphuretted hydrogen); the Greenbrier White Sulphur Springs, of Greenbrier Co., W. Va., an excellent aperient and alterative sulphur water,—"these springs are the Mecca of southern tourists, the resort of the gay and fashionable, a place where pleasure seeking reigns supreme" (Walton); the Yellow Sulphur Springs in Montgomery Co., Va,—fine calcic sulphur waters, with an active proportion of purging sulphates; Jordan's White Sulphur Springs, in Frederick Co., Va.; the Avon Springs in Livingston Co., N. Y.; the Dryden Springs in Dryden, N. Y., which are magnesian sulphate and sodic chloride; the Bedford Springs in a town of the same name in Ky.; the Louisville Artesian Well in Louisville, Ky.; the Blue Lick Springs in Ky., exceedingly "fine waters of the saline sulphur class;" Lafayette's Well in Indiana, (saline sulphurous); the Indian Springs in Indiana; the French Lick Springs in the same state; lastly, the Saratoga waters are for the most part laxative saline waters.*

Vide Walton's Mineral Springs of the United States and Canada.

LECTURE XX.

ON SACCHARINE, DRASTIC AND MECHANICAL PURGATIVES.

SUMMARY.—Saccharine Purgatives — Manna — Honey — Vegetal Non-Drastic Purgatives—Cassia Pulp—Tamarinds—Prunes—Cholagogues —Calomel — Rhubarb—Podophyllin—Aloes — Drastic Purgatives—Senna—Jalap—Scammony—Indian Jalap (Turpeth)—Croton Oil—Muscular Purgatives — Belladonna—Atropine—Hyoscyamin — Electricity—Purgatives with Local Action—White Mustard Seed—Oily Purgatives—Castor Oil—Therapeutic Applications—Purgatives Applied to the Treatment of Constipation—Resumè of Treatment.

YOU remember, gentlemen, that in the division of purgatives, I ranged in the first group of these medicaments those which increase the secretion without augmenting the intestinal contractions, and I told you that there exist in this group two sub-varieties: the saline purgatives which we have studied in the foregoing chapter, and the saccharine purgatives of which I am now to speak.

Certain sugars have the property of producing a dialytic effect on the intestines similar to that of saline purgatives, and Medicine utilizes two of these substances, manna and honey. Manna has been employed for children; it is an agreeable purgative, containing a particular principle, mannite. You know that manna is extracted from the trunk of an ash (fraxinus ornus, fraxinus excelsior) which grows in Italy, and that this substance oozes from transverse incisions made during the flowering season, and according to its shape, manna is said to be in tears or flakes and in lumps. The sweetish odor and savor of manna rapidly fatigue the stomach, and it is difficult to continue its usage long, hence as a means for combating habitual constipation, it has been almost abandoned.[1]

Common honey is a mild laxative and is much utilized for this purpose; the same may be said of molasses, which constitutes the laxative principle of American gingerbread, and of the brown bread, so much in use in New England.[2]

By the side of these saccharine purgatives, you will place certain substances which belong to the vegetal kingdom, and constitute the mild aperient medicines of the ancients—purgatives which had a great vogue under Louis XIV., but which are abandoned to-day; I allude to cassia pulp and tamarinds.

Cassia has served as the basis of a multitude of apozems or decoctions formerly very much vaunted, such as the marmalade of Tronchin,* the confection of Hamech, the *Lenitive,* and especially the celebrated *Catholicum;* preparations which are to-day forgotten, but whose history bears testimony to the popularity in which cassia was once held, a sort of craze, in fact, to which Molière directs the shafts of his ridicule—which did not, however, prevent Delille from affirming that it was to cassia that Voltaire owed his great age.[3]

The tamarind[4] is also much used as a laxative; the fruit, which like that of cassia is a pod, is the part used in medicine. A ptisan and a purgative electuary were formerly prescribed; these are not now in use; the last few years, however, Grillon has taken up again this preparation, and has made pastilles of tamarind pulp with extract of senna, the whole being covered with chocolate (Tamar Indien).

Lastly, prunes may be mentioned in this group. All these substances contain saccharine principles, to which they owe their purgative action. I will add to these sweet purgatives, in little use at the present day, two well known syrups, much employed in infantile medicine, *the syrup of peach flowers,* and *the syrup of pale roses,* which are given in the dose of one or two dessert-spoonfuls for a laxative effect.†

Such is the first group of purgatives which you may utilize in the treatment of constipation, whether habitual or accidental. You can not help noting the minor importance which is assigned to-day to this subdivision. While the saccharine purgatives and the non-drastic vegetals are now virtually abandoned, the saline purgatives, on the other hand, and the purgative waters indisputably and deservedly occupy the first place.

I come now to the second or intermediate group of purgatives, those which both augment the intestinal secretions and the muscular contractions. We shall have to make here two subdivisions, comprising the cholagogues and the drastic purgatives proper. I shall begin by saying a few words about cholagogues, and I shall mention only the principal medicaments which act by augmenting the secretion of bile, reserving the consideration of their physiological action till we come to speak of the treatment of diseases of the liver.‡ The first rank is assigned to the proto-chloride of mercury or calomel, which determines those greenish

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* Marmalade of Tronchin. A kind of thick looch, of an agreeable taste, prepared with two ounces of oil of sweet almonds, as much syrup of violets, manna in tears, very fresh pulp of cassia, sixteen grains of gum tragacanth, and two drachms of orange-flower water. It is used as a laxative, demulcent and pectoral. The *Confectio Hamec,* the *Lenitive,* and the *Catholicum,* were very complicated preparations; the former contains twenty-five, the latter fifteen ingredients.

† Peach flowers and pale roses are credited with laxative properties, and syrups made from them are much in use on the Continent of Europe.—[Tr.

‡ Vol. 2.

discharges to which the English give the name of calomel stools. This greenish matter, concerning which there has been so much dispute, is to-day recognized as being of the nature of bile. When calomel is given in the dose of from 5 to 15 grains, a purgative effect is rapidly produced. This medicament is much given to children and it is used more in England and the United States than anywhere else. If the administration of this mercurial is easy on account of its small volume and absence of taste, you should remember at the same time that you are dealing with a proto-salt of mercury, and that you are to avoid in its administration everything which might transform it into the bichloride, a substance which is eminently toxic. You will then avoid the mineral and vegetal acids and the acid jellies, and you will take care not to prescribe with your calomel the soluble alkaloids, salts, bromides, and iodides which may decompose this protochloride, and transform it into the bichloride. You should also avoid substances containing hydrocyanic acid, and not administer calomel with cherry-laurel water. It will not do, however, to overstate the danger of the transformation of calomel into corrosive sublimate, and Vernes has recently shown that the mercurious chloride is more stable than has been generally believed, and that it is with difficulty transformed into the bichloride.

By the side of calomel there is also a purgative very widely used, namely rhubarb, the dose of which is from one to two scruples. Rhubarb has many advantages in its favor; it acts as a tonic stomachic, and is generally well borne by the stomach; hence it is generally taken about meal-time.

Rhubarb is given in powder, in potion, or in syrup. There are two syrups in common use, especially in infantile therapeutics, the simple syrup of rhubarb, and the aromatic syrup; the dose of both is one or two teaspoonfuls for young children. The simple syrup is a mild cathartic, while the aromatic syrup is both laxative and astringent, and is much used in the bowel complaints of children. As an habitual laxative for infants I much prefer magnesia, especially calcined magnesia.[5]

Podophyllin is also classed among the cholagogue medicaments, and I shall return to its uses when I come to speak of the treatment of calculous affections of the liver: I shall only allude to this medicament to-day in its application to the treatment of constipation.

Employed first in America, where the plant *podophyllum peltatum*, from which podophyllin is extracted, originated, this resinous matter has been highly praised in France by Trousseau, and recently by Constantin Paul, who has shown its advantages. According to Paul, podophyllin is the regulator *par excellence* of stools, and the best medicament for constipation. It has, moreover, the advantage over other purgatives of not losing its power by habitual use; it produces its laxative effects in small doses of even one third of a grain, while in large doses of two grains or more it is a true drastic purgative.

Notwithstanding the competence of the medical authorities who have extolled podophyllin, and notwithstanding the painstaking and exact researches of Marchand,* this resin has not the repute which was predicted for it by the physicians who have studied it, and this results, I think, from this fact, that in most cases podophyllin determines quite severe colicky pains, and for my part, whenever I have prescribed it, especially to females, I have been obliged to abandon it for this reason, even when the minimum dose of one third or half a grain was not exceeded.[6]

The formula of the pills of podophyllin varies little. Constantin Paul adds the powder of ginger; the English endeavor to diminish the excitant action of podophyllin by associating with it hyoscyamus; as for Trousseau and Blondeau, they obtain the same result with preparations of belladonna.

If podophyllin has been to a certain extent abandoned, there is another medicament which has better withstood the assaults which have been made upon it, and which remains one of the best remedies to combat constipation;—I refer to aloes, which belongs also to the cholagogue medicines, and merits a place by itself in the study of purgatives.

Aloes has an elective action on the lower part of the large intestine, of which it excites the muscular fibres and augments the circulation. This is even one of the most serious disadvantages in the administration of aloes when you have to do with hemorrhoidal patients whose rectal varices it irritates and inflames. This very property is, however, an advantage when it is desirable to provoke physiological congestions of the uterus or other organs of the pelvis, or even create hemorrhoids for derivative effect. However this may be, aloes is a medicament very much employed, which serves for basis to all the stomachic or other pills which have the property of determining regular stools. It is slow in its action, and is administered at the time of the evening meal when given to produce stools the following morning. It is a good medicament, of which I have spoken under the head of affections of the stomach, and which is given in the dose of one to two grains in pill or powder.[7]

I have now finished the consideration of the purgatives which are comprehended in the class of cholagogues, and I shall now take a brief glance at the medicaments of the second subdivision, which act, as you know, both by augmenting the secretions and muscular contractions of the intestine, or, in other words, which purge in producing more or less griping. This is the group of drastic purgatives, which are very numerous, and of which I can only mention in this chapter the principal agents. At the head of the group, and in a sort of intermediate position between the members of this and the preceding group, belongs a species of cassia, which serves as basis to the greater part of purgative decoctions. I refer to SENNA.[8]

Senna in the state of leaves or pod is an excellent purgative; if we

* Marchand, New Researches on Podophyllin, Bull. de Thér., 1874.

may trust the experiments of British authorities, it is to a combination of ammonia with cathartic acid, cathartate of ammonia, that its purgative action is due. Senna is the basis of all the purgative ptisans or teas, such as the *black draught*, the Ptisan Royale or Imperial, the Purgative tea of St. Germain, and others.

One of the best purgative ptisans is that known under the name of *purgative ptisan of the Saint Louis Hospital*, which Prof. Hardy formulates thus:

Take of:

Senna leaves, ...	} ā ā	ʒ ii.
Wild pansy, ...		

M. Steep one hour in a quart of boiling water, strain and sweeten with honey. Dose—a tumblerful every morning on rising.

You can advantageously combine senna with prunes in infusion, or add ginger, cardamoms, coriander or anise. The "Imperial ptisan" which Corvisart prepared for Napoleon I., who sought his advice during the German campaign for an eczema of the neck which troubled him about wearing his uniform, had senna for its basis. If I allude to this fact, it is because there is a curious history connected with it. The German physician whom Napoleon at first consulted was opposed to the rapid cure of this eczema, affirming that its suppresion might have grave consequences. The emperor, pressed by the military campaign which he was conducting with his usual vigor, did not follow the advice of the German physician, but that of Corvisart, whom he had summoned from Paris.[9] The triumph of Corvisart was complete, and the emperor's rash disappeared; but after Napoleon's death, which was caused, as you are aware, by cancer of the stomach, the German physician sought to have his revenge by insisting that if his advice had been followed this disease would never have declared itself. Unhappily for this affirmation, the antecedents of the family show that the father and uncle of Napoleon died of cancer, and it would seem that heredity played the principal part.

However this may be, senna deserves to retain its place in therapeutics as an excellent purgative, and as the one of all the drastics which gives rise to the least griping. Nevertheless some griping does accompany its action, and this is an inconvenience which can be partly obviated by macerating the leaves and pods in alcohol before using them.

The other drastic purgatives belong chiefly to two families: the convolvulaceæ and the cucurbitaceæ. To the first belong turpeth,[10] jalap,[11] and scammony;[12] to the second, colocynth,[13] elaterium,[14] and cayapona.[15]

Of all these cathartics, jalap and scammony are the most employed. Scammony enters into the composition of certain cathartic cakes and chocolates and the anisette purgatives. Of an agreeable taste, it is taken without difficulty, but it has the disadvantage of griping severely. The dose is seven grains in a little sweetened milk.

If you prescribe jalap, you would do well to employ the compound tincture of the German pharmacopœia (the *eau de vie Allemande*), of which the dose is half a fluid ounce. This is an excellent hydragogue cathartic in mitral heart disease. The compound jalap powder in drachm doses is also a good purgative in dropsical affections.

Lastly, at the head of the group of drastics is a member of the Euphorbiaceæ, croton oil, which is occasionally given in the dose of one or two drops in pill with bread crumb. It is a dangerous medicine, which acts by determining in the intestine an irritation similar to that which it produces on the skin.[16]

The third group of purgative medicaments comprehends those that act by determining intestinal contractions. In it are included the strychnias, and particularly tincture of nux vomica and the bitter tincture of Baumé, which have considerable efficacy in the constipation arising from intestinal paresis. It is in this way that certain of the solani act, such as belladonna, which Trousseau has much vaunted; he used to prescribe it in pills of one centigramme of extract of belladonna, and one centigramme of the powder. This medication merits perpetuity, and will render you service in combating constipation.

Electricity may also be regarded not exactly as a muscular purgative, but as a therapeutic agent which combats constipation by increasing intestinal contraction. Althaus, Duchenne, and especially Onimus and Legros, have well studied the action of electricity on the intestinal movements, and the two latter experimenters have shown us that we may both employ constant currents and faradization. When galvanism is used the current should be applied to the spinal cord or splanchnic nerves.

If you use faradization, which is most employed and is really the most efficacious, you introduce one of the poles into the anus, and pass the other back and forth over the abdominal walls. I shall have more to say on this subject in another chapter.[17]

There are, lastly, purgative substances which act by a mechanical effect, and to this group belong the oils and white mustard seeds.

White mustard seed was formerly very much in vogue in the treatment of constipation. It was highly vaunted by Cullen and Marcatan, and in 1826 a fanatic by the name of John Taylor travelled extensively over the world, proclaiming the anti-costive virtue of this seed. Latterly, however, the reputation of this crucifer has materially fallen. White mustard seed, which may have a real purgative action, has also its inconveniences; it sometimes accumulates in the digestive tube, and has even formed compact masses in the lower part of the small intestines, causing occlusion.

Repudiate then the use of these grains, as well as the employ of all those foreign bodies which the lower classes sometimes swallow in order to obtain purgative effects. Remember the fact which took place in the service of Potain: a man died in consequence of saturnine encephalopathy caused by balls of lead which he had swallowed from time to time under pretext of clearing his digestive tube. He pretended that he kept exact account of the entrance and exit of these balls, and consequently not one could have remained in his intestine. The autopsy showed that his reckoning was at fault. There were, in fact, found in the stomach seventeen of these balls whose presence had determined lead poisoning. This case reminds me of the famous "perpetual pills" formerly employed, and which when swallowed produced a purgative effect leading to the expulsion of the pill which acted simply mechanically; the latter, when recovered, might serve again the same purpose, and was often handed down by inheritance in certain families.

Of much more importance are the fatty purgatives. Oil, whatever may be its origin and its nature, if taken in great abundance is not completely transformed by the pancreatic juice, but acts as a foreign body, causing a local disturbance, which excites the intestinal secretion and leads to a purgative effect.

Castor oil is the type of purgative oils. It is a mild laxative cathartic, seldom griping, and one that renders great service. You know what a marked difference there is between the fruit of the ricinus and the oil which is extracted from it. Tempted by the enticing aspect of these seeds (which resemble certain beetles), and supposing that the seeds would have the same mild purgative effect as the oil, persons have now and then eaten these seeds, only to suffer grave disorders and even poisoning therefrom. The seeds, in fact, contain a very energetic and very acrid drastic principle.[18]

The castor oil obtained at the present day is of excellent quality, and thanks to the improvements made in its fabrication, is not difficult to take; it is in fact far different from the oils of a former day whose taste and whose odor were so repugnant. Add, moreover, that its mode of administration has been improved and that the combination of the oil with strong coffee or with onion soup* renders it more palatable and more easily borne, even by delicate stomachs. You can also completely mask the taste of castor oil by giving it in emulsion; the following is a good formula:

Take of:

Castor oil, ...	℥ i.	(grammes xxx.)
Pulv. acaciæ, ...	ʒ ii.	(" viii.)
Peppermint water, . . .	℥ ijss.	(" lxxv.)
Syrup, ...	℥ i.	(" xxx.)

M. Dose—one to four ounces.

While the ordinary dose is about an ounce, it seems to be a fact that even in a smaller dose (two to four teaspoonfuls) it purges relatively as much as in the larger doses.

* Or, better still, with hot milk, well flavored with cinnamon.—Trans.

I have now finished this long and perhaps tiresome enumeration of purgatives, and the details into which I have entered will permit me to be brief in the statement of the treatment of constipation. You note now the rich arsenal of remedies which therapeutics furnishes, and from which you can draw weapons to combat constipation; I shall now complete this lecture with some hints as to the treatment of this affection.

From a therapeutic point of view, constipation not only authorizes the divisions which we have established, but it also presents itself under two quite different aspects: sometimes the constipation is only a passing incident, caused, it may be, by a change of diet, by certain medicinal or toxic substances, as in lead poisoning, or by numerous other circumstances—this is accidental constipation; sometimes it is a part of the individual temperament, being a constitutional peculiarity, and unless remedied lasts for months and years, or even a whole lifetime; this is habitual constipation.

In accidental constipation, you can draw freely from the whole group of purgatives. The salines, oily purgatives, and even the drastics may be used, care being always taken to grade the intensity of the remedy to the obstinacy of the constipation. You can vary the treatment by lavements, first simple, then purgative. These latter, when the mechanical action of the water is associated with the local irritant effect of certain purgative substances, is an excellent therapeutic means, but it often fails.

Then come the mild purgatives, saline and oily and saccharine, and lastly the drastics; the latter are reserved for certain toxic constipations, such as are due to lead poisoning, where, in order to overcome the constipation, you will be obliged to resort to the most violent drastics, such as croton oil, which you will administer in dose of one drop, either in pill or with castor oil. When the lead constipation is overcome, you can, as you often see me do, make use of a preparation which readily promotes freedom of the bowels, in these cases of lead colic—I refer to the *honey of sulphur* (*mel sulphuris*), a mixture of equal parts of flowers of sulphur and of honey. This mixture, which may be given in great-spoonful doses, is palatable and constitutes a well tolerated and admirable laxative.

To these purgatives I may add a drug very much employed in the United States, the *Cascara sagrada*, or, to give the botanical term, the *Rhamnus Purshiana*, the family of which already furnishes to therapeutics the buckthorn (*Rhamnus Catharticus*), a drastic purgative. This purgative is given in the form of powder of the bark in the dose of six grains in capsules, or in that of the extract. My pupil, Dr. Eymeri, has devoted to the study of this plant a very interesting thesis.[19]

In habitual constipation, attention to hygiene claims the first place. You should, moreover, endeavor, before deciding upon your treatment, to fathom the pathogeny of the constipation. If it be due to want of muscular contractility, as in the case of arthritic dyspepsia, or even of certain neuropathies which are attended with a paresis affecting not only the muscular coat of the stomach but also that of the entire digestive tube, you will employ the muscular purgatives, or even certain of the drastics. You may even advantageously resort in these cases to electricity.

When, on the other hand, the constipation is due to a want of intestinal secretion, you will employ the appropriate purgatives, remembering that it is often by minute doses frequently repeated that you will succeed in triumphing over the constipation. But what it is necessary to avoid is the prolonged use of drastics, which are only beneficial in preparing the way for other medications.

In fact, in many cases, in order to obtain the first catharsis and get the bowels to act at all, we are obliged to employ the most violent purgatives, but when once we have attained our end, we must return to the milder laxatives, from fear of irritating the intestines and determining enteritis.

Thus far I have considered only those forms of constipation which are determined by want of secretion or by want of muscular contractility, leaving one side that which is due to mechanical obstruction.

I propose in the next chapter to study this form of constipation, which requires a special treatment.

NOTES TO LECTURE XX.

[1] Manna is the concrete juice of two species of fraxinus, both natives of southern Europe. When the young tree is still a sapling of eight years, and its stem has a thickness of at least three inches, transverse incisions are made in the bark, and a juice oozes, which, being collected and dried on slabs, constitutes tear or flake manna. The manna which flows from incisions after this first gathering concretes in little fragments on the tree, constituting what has been called little manna, (petite manne.)

Manna dissolves at ordinary temperature in six parts of water.

The purest is that named flake manna, which is the same as the manna in tears before spoken of; common manna (*manne en sorte*) of the French pharmacy is next in quality, but is more or less mixed with impurities, and is lumpy. Fat manna, collected later in the season, is a soft viscous mass, very active, but very disagreeable to the taste. The best manna of commerce contains from seventy to eighty per cent. of mannite ($C_6H_{14}O_6$) sugar, a resinous and acid matter, an azotized substance, and an insoluble matter, water and ashes. Mannite is found, not only in manna, from which it was extracted for the first time by Proust in 1806, but also in a large number of vegetables: celery, ergot of rye, pomegranate bark, couch grass root, etc. Mannite is a hexatomic alcohol, as Berthelot has shown.

[2] Honey is formed chiefly of dextrogyrous glucose, of cane sugar and of inverted sugar; it possesses, besides, several free acids and aromatic principles, varying with the flower that formed it. Some kinds of honey are white and some are of a deep-brown color. Common honey is much in use for purgative purposes, and serves as the basis of two kinds of

medicaments, the mels and oxymels. The preparations in which honey and vinegar are combined are called oxymels. The mels are (U.S.Ph.) the mel depuratum, or clarified honey, mel rosæ, or the honey of roses, mel boracis, or the honey of borax; the oxymels are common oxymel and the oxymel scillæ.

[3] Cassia fistula is a member of the leguminosæ. It is a native of Upper Eygpt and India. The cassia tree attains to large size and the height of 40 or 50 feet. The fruit, which contains the officinal part, consists of long cylindrical, dark brown pendulous pods; these are a foot or more in length, less than an inch thick, with a woody shell. Internally the pod is divided into numerous cells by thin transverse septa, which are covered with a soft black pulp. Each cell contains a single oval shining seed. The pulp is extracted from the pods by first bruising them, then boiling them in water, and afterwards evaporating the decoction, or, when the pods are fresh, by opening them at the sutures and removing the pulp by a spatula. (U. S. Dispensatory.)

Cassia pulp has a sickly odor and a sweetish mucilaginous taste. According to Vaquelin and Henry, it contains sugar, gum, a substance analogous to tannin, gluten, water, and a coloring matter soluble in ether.

[In this country cassia is seldom prescribed except as an ingredient in the confection of senna, which we give in place of the complex foreign preparations mentioned in the author's notes, many of the components of which could not easily be obtained in the United States.]

CONFECTIO SENNÆ, U.S., Br.—*Lenitive Electuary.*

"Take of senna in fine powder, eight troy ounces; tamarind, ten troy ounces; coriander, in fine powder, four troy ounces; purging cassia, finely bruised, sixteen troy ounces; prunes, sliced, seven troy ounces; figs, bruised, twelve troy ounces; sugar in coarse powder, thirty troy ounces; water a sufficient quantity. Digest in a close vessel, by means of a water bath, the purging cassia, tamarind, prune, and fig in three pints of water for three hours. Separate the coarser portions with the hand and pass the pulpy mass, by rubbing, first through a coarse hair sieve, and then through a fine one or a muslin cloth. Mix the residue with a pint of water, and having digested the mixture for a short time, treat it as before, and add the product to the pulpy liquid first obtained. Evaporate the whole until it weighs ninety-six troy ounces or until it has been brought to the consistency of honey. Lastly, add the senna and coriander and incorporate them thoroughly with the other ingredients while yet warm." Under the name of medicated prunes a confection is prepared by mixing prunes with a strong infusion of senna, adding sugar and evaporating to the consistence of a paste. Senna paste consists of figs and powdered senna beaten together and covered with granulated sugar.

The following prescription from Beasley contains cassia: Take of cassia pulp, one troy ounce; bitartrate of potash, two drachms; cinnamon water, three fluid ounces; manna, one and one half drachms; mix, and give a tablespoonful every two hours till it operates.

[4] The tamarind is the preserved fruit of Tamarindus Indica. This is a tree of the leguminosæ, growing in the Indias. It is a tree which rises to a great height (18 to 25 metres); the fruit is a pod from two to six inches long, and about as thick as the finger, ash colored, much curved, with numerous quadrangular seeds, contained in cells formed by a tough

membrane. Exterior to this membrane is a light-colored and pulpy matter, which is the part employed in medicine. According to Vauquelin's analysis, 100 parts of the pulp contain 9.40 of citric acid, 1.55 of tartaric acid, 0.45 of malic acid, 3.25 of cream of tartar, 4.70 of gum, 6.25 of jelly, 34.35 of parenchymatous matter, and 27.55 of water.

There are in commerce two kinds of tamarinds: the one, preserved in sugar or molasses, is the brown or red tamarind of the West Indies; the other, preserved without sugar, is the black tamarind of the East Indies; it is the pulp of this latter which is chiefly used in medicine.

In the United States tamarinds are seldom prescribed except in the form of tamarind water (which is an infusion of the tamarind and is an agreeable acid drink in fevers) and the confection of senna, above given. The author gives in the notes of the French edition a purgative electuary of tamarind prepared as follows:

Take of:

Tamarind pulp,	10 parts.
Cream of tartar,	1 part.
Rochelle salts,	2 parts.
Manna in tears,	4 "
Syrup of pale roses,	8 "

Mix. Dose—Half an ounce to an ounce.

[5] In a work on the alterations of calomel, Vernes (Comptes Rend. de la Soc. Mèd. de l'Isère, 1879) has shown that sugar in contact with this salt does not undergo decomposition. It is the same with acids; citric acid after fifteen days of contact with calomel did not modify it, nor did chloride of sodium have the least action upon it, even in the presence of albumen. According to this authority, proto-chloride of mercury is more stable than is usually supposed, and the bichloride more easily becomes chloride than the chloride undergoes transformation into corrosive sublimate.

Rhubarb (for description of which see U. S. Dispensatory) contains rhubarbaric acid, tannic and gallic acids, extractive matter, uncrystallizable sugar, starch and gummy extractive, malate and oxalate of lime, a yellow crystallizable substance, resin, oxide of iron, and other substances.

According to the researches of Kubly, rhubarb contains rheotanic and rheumic acids, a colorless substance pheoretine, chrysophanic acid, and a pectic matter. The Chinese and Persian rhubarbs are the best; the European rhubarbs not being half as active.

Rhubarb when roasted loses its cathartic property, but becomes more astringent. The pill, syrup, tinctures, compound powder, syrups and wines of rhubarb are all officinal and useful preparations. The infusion, especially when made with the addition of cardamoms, is a very excellent stomachic laxative.

[6] Podophyllum peltatum is a perennial plant of the family Berberidaceæ, which grows in North America. The parts employed are the rhizomes and roots; a resin is extracted called podophyllin, which presents itself under the aspect of a brilliant powder deprived of crystalline appearance, of a yellowish brown color and acrid and bitter taste.

According to Mayer of New York, besides this resin, podophyllin contains berberine a colorless alkaloid, a special acid, an odorous matter and saponine.

The resin is soluble in alcohol, ether, the essential oils, bisulphide of carbon, and in part in the alkalies.

In the dose of from $\frac{1}{3}$ to 1 grain podophyllin provokes regular stools 10 to 12 hours after its administration.

[The larger doses of 1 to 2 grains are likely to produce nausea and vomiting, as well as colic.]

Trousseau's and Blondeau's pills consist each of podophyllin gr. $\frac{1}{3}$; extract of belladonna gr. $\frac{1}{6}$; powder of belladonna root, gr. $\frac{1}{6}$; one or two such pills to be given per day. Van-de-Corput's pills consist of podophyllin, grs. $\frac{1}{6}$, Castile soap, gr. $\frac{1}{6}$, in each pill; those of Constantin Paul contain each $\frac{1}{2}$ gr. of podophyllin, with as much powdered ginger and a little honey.*

7 Aloes is a bitter juice furnished by numerous species of *aloe* (liliaceæ), originating for the most part in southern and western Africa.

When it is desired to obtain this product, the leaves are plucked near the stem and placed in goat skins, into which the juice is allowed to exude; it is then inspissated by artificial heat in iron cauldrons. The following species furnish the aloes of commerce:

1. Socotrine aloes (from Bombay, East Indies, or Zanzibar.) Deep brownish red color and disagreeable odor.
2. Common aloes (Barbadoes, Curacao). A dry, hard, chocolate-brown substance with clean, waxy fracture.
3. Aloes ferox, which furnishes the Cape aloes. Dark olive or greenish color, approaching to black; presents a smooth, bright, almost glassy surface; powder is of a fine greenish yellow color; its odor is strong and disagreeable.
4. African aloes, which is of little activity.
5. Arborescent aloes.

The juice of aloes, of a disagreeable savor and odor, owes its odor to a volatile oil. Aloes is soluble in alcohol, insoluble in chloroform; put in warm water it dissolves, but there separates from the solution a brownish mass formed of resinous drops constituting what has been called the *resin of aloes;* the soluble portion has been called the *bitter of aloes,* or *aloetine.*

The bitter principle of aloes is a crystalline substance, *aloine,* from which have been extracted *babaloin, nataloin,* and *socaloin.*

Aloes is prescribed as an aperient and purgative. In the dose of 7 to 15 grains it acts gently in five or six hours, causing diarrhœic stools with evacuation of bile; it at the same time sets up an irritation and congestion in the lower part of the rectum, and in the female a congestion of the uterus. In larger doses aloes may produce, besides abundant stools, general enfeeblement with a fall in the pulse and temperature.

Aloes is given along with gamboge, scammony, calomel, myrrh, etc. To render it less irritant, it may be associated with extract of hyoscyamus ($2\frac{1}{2}$ grs. to 15 of aloes), with rhubarb or with sulphate of iron.

Barbadoes aloes is given in one fifth the dose of Cape aloes. The officinal preparations of aloes are numerous. (See U. S. Dispensatory.) A useful lavement is made by steeping ʒ iss aloes with a half imperial

* Constantin Paul, On the Treatment of Habitual Constipation by Podophyllin, Soc. de Thér., April, 1873. Marchand, New Researches on Podophyllin, Bull. de Thér., t. lxxxvii., 1874, p. 164.

pint of decoction of oats; suppositories with 1 gramme aloes to 10 of cacao butter are also sometimes used to combat constipation.

DINNER PILLS. (*Pilulæ ante cibum.*) (Lady Webster.)

Take of:

Socotrine aloes	48 grains.
Mastic	12 "
Red rose	12 "

Beat them into a mass with water, and divide into 24 pills. Dose—1 to 3 pills.

SCOTCH PILLS. (*Anderson's Pills.*)

Take of:

Barbadoes aloes,	8 centigrams.
Gamboge,	8 "
Essence of anise,	4 milligrams.
Honey,	4 centigrams.

Mix for one pill. Dose—2 to 6.

The Pil. Rhei Co. and the Pil. Aloes et Myrrhae are old and famous cathartic combinations.

The Comp. tincture of aloes or *tincture of long life* of the Codex is made by macerating together Cape aloes, gentian root, rhubarb root, zedoary, saffron, white agaric (polyporus officinalis), theriac and alcohol. The various pills of aloes of the French Codex do not materially differ from those of the U. S. Ph. The COMPOUND DECOCTION of the U. S. Ph., which is not given in the Codex, is a very useful laxative preparation in the dose of a couple of tablespoonfuls at bed time. In this decoction the active principles of the aloes are kept soluble by means of an alkaline carbonate, and the tincture of cardamoms gives it a cordial property. The VINUM ALOES is a warm stomachic laxative, and the tinctures are emmenagogue as well as purgative; the tincture of aloes and myrrh is a deservedly popular preparation.

Senna (or rather *the sennas*) comes from a great number of species, (cassia acutifolia, obovata, angustifolia), whose leaflets are mixed with the leaves of a plant of the family of apocynaceæ, arguel, (cynanchum arguel); this mixture is sold under the name of *séné de la palthe*, a name derived from an impost formerly laid upon it by the Ottoman Porte. Pharmacy distinguishes also varieties of senna by their source; (the Syrian, Indian, Italian, Senegal and Tripoli sennas, etc). The leaves of this leguminous plant are found in commerce mixed with the pods.

Senna contains an active principle, *cathartine*, which has been given in the dose of 10 to 15 centigrams as a purgative.

The *Black Draught* (*Haustus niger*) of English and American medicine is the familiar infusion of senna and ginger to which Epsom salts is added after the infusion is strained. The following (from the U. S. Dispensatory) is a good formula for senna tea: Take of senna, half an ounce, sulphate of magnesia and manna, of each an ounce; fennel seed a drachm; boiling water, half a pint. Macerate in a covered vessel till the liquid cools. One third may be given for a dose and repeated every four or five hours till it operates. The French Codex substitutes Glauber salts for the Epsom, and includes rhubarb. The "Tisane Royale" of the Codex is essentially the same as the Infusion of Senna of the U. S. Ph., with the addition of sliced lemon, parsley, anise, and sulphate of soda:

"Take of:

Senna leaves, Sulphate of soda, Parsley leaves,	of each, ℥ ss.
Anise and Coriander seeds,	of each, gr. lxxv.
Water,	Oii.
Sliced lemon, No. 1.	

Macerate 24 hours, stirring from time to time, express and filter. Dose—a wineglassful."

The "Médecine de Napoleon," *imperial ptisan,* contains infusion of senna with cream of tartar, tartar emetic and sugar, (each quart of the infusion would contain about ½ grain of tartar emetic and an ounce of cream of tartar; to be taken hourly in tumblerfuls till free purgation.)

The Mistura Sennæ Co. of the B. Ph., has Epsom salts, extract of liquorice, tincture of senna, comp. tincture of cardamoms, and infusion of senna, and is a popular and excellent preparation.

[9] The original formula of the "imperial ptisan," prescribed by Corvisart, is as follows (cream of tartar being replaced by the neutral tartrate):

Take of:

Neutral tartrate of potassa,	30 grammes.
Tartar emetic,	25 miligrammes.
Sugar,	60 grammes.
Infusion of senna,	1000 "

Dissolve and filter. Dose—a small glassful every half hour or hour till purging ensues.

[10] Turpeth is the root of Ipomæa Turpethum, an Indian plant. It has an energetic purgative action, due to the resinous juice which it contains; this resin contains an active principle *turpethine.* The dose is about the same as that of jalap.

[11] Jalap is the tuberous root of the Ipomæa Purga, a Mexican plant. It contains a peculiar resin which is its active principle. Jalap is an active drastic cathartic, producing copious watery stools. Being hydragogue, it is much in use in dropsies. The dose is from 15 to 30 grains; of the resin from 4 to 8 grains. A good old-fashioned purge consists of calomel 5 grains, jalap 15 grains.

The officinal preparations are the *extract,* the *compound powder,* the *pulvis scammonii Co.,* the *resin,* and the *tincture.* The *compound powder* contains 1 part jalap to 2 of cream of tartar, and is much used in dropsical complaints. The *compound tincture* of the German Ph. is also a popular hydragogue purgative. It is made as follows:

Take of:

Jalap root,	8 parts.
Turpeth root,	1 part.
Scammony,	2 parts.
Alcohol,	96 "

Mix, macerate for 10 days and filter. Dose—one or two tablespoonfuls.

[12] Scammony is the concrete juice of the root of Convolvulus Scammonia, a Syrian plant. It is a powerful drastic purgative; is more active and less unpleasant than jalap. The dose is 5 to 10 grains. The officinal preparations are the *Confection,* the *Pil. Colocynth Co.* the *Pulvis Scammonii Co.* and the resin.

[13] Colocynth is the decorticated fruit of cucumis colocynthis, an Oriental plant. Colocynthin is the active principle. Colocynth is a drastic purgative, in large doses producing violent irritation, purging, vomiting, cramps and colic. The *Compound extract* is a favorite preparation; it contains colocynth, aloes, scammony, cardamoms, and soap; it is an energetic and safe cathartic in the dose from 5 to 30 grains.

The compound cathartic pills contain this extract combined with calomel, gamboge, and jalap. The *compound colocynth pill* of the B. Ph. contains colocynth, aloes, scammony, sulphate potash, and oil of cloves. The *pill of colocynth and hyoscyamus* contains the above, with the addition of ext. hyoscyamus to prevent griping.

[14] Elaterium is the concrete juice of the fruit of the Momordica elaterium (wild cucumber), a plant of southern France. The active principle is *elaterine*. Elaterium is a very powerful drastic cathartic, seldom prescribed except in dropsical affections. The dose is from $\frac{1}{16}$ to $\frac{1}{4}$ grain. A good way to administer elaterium is to order 1 grain to be divided into 16 pills; give one pill every hour till active purgation results.

[15] Cayapona, the Brazilian purge, though much used in South America, is not given in the United States.

[16] Croton tiglium is a tree 5 or 6 metres in height which grows in the East Indies, Ceylon, and Mollusca. It furnishes seeds (*grana Mollusca, grana tiglii*) contained in a capsule the size of a hazel nut. The seeds contain a fixed oil and crotonic acid, a volatile oil, a yellow-brown resin, wax, etc. The oil is obtained by crushing and expression, or by ether. Ingested it causes an acrid sensation in the œsophagus and a sense of heat in the stomach, then follow nausea, sometimes vomiting, then griping pains and numerous evacuations. In large doses it is powerfully toxic. The dose is one or two drops.

[17] Induction currents applied directly to the intestines cause a contraction in the immediate neighborhood of the electrodes; between the electrodes there is relaxation of the walls.

The constant currents abolish the peristaltic movements and cause a diminution of tension. The current follows the normal direction of the movements, or, if it be reversed, causes augmentation of the contractions.

Electrization of the spinal cord by constant currents augments notably the peristaltic contractions at the moment of their application.

Induction currents applied over the splanchnics augment the tension without determining peristaltic movements.

Constant currents over the splanchnics give rise to peristaltic contractions. Electrization of the nervous plexuses and mesenteric nerves produces similar effects.

Interrupted currents in the direction of the pneumogastrics cause a dilatation of the intestines and arrest of their movements; this phenomenon takes place by reflex action. They produce directly, on the other hand, contraction of the stomach.

Constant moderate currents over the pneumogastrics have little effect on the intestine; they arrest the normal or pathological contractions of the stomach.*

* Legros and Onimus, Electricité Medicale, 1872, p. 666.

[18] Castor oil is obtained from the seeds of the *ricinus communis*, a member of the Euphorbiceæ, a native of India and Africa. The ricinus has been cultivated in France, where it is a shrub attaining the height of about six feet. In India the ricinus or *palma Christi* is a tree, sometimes rising to the height of 30 or 40 feet. The fruit is a three-celled capsule, covered with spines; each cell contains a small oval compressed bean, the analysis of which gives: resin, extractive matter, gum, (in the integuments), a fatty matter (oil), casein, albumen, ligneous matter, and starch (in the kernel). According to Pereira, there is also a bitter acrid principle. The seeds are not employed in medicine, as they possess too energetic drastic properties.

The oil is obtained by expression or by exhausting the seeds with boiling water. Tusson, in 1864, extracted from the seeds by boiling water a crystalline alkaloid which he called *ricinine*.

The ordinary dose of castor oil is a couple of tablespoonfuls. The unpleasant taste of this purgative may be partly disguised by administering it with orange or lemon juice, in hot broth, in coffee, or peppermint water. The Lancet gives the following palatable method: Take an orange, divide into two equal parts, squeeze the juice of one half into a cup, and pour the oil over it, then cover it with the juice of the other half. The following is a good cathartic draught.

Take of:

Castor oil, ...	ℨ vi.
Peppermint water, ...	ℨ x.
Vitelli ovi, ...	No. i.

Mix—one dose.

[19] [Among the purgative lavements given in the author's notes, the following is selected:

Take of:

Sulphate of soda, ...	1 ounce.
Honey (or molasses), ...	1 "
Infusion of senna, ...	½ pint.

M. For a cathartic lavement.]

The *Cascara Sagrada* (rhamnus purshiana, so-called after Frederick Pursh, the German botanist who first described it in 1814) belongs to the family of Rhamnaceæ which gives us the buckthorn. It is a shrub which is a native of the Pacific coast of North America. It contains, according to Prescott's analysis, brown, red, and yellow resins, tannic, malic and oxalic acids. The powder of the bark is used in medicine; it is generally given in capsules of six grains. The fluid extract, first introduced into therapeutics by Parke, Davis and Co. of Detroit, is chiefly used in America, and is given in doses of from 30 drops to a teaspoonful. The taste is rather unpleasant, hence means have been taken to render it more palatable; the *cascara cordial* seems very well to fulfill this end. Some physicians prefer to administer the cascara in the form of pills of the solid extract, of which the dose is a grain or two.

It is to Bundy that we owe our first acquaintance with this new cathartic. In France, Landowski was the first to experiment with it. Dujardin-Beaumetz has made trials with it in his service, and his pupil Eymeri has embodied the results in his thesis. (*Eymeri, La Cascara Sagrada, Thèse de Paris*, 1884).

LECTURE XXI.

ON THE TREATMENT OF INTESTINAL OCCLUSION.

SUMMARY.—Intestinal Occlusion—Pathogeny—Symptoms—Diagnosis of Cause: Certain, Probable, Uncertain—Diagnosis of the Seat of the Occlusion—Treatment—Purgatives—Mechanical Means—Mercury—Lavements—Forced Irrigation—Injections of Air, of Carbonic Acid—Lavements of Seltzer Water—Lavements of Tobacco—Punctures of the Intestines—Coffee—Belladonna—Massage—Electricity—Surgical Treatment—Termination of Strangulations—Choice of the Operation—Laparotomy—Enterostomy—Moment for the Operation.

GENTLEMEN: When in the last lecture I was speaking of the treatment of constipation, I told you that I should reserve for a special chapter that form which results from mechanical obstructions opposing the course of fæcal matters, and thus producing occlusion. It is this accident, unhappily too frequent, which I wish to study to-day, while setting forth the therapeutic resources which enable us to combat it.

I shall be brief on the symptomatology, for I cannot here trace the pathological history of intestinal occlusion, and shall have to refer you for fuller details to your treatises on Practice, and in particular to a remarkable memoir on "Internal Strangulations of the Intestine" by my friend and colleague Ernest Besnier.

As for the causes which are capable of obstructing the course of the fæcal matters, you know that they may be seated within the intestine, in the walls of the intestine, and outside of the intestine. Among those having their origin in the interior of the intestinal canal, are foreign bodies, hardened fæcal matters, intestinal calculi, etc. Those which have their source in the walls are more frequent, and present themselves under two circumstances; either the intestine is in a healthy state or it is diseased. In the latter event, it is a cancer or cicatrices which diminish the calibre of the intestines, this is intestinal stenosis; in the former event we have to do with invagination or twisting of the intestine; this is ileus or volvulus.

As for the causes which act outside of the intestinal walls, they are very numerous, and are due, sometimes to fibrous bands originating in a former inflammation of the mesentery or peritoneum, or to strangulation by an intestinal diverticulum, sometimes they are consequent on an abnormal opening of the abdominal walls or diaphragm, as in hernias.

Lastly, there is the entire group of abdominal tumors which exercise more or less compression on the intestine.

What it is important to know is the relative frequency of these causes, and Brinton has given us in this regard interesting data. In analyzing 600 cases of occlusion, he has found that invagination takes the lead in causation, being accountable for 49 per cent.; then come fibrous bands and adhesions: 31.5 per cent.; then strictures and compressions of the intestinal walls: 17.5 per cent.; and lastly twisting or volvulus: 8 per cent.[1]

The symptoms of occlusion ought to be well understood; they will enable you to establish the diagnosis of the cause, and as you will see, this matter of diagnosis has a great importance therapeutically. Let us then briefly sum up the principal symptoms, which are: vomiting, constipation and tympanites.[2]

Constipation plays a dominant part; it is the absolute absence of stools, and the resistance of this constipation to purgatives which constitute the important element in the symptomatology of occlusion. Do not forget, moreover, that if the strangulation be seated at the upper part of the intestine the patient may have stools, despite the obstruction, from emptying of the bowel below the seat of the strangulation.

Another important phemonenon, the vomiting, presents a special characteristic to which reference has often been made, namely, the appearance of fæcal matters in the vomitus. This is in fact one of the pathognomonic signs of this affection.

Lastly, the accumulation of gas above the obstruction determines more or less meteorism, which sometimes indicates the seat of the strangulation. The graver incidents of the affection sometimes appear quite suddenly, sometimes on the contrary, they supervene in a slow and progressive manner.

The diagnosis is a matter of the utmost importance, and involves two points. first, the determination of the cause of the obstruction, next the place where it is seated. To ascertain the cause you must rely on the appearance of certain symptoms, on the march of the consecutive phenomena, on the age of the patient, etc.; but, considered in a general way, it may be said that the diagnosis of occlusion presents itself under three aspects: as certain, as probable, and as uncertain.

I. The diagnosis is certain when there exists a tumor perceptible to palpation or the rectal touch; it is certain when by the finger introduced into the rectum the obstacle can be felt; certain also when there exists an engorged and irreducible hernia. Moreover in most of these cases the morbid manifestations are developed slowly.

II. The diagnosis is probable, when one is obliged to infer it from certain special symptoms. For instance, if you have to do with a sudden case of obstruction, if the stools contain blood, if the patient experiences a very acute anal tenesmus, if palpation of the abdomen enables you to feel an elongated sausage-shaped tumor which follows the peristaltic movements of the intestine, it is likely that the cause is intussusception.

In another patient the occlusion is almost instantaneous, and at the moment of its occurrence the patient feels an excruciating pain in the abdomen; there is abundant fæcal vomiting, and when you inquire into the history, you ascertain that there was an old attack of peritonitis; it is probable that you have here a case of strangulation by peritoneal bands.

Lastly, we will suppose that it is in an old person that the obstruction has taken place; that it has been preceded by alternations of diarrhœa and constipation; the patient, moreover, is cachetic; he has for a long time had pains in the abdomen; his belly is voluminous; his fæces are in flattened ribbon-like masses; it is probable that in this case it is cancerous stenosis of the intestine which is the cause of the occlusion.

III. Lastly, cases are unhappily too numerous where the symptoms are obscure, rendering the diagnosis of the occlusion very difficult, and notwithstanding the remarkable report made by Hutchinson at the Medical Congress at Bath, the exact diagnosis of internal strangulation is still one of the most difficult problems of clinical medicine.[1]

As for the seat of the obstacle, we must base our judgment not only on what we can discover concerning the cause, but also on the information furnished by the rectal touch; but it is chiefly the form of the abdomen which can and ought to guide us. Langier has, in fact, shown that when the obstacle is seated in the small intestine it is the central part of the abdomen which is tumefied; when, on the contrary, the obstruction is in the large intestine, the swelling is in the colon, which forms a salient peripheral border leaving the central part sunken.

After these short explanations, the importance of which you now understand, let us take up that portion of our subject which has the most practical interest, namely, the treatment of occlusion.

You have before you a case of intestinal obstruction; you begin by a careful examination of the patient, you ascertain the march of the disorders, the circumstances which have preceded them; you palpate the abdomen and explore the rectum; then, when once your diagnosis is made as accurately as possible, you institute your treatment. What shall be your first step?

In most cases you will begin by giving a purgative; this is as much to aid diagnosis as for therapeutic intent; you must, however, be careful and not have recourse to too energetic drastics. I shall never forget a patient whom I observed when I was clinical chief to Behier; it was a man affected with internal strangulation; the diagnosis of the cause was uncertain, and mild purgatives had been given without any effect on the obstruction; a pill of croton oil was ordered which caused excruciating colicky pains, and the patient died with rupture of the bowel. At the post mortem we found the cause of the obstruction in a peritoneal band constricting the intestine. So then be chary of powerful cathartics; give oily or saline purgatives, and do not prescribe anything more drastic than jalap.

Your purgatives, we will suppose, have aroused intestinal action, your patient has had stools, the obstacle is removed, and recovery is assured; everything has gone well in this case, but it is unhappily not always so, and oftener than otherwise your purgative remains without effect. What must now be done? Certain mechanical means have now been recommended; such as metallic mercury by mouth, and free lavements by the rectum. The administration of metallic mercury by mouth is an old method, once much in vogue for overcoming intestinal strangulation; it was supposed that the mercury could do this by its weight. Medical writers of a former day such as Ambroise Paré, Rolland, and Belluci, have reported numerous cases in which metallic mercury overcame the intestinal obstacle. A pound and even a pound and a half of this metal would be given in one dose; the patient was put into a bath; and while there two vigorous assistants kept shaking him in order to make the mercury fall into the intestine, and cause the obstruction to disappear.

Gentlemen, this is a measure which should be mentioned only to be condemned. Hanius has shown by careful experiments that mercury when introduced in large quantity does not descend in bulk into the large intestine, but penetrates slowly, globule after globule, and this is so true that if the obstacle be removed you do not see the mercury voided in gross masses, but little by little, in particles or globules, in the stools, and for weeks afterward this metal is found in the dejecta. Moreover the horizontal position maintained by the patient is a hindrance to the direct action of mercury on the obstruction. So, despite the recent favorable facts reported by Tessier, Tesson, Houdebeine, Feillé, Pousseau, and Matignon,[1] I am of opinion that mercury should be utterly discarded from the treatment of intestinal occlusion.

The mechanical means employed per rectum are as follows: first lavements, which may contain purgative substances to promote intestinal contractions, but you can also use water alone; and it is not now a simple enema which you must administer, but a powerful injection thrown into the large intestine. Two means may be utilized to make the water penetrate as high up as possible in the intestine; either you may make use of enteroclism or forced irrigation.

I have already told you in former lectures what Cantani means by this word enteroclism, and how he employs this method; I have told you that the best enteroclist is the long flexible Debove tube. This process will give you excellent results when you have to do with compression of the inferior extremity of the large intestine by abdominal tumor, or stenosis by cancerous degeneration; in penetrating above the obstacle, the long tube enables you to throw currents of water into the midst of fæcal matters accumulated in this point, and may determine their exit in a liquid state.

The other means consists in the use of powerful force pump syringes which enable us to throw a very energetic stream of water into the intestine. This is a procedure not always without danger, so I greatly prefer enteroclism to this practice of forced injections. But whether you make use of one or the other process, it is only addressed to obstacles seated in the large intestine, for despite the facts reported by Isnard and those still more recently by Cantani, I believe it is very seldom indeed that Bauhin's valve (ileo-cæcal) can be forced by injections.

At other times it is not water that is injected but air. Hippocrates advised to employ for this purpose a blacksmith's bellows, of which the nozzle was introduced into the anus. Cœlius Aurelianus and Wood have used this means and vaunted its results.

It has been proposed to substitute for air carbonic acid gas, which you know has a real action on muscular contractility; and in this connection you remember the story of the negro who was suffering from strangulation. The American physician who had the care of this patient introduced into his rectum a triple charge of Seidlitz powders; two assistants stopped the anus, the patient felt himself on the point of bursting, something gave way, the obstacle was removed and the negro recovered.

Without recommending so harsh a measure as this, and which might be dangerous, I can heartily endorse a more simple method, and one which in many cases gives good results; I refer to the injection of seltzer water into the rectum. The operation is very easy; you introduce as high up as possible a canula furnished with a long rubber tube, which you then adapt to a suitable syringe and a seltzer fountain; you press upon the piston and the seltzer water penetrates with violence into the intestine. There are numerous cases of cure by this method.

I advise you to repudiate the employment of tobacco injections, recommended by some authorities, and in particular by Ronzier Joly, whether in the form of smoke or of decoction. For if it is not demonstrated that tobacco in lavement is superior to other injections, it has been proved that these lavements may be toxic, and determine symptoms of fatal poisoning.

Purgatives, lavements of water, of Seltzer water, have failed, what will you do next? You can try by punctures to diminish the extreme distension of the intestine by gas, for the muscular fibres of the gut if unduly stretched lose their contractility. You can use for this purpose one of the small needles of your aspirator, or a fine capillary trocar, puncturing the intestine in places where it is most distended, but this operation must be done with great prudence, because these punctures, made with ever so fine a needle, may determine peritonitis. They are, in fact, the more likely to do this for the reason that they are generally inefficacious; for it is much more difficult than one would imagine to withdraw gas from the intestine by this means. I have often punctured loops of intestine, and despite numerous aspirations, I have hardly ever obtained in this way much reduction of the tympanitic swelling. Reserve then these prickings for cases in which the meteorism is so great that the diaphragm is crowded upward into the thorax, and circulation and respiration are seriously impeded.

Another means superior to the puncture is the employ of ice, vaunted by Grisolle and Masson. You should always resort to this simple remedy; the application of cold to the abdomen diminishes the quantity of gas, excites intestinal contraction, and opposes the peritonitis which so frequently complicates the strangulation.

By the side of ice we may place the use of belladonna, vaunted by Hanius, Chrestien, Giraud and others, as possessing curative virtues in strangulation. Coffee in large doses has been advised by Durand, Guyot and Lamarre Picquot as being especially efficacious in hernial strangulation. Coffee has for its effect to augment the intestinal contractions; strychnine, which acts in the same way, may also do good, according to Homolle; Hervieux has recommended Mayor's hammer; Logie, Richard Neale, and Bonnemaison of Toulouse have counselled suspending the patient by his feet with the head downward; massage and wet cups over the whole abdomen are measures which have long been in use among the Russian peasants, but all these means are very uncertain. Therefore after having employed purgatives, ascending douches, applied ice to the abdomen, if you are not able to overcome the obstacle, there remains, before resorting to surgical means a last resource, electricity.

Leroy of Ètiolles (1826) was the first to apply electricity to the treatment of strangulation; he was followed by Duchenne of Boulogne (1851), Chrestein, Stokes (1865–1867), Keyhel (1867), Macario (1870), Duteuil (1872), Fleuriot, Dalmonte, Mario Giommi (1875), all of whom claim signal successes. In 1878, Bucquoi reported three cases of intestinal occlusion cured by strangulation. How is electricity to be applied? Till quite recently the only form used has been faradization. A bent rheophore was introduced into the rectum, the other electrode was placed over the abdominal walls. But Boudet[5] of Paris has laid down the rules which ought to be followed in such cases, and which are as follows:

You will make use, not of faradic but of galvanic currents, and introduce by the anus a special electrode constituted by a rubber sound in which is placed a metallic stylet which does not quite reach the extremity of the sound, so that the mucous membrane is never in direct contact with the stylet. The stylet is in communication with the negative pole of the battery while the positive electrode is applied over the abdomen. The force of the current must not exceed 10 to 15 milliampéres, and each séance ought to last about 20 minutes. You will have care to interrupt the current from time to time.

Bardet has ingeniously modified the rectal excitator; he employs an instrument quite like that which he uses in direct electrization of the stomach. This apparatus serves not only for intestinal galvanization, but also for the practice of enteroclism.

Finally, when you have quieted the vomiting by iced drinks, when you have relieved the pain by subcutaneous injections of morphine, which by themselves, according to James Martin, may combat strangulation, you have exhausted all the resources of medical therapy, and the interference of the surgeon is demanded. And although this subject is foreign to the province of these lectures, permit me in a few words to state what kind of aid we are to expect from the surgeon when everything else has failed.

This is one of the gravest and most difficult problems of therapeutics, and one which you may often be called upon to encounter. You ought then to be familiar with every step in the operation contemplated, and with its possible and probable results, in order to give sound advice when the subject matter of discussion is what to do in a case of internal strangulation that resists all medical measures.

Under what circumstances and at what stage in the disease ought surgical interference to be sought, and what should be the operation chosen? In reply to these questions I shall draw largely from the interesting monograph of my colleague Le Dentu,* and from a discussion which took place at the Society of Surgery, in which Le Fort, Terrier, Lucas Championniere, etc., took part.

Under what circumstances is surgical interference demanded? As intestinal occlusion is an affection incompatible with life, unless the obstacle to the course of fæcal matters is removed, the patient is doomed to die. There is but one condition in which nature unaided can bring about a cure, namely, when the obstruction is due to invagination; here sometimes the invaginated, sausage-shaped tumor has sloughed away and been voided in the stools.

According to Leichtenstein's statistics which comprise 593 cases of intussusception, the general mortality is 73 per cent. and the chances of separation and elimination increase with age, that is to say, below five years the chances are 6 per cent., while at 60 years they are 60 per cent., but on the other hand, the chances of death increase with age. Moreover, if we refer to the results of gastrotomy as far as known, we find a mortality of 60 per cent., which goes to show that in persons of a certain age affected with ileus, there are as many chances of recovery without operation as with one.

Save in cases of intussusception, where the probabilities of recovery, with or without surgical interference, must always be a subject of debate,

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* Le Dentu, The Conditions of Success of Surgical Intervention in Intestinal Occlusion, Jour. de Thér., 1876, p. 485.

such interference is always necessary, and here you must take your choice between two operations, enterostomy, or the opening of the intestine and the formation of a false anus, and laparotomy, or the opening of the abdomen by a simple incision of the abdominal walls.

This latter operation, although counselled as early as 1672 by Barbette, has been heretofore neglected, but now, thanks to the antiseptic methods, the peritoneum is a new domain conquered by modern surgery, and to-day laparotomy is an operation which may be contemplated without the horror with which it was formerly regarded. The operation for artificial anus presents serious difficulties; on the one hand there is the uncertainty at what point to make the opening into the intestine, and on the other, the impossibility of maintaining existence if the false outlet is made at too high a point of the intestine. And then, to bring back a poor wretch to life to doom him henceforth to be the victim of a repulsive and mortifying infirmity, does not seem to be a very desirable result.

Hence it is that the medical profession has come back to laparotomy as being the preferable operation, which is always advised as a last resort in cases of strangulation, whether by a band, by intussusception or by torsion of the intestine. Enterostomy should be reserved for cases of tumor of the intestine, and when the obstacle is seated in the large intestine; the false anus should always be made above the obstruction, and it will always be a matter of deliberation where to perform the operation. In regard to this, however, you should remember that, according to the English authorities, Amussat's method, in which lumbar colotomy is practised on the right side and on the level of the cæcum, gives better results than the method employed in France, which consists in making the unnatural anus in front, in the left flank, on the level of the sigmoid flexure. In a recent discussion before the Society of Surgery, Trelat showed all the advantages of the method of Amussat, advantages which pertain, not only to the operative procedure, but also to the subsequent convenience of the situation for the adaptation of apparatuses designed to remedy as far as possible the serious inconveniences of the artificial anus.

As for the period when this operation ought to be performed, there is general agreement that the earlier is the better time; the longer the interval that has elapsed since the date of the strangulation, the fewer are the chances of recovery, although life may possibly be compatible with a strangulation existing for weeks.

I myself saw, in fact, a patient who for three weeks had intestinal occlusion with fæcal vomiting, and who during that time suffered but little pain. But at these advanced periods the pulse becomes filiform, the temperature falls, and the economy becomes so enfeebled that but little can be expected from an operation, and when one is attempted and the obstacle removed, the patient succumbs from the shock.

So, then, after having tried all medicinal means without effect, if you decide to resort to a surgical operation, do so at an early date, before your patient is exhausted by the sequelæ of the occlusion.

NOTES TO LECTURE XXI.

[1] Classification of the Causes of Intestinal Occlusion (after Doliger).

I. By organic affections of the intestinal walls.	1. Inflammatory stenosis. 2. Cicatricial stenosis. 3. Hypertrophic stenosis. 4. Valvular stenosis. 5. Stenosis by polypi. 6. Cancerous stenosis.	
II. By lesion of position of the intestinal walls.	1. Invagination. 2. Torsion. 3. Sudden flexion.	
III. By strangulation, properly so-called.	1. Internal hernias through the diaphragm; abnormal openings of the mesentery, etc. 2. Strangulation by the ileo-cæcal appendix, or an intestinal diverticulum. 3. Strangulation by peritoneal bands. 4. Strangulation of intestine by intestine.	
IV. By foreign bodies.	1. Calculi, { biliary. intestinal. 2. Foreign bodies, properly so-called. 3. Intestinal worms. 4. Hardened stercoral matters.	Internal.
	1. Kidney, uterus, or other organ compressing the intestine. 2. Abdominal tumors compressing the intestine.	External.

[2] These, according to Ernest Besnier, are the principal symptoms which enable us to establish the diagnosis of the nature of the intestinal strangulation.

Invagination. Vomiting, ordinarily bilious, rarely stercoraceous, constipation, rarely absolute; bloody fetid diarrhœic stools; straining and violent anal tenesmus; belly at first retracted afterwards tympanitic; abdominal tumor cylindrical, knee or elbow shaped, length greater than width, more salient during the crisis of colic than in the state of repose.

Stricture. Antecedent signs of importance: diseases of the intestines; cahectic state of the patient; frequent alternations of diarrhœa and of constipation; abdomen habitually distended and voluminous; stercoraceous vomiting; tympanites much developed.

Strangulation properly so-called. Antecedent signs; anterior peritoneal inflammation; actual signs, pains excessive at the moment of strangulation; obstinate precocious vomitings; absolute constipation; no bloody evacuations, no tumor.*

[1] These are Jonathan Hutchinson's observations concerning the differential diagnosis of the various kinds of strangulation:

1. When a child suddenly presents symptoms of intestinal obstruction, it is probable that it is a case of invagination or peritonitis.
2. When the patient is aged, the diagnosis will be either obstruction by fæcal matters, or cancerous affection.
3. In adult life the causes of intestinal obstruction may be multiple, but invagination and cancer are met with very rarely.
4. Invagination is recognized by severe straining efforts in defecation, the presence of blood or mucus in the excreta, the incomplete constipation, and the presence of a semi-solid swelling felt by palpation of the abdominal walls, or by the rectal touch.
5. In invagination, the abdominal walls remain generally relaxed, and as there is but little meteorism, it is always possible with the help of anæsthesia to detect the intestinal tumor.
6. You will suspect a cancerous lesion when an old patient has for some time had abdominal pains, or periods of temporary constipation. In these cases also the constipation is often incomplete.
7. If there be a tumor which compresses the intestine, if you etherize the patient you will generally find it by palpation or by the rectal or vaginal touch. You must take care not to be led astray by the presence of scybala.
8. If, between grave attacks of obstruction, the patient has enjoyed perfect health during long intervals, one may suspect the presence of an abnormal diverticulum, or of a band formed by old adhesions, or of a portion of the intestine distended in the form of a pouch, or of a volvulus.
9. If from the beginning of the intestinal obstruction the abdomen becomes hard and distended, it is almost certain to be a case of peritonitis.
10. When you can see the movements of the intestine through the abdominal walls, it is almost certain there is no peritonitis. This symptom is chiefly observed in lean subjects, with an old obstruction having its seat in the colon.
11. The tendency to vomiting will be in proportional relation with the three following conditions: first, the proximity of the seat of the obstruction to the stomach; second, the closeness of the constriction, and lastly, the persistence with which food or medicine is given by the mouth.
12. When the obstruction has its seat in the colon or rectum, nausea is completely absent.
13. Violent straining and bilious vomitings are often more painful in hepatic or nephritic colics than in intestinal obstruction.
14. Vomiting of fæcal matters is observed only in cases where the obstruction is relatively high up. If these vomitings appear early, it is a grave symptom, indicating very close coarctation.
15. The introduction of the hand into the rectum, after the method of Simon of Heidelberg, may often give valuable information.

The following table by Ernest Besnier, gives the frequency of the seat of the strangulation in the different varieties :

* E. Besnier, On Internal Strangulation of the Intestine, Paris, 1860.

Nature of the Strangulation.	Number of cases.	Seat in the small intestine.	Seat in the large intestine.
Invagination	47	13	34
Stenosis	26	9	17
Strangulation by torsion	10	2	8
Flexion	6	5	1
Solid bands (bridges or arcades)	26	19	7
Application of the cæcum	9	9	0
Diverticuli	9	9	0
Intestinal bands	5	5	0
Abnormal openings of the peritoneal folds	11	9	2
Diaphragmatic openings	4		4
Peritoneal pouches	4	4	0
By compression (tumors)	6	2	4
Total	183		

[a] Matignon examined the action of metallic mercury in ten cases of internal strangulation. His conclusions are: 1, Given in doses of from $\frac{1}{2}$ lb. to 1 lb. it is perfectly inert, as far as any medicinal action is concerned; 2, It acts both by its weight and by dividing the stercoraceous matters; if the intestine is sound it does not cause lacerations; 3, Mercury thus given is well tolerated; it stops vomiting and alleviates the pain; 4, In obstruction due to fæcal impaction its beneficial effects are almost certain. It is the same in cases of compression and stenosis, where the calibre of the intestine is not utterly suppressed; 5, in other forms of occlusion it is very uncertain, and is not to be recommended.*

[b] Boudet's labors date from 1880. He shows that constant currents act more particularly on the smooth fibres of the intestine, promoting contraction, while interrupted currents act chiefly on the muscles of the abdominal walls. He cites cases of recovery under galvanism. Boudet has also obtained good results from the same means.†

[c] This elimination generally takes place from the 11th to the 20th day. Even in cases where elimination takes place the mortality, according to Le Dentu, is considerable,—from 28 to 83 per cent.

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* Matignon, On the Treatment of Intestinal Occlusion by Metallic Mercury in Large Doses, Thése de Paris, 1879.

† Boudet of Paris, Note on Two Cases of Intestinal Occlusion Treated and Cured by Electricity, Progrès Méd., 1880. Bardet, Traité de Electricité Médicale, Paris, 1885.

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LECTURE XXII.

THE TREATMENT OF DIARRHŒA.

SUMMARY.—Diarrhœa—Causes and Pathogeny—Alimentary, Vaso-Motor Diarrhœa—Diarrhœa from Excess of Contractility—Diathetic Diarrhœa—Therapeutic Indications—Not all Diarrhœas to be Cured—Hygienic Treatment—Milk and Raw Meat—Influence of Cold—Pharmaceutical Treatment—Inert Powders—Astringents—Bismuth, Chalk, Tannin, and Rhatany—Oxide of Zinc—An-exosmotic Substances—Opium — Morphine—Association of these Different Substances—Lavements of Ipecac—The Diarrhœa of Children—Cholera Infantum—Treatment of Infantile Diarrhœas—Malarial Diarrhœa—The Diarrhœa of Warm Countries—Diarrhœa of Cochin China—Thermal Waters in Diarrhœa.

GENTLEMEN: Diarrhœa, the treatment of which I desire to consider to-day, is a symptom which is the opposite of constipation, for while the latter is distinguished by the hardness and scantiness of fæcal matters, it is their abundance and their liquidity which characterize diarrhœa.

Despite this opposition, the causes which determine these symptoms are identical while being contrary, and just as we have seen constipation produced by alimentary substances, by modifications effected in the intestinal secretions, and by perturbations whose seat is the muscular coat of the intestines, so we see the same causes produce diarrhœa.

We have then a diarrhœa of alimentary origin, *crapulous* diarrhœa, due to the ingestion of food in too great quantity, or badly prepared, or badly tolerated by the intestinal mucosa. When I was on the subject of alimentation, I had considerable to say concerning the influence of the quantity and quality of foods in causing diarrhœa, and I shall not repeat what I then said.

In other cases it is to troubles affecting the function of the intestinal mucosa that we are to attribute the flux. It is a vaso-motor disturbance, as Vulpian has well shown, which is the initial cause of this intestinal hypercrinia,* and this disturbance generally has its starting point in a reflex act; it is thus that diarrhœa may be produced by cold; it is thus that dentition may originate intestinal troubles; it is thus that nervous diarrhœa may be explained; even inflammation acts in the same manner, and it is the irritation of the mucosa which by reflex action, determines

* Secretory excess.

an increased vascularity of the intestine and thereby an exaggeration of the intestinal secretion. Lastly, mechanical troubles of the abdominal circulation may give rise to diarrhœa, of which we see an example in the serous diarrhœa produced by stasis of the vena portæ.

In other cases the diarrhœa results from elimination of toxic principles by the intestinal mucosa. And just as we see uræmic and sudoral diarrhœas produced by the inactivity of certain emunctories of the economy (uræmic poisoning, sudden sweat-suppression), so also certain poisons such as the malarial, and that engendered in the vitiated air of amphitheatres may produce the same effect. There is in fact, a malarial diarrhœa which is tributary to quinine, and you are all acquainted with the diarrhœa due to prolonged sojourn in dissecting-rooms, where the air of respiration is rendered foul by emanations from subjects in an advanced stage of decomposition. But this is not all,—I have previously shown you the important rôle played by microbes and ptomaines in intestinal digestion, in provoking veritable infectious diarrhœas, which should be combated, as we shall soon see, by a special medication, to which is given the name of antiseptic intestinal medication.

But it will not do to acquire the notion that the mucous membrane is alone concerned in the pathogeny of diarrhœa, and Trousseau has done well in calling attention to the intestinal fluxes produced by an exaggeration of the peristaltic movements, and which he calls diarrhœa by exaggerated tonicity.

Such are, briefly stated, the principal causes of diarrhœa, and if I have signalized them, it is that I may make etiology do service in therapeutics. You will then take great care, whenever you are called to a case of intestinal flux, to ascertain the cause, in order, if possible to remove it, and thus cure your patient.[1]

From a therapeutic point of view diarrhœa presents itself under three principal aspects: sometimes it is but a temporary phenomenon, disappearing with the cause which produced it; sometimes it is persistent, chronic, due to profound lesions of the intestinal mucosa; lastly, under other circumstances, the abdominal flux is one of the manifestations of a general diathetic state, such as arthritism, herpetism, constituting the gouty or dartrous diarrhœa to which Gueneau de Mussy has called attention.

The therapeutic indications in the latter class of diarrhœas are quite different, and while we ought very energetically to combat certain diarrhœas, we must on the other hand carefully respect certain abdominal fluxes, and this is, it must be confessed, one of the most delicate points in the treatment of diarrhœa.

As a general rule, when the diarrhœa is not very abundant, when it has lasted but a few days, and especially, when it has not seemed to enfeeble the patient, it is not best to be in too great haste to suppress it.

On the contrary, when the intestinal flux shows a tendency to become chronic, and thus be a drain on the vital forces of the economy, you ought to labor for its suppression, and the more earnestly, the more profuse and stubborn the diarrhœa. It is to be taken for granted that I leave one side the febrile diarrhœas, due to mucous states; these are epiphenomena which ought always to be respected. These reservations being made, I proceed to the treatment of diarrhœas, and especially of chronic diarrhœas, and I will begin by hygiene, which here, as always, plays the predominant part.

A great number of diarrhœas arise from alimentary causes, whether because the patient eats too much or not enough, or digests poorly. Have care then always to examine attentively into the diet of persons suffering from chronic diarrhœa, and you will find in the majority of cases the cause of the affection and its remedy. As I have before dwelt sufficiently on this subject under the head of stomach diseases, I shall pass on without further preliminary remarks to two aliments which occupy the first place in the treatment of chronic diarrhœas; I refer to milk and raw meat.

Milk is the best medicament for chronic diarrhœa, sometimes, in fact, it is the only medicament, and you must not forget to combat that foolish prejudice which imputes to milk the causation of abdominal fluxes. This is a great mistake, for a milk diet always produces constipation.

As for raw meat, of which I have before spoken at some length, this is the way that Weiss of St. Petersburg came to employ it. He was treating a young child affected with chronic diarrhœa of a most rebellious kind; one day the child eagerly snatched a piece of raw meat and eat a portion of it; contrarily to what was feared, there was immediate amelioration and a diminution in the number of stools. Struck by this result, Weiss made further trials of raw meat in similar cases, which led to its introduction into therapeutics.

I cannot here state the rules which regulate the milk or raw meat diet in diarrhœa, and must refer you to what I have previously said under the head of diseases of the stomach. I must, however, give my decided opinion that the meat powders are superior to raw meat in the treatment of chronic diarrhœa, and coupled with milk diet, I have always found these powders to bring about a cure when there did not exist, be it understood, on the part of the intestine disorders of too great gravity.

This is my manner of treating chronic diarrhœa. I keep the patient a week on a diet of pure milk, then I begin to administer in increasing doses the meat powder, whether in milk or in broth (which must be free from fat); and when I have obtained well formed stools, I combine with the powder of meat lentil flour, and if this mixture is well supported, I add corn meal, then I return gradually according to the state of the intestine, to the ordinary regimen.

I much prefer these powders of meat to the peptones which have recently been recommended by Basile Feris in the treatment of the diarrhœa of Cochin China.*

Moreover with regard to the dietetic treatment of diarrhœa, there is a great difference between the abdominal fluxes which have the small intestine for their seat, and those which are due to disorders of the large intestine. It is in the first only that the meat powder or milk diet has any curative efficacy; such a regimen is of much less account when the diarrhœa originates in the large intestine.

In connection with these aliments I must mention certain substances, as quinces, which possess astringent properties, just as do all vegetable substances which contain tannin, and thereby are therapeutical in diarrhœa. [There is a syrup of quinces which is officinal in France and is given in doses of a couple of ounces or more; the seeds are never prescribed for internal use though employed externally in maceration.]

Rice, as well as wheaten starch, is especially applicable to the dietetics of diarrhœa, and the same may be said of white of egg; albumen water has in fact been greatly extolled, and its efficacy doubtless consists in that it demands no labor on the part of the intestines, but allows this portion of the alimentary canal to rest; white of egg, by the way, is rapidly peptonized in the stomach, and absorbed.

Next to the alimentary regimen, and of almost equal importance from an etiological point of view, is the influence of cold and wet. Cold air saturated with moisture is one of the most frequent causes of that diarrhœa which may be called seasonal, and you should not forget to enjoin upon persons who with difficulty adjust themselves even to slight atmospheric changes, to wear a well-padded flannel waistband. In countries like Algiers where the transit from the heat of day to the cold of night is so sudden, the military ordinance makes this flannel waistband obligatory, and this simple hygienic measure preserves the soldiers from the diarrhœas so rife in that country. Lastly, urge your diarrhœic patients to guard against yielding to emotions, which often so aggravate diarrhœal tendencies. I hasten now to the pharmaceutical means in our possession for the treatment of diarrhœa.

Pharmacy furnishes us inert powders, astringents, and medicaments which oppose the osmotic movements which take place in the intestines, and lastly, there are local means which we can put in usage. These means we will now consider in their order:

The inert powders deserve the first mention; they do good by a local action, and perhaps by a special action which they derive from the chemicals of which they are composed. We have first subnitrate of bismuth, which is more used than any other medicine. The subcarbonate, lactate

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* Basile Feris, On the Treatment of the Diarrhœa of Cochin China by Peptones. (Soc. de Thérap., Oct. 25, 1882).

and tannate have also been proposed, but all these preparations are now abandoned. At the same time I must make reservations in favor of salicylate of bismuth, which you have seen me experiment with in my hospital service, and which seems thus far to give excellent results.

Subnitrate of bismuth is administered in powder, in potion, in pastilles and even in medicinal creams. It is a tasteless medicament, easily administered, even to infants; as it is not toxic, it may be given in large doses, and you know that Monneret, who has done so much to popularize subnitrate of bismuth, employs it in excessive doses, twenty to thirty grammes (ʒ v to ℥ j) a day. Ordinarily one to three grammes (fifteen to forty-five grains) suffice, but larger doses are quite safe.

Latterly, Carnot has raised an interesting question *apropos* of subnitrate of bismuth; he has shown that this salt ordinarily contains lead, and hence Bouchut has maintained that the presence of lead is not an evil, and that it is owing to this impurity that subnitrate of bismuth is such a good antidiarrhœic medicine.

However this may be, whether pure or impure (and the pharmacopœias now give means for obtaining subnitrate of bismuth in its purity) it acts both as an inert powder and as an antacid and absorbent. Bismuth is a very basic salt, which readily neutralizes the excessive acidity of the gastric and intestinal juices, moreover it absorbs the gases generated in the intestine, and which have a certain share in the production of the diarrhœa, and the sulphuretted hydrogen thus absorbed transforms the bismuth into bismuth sulphide, coloring the fæces black; a very common occurrence, by the way.

But bismuth is somewhat expensive, and calcic preparations may often be advantageously substituted. Lime water is an excellent medicament in diarrhœa, and is especially valuable in infantile therapeutics, being generally added to milk in the ordinary diet of infants suffering from looseness of the bowels.

Then come the preparations of chalk, which are more or less numerous and complex. Lastly, there is the calcic phosphate, (the tribasic and insoluble, or the acid and soluble,) which acts chiefly by depositing on the surface of the intestine a stratum of insoluble powder. I have already referred to these different phosphates, under the head of dyspepsia of new born infants, and simply add in this connection that the utility of these phosphates in the treatment of diarrhœa is unquestioned.[3]

In the old pharmacopœias we find numerous substances borrowed from the animal kingdom, and having chalk for their basis. The powder of crab shells, the eyes of the cray fish,[4] egg and oyster shells, have in turns been proposed in the treatment of abdominal fluxes. These preparations are to-day abandoned, with the exception of one which merits some attention, namely, calcined hartshorn, which serves as the basis of one of the most useful decoctions in the therapy of diarrhœa, namely, the White Decoction of Sydenham.[5]

Finally, Gubler, taking up again the practice of Adair and Henly, has brought anew into repute the oxide of zinc, which gives excellent results in from twelve to fifteen-grain doses, associated with eight grains of carbonate of potash four times a day. Bonamy of Nantes, Puyagutier and Jacquier, have shown by numerous reported cases the good effects of this oxide of zinc in diarrhœa.*

Therefore, to sum up the foregoing observations respecting inert powders, we have first, the subnitrate of bismuth, then the oxide of zinc, and lastly the salts of lime, of which one of the best preparations is Sydenham's white decoction.

The astringents, and especially those which are derived from the vegetable kingdom, have a predominant action in the treatment of diarrhœa. Thus tannin is a good remedy in chronic diarrhœas; it is given in pills in the dose of two to eight grains and even more.[6] Rhatany furnishes also a ptisan and an extract.[7] Catechu is less employed, yet has many advocates.[8] The same may be said of columbo, and of guarana, which Hervé of Lavaur and Denucé have recommended, the first in potion, the second in pills, to combat diarrhœa. Lastly, the plants containing tannin, such as strawberry vine, tormentilla, bistort, rose leaves, walnut leaves, have been recommended as anti-diarrhœic medicines, though little used.[9] Such are in brief the principal astringents employed in diarrhœa. Let us pass now to the opiate medicaments.

There are, you know, medicaments which augment or diminish the osmotic exchanges which take place through the intestinal walls; the name *an-exosmotic* has been given to preparations which prevent this dialytic action, and such medicaments have been utilized for the cure of diarrhœa.

Opium is the an-exosmotic substance par excellence, and if to this you add its power of enfeebling the peristaltic movements, you understand the great utility of this medicine in the treatment of abdominal fluxes. But here is an important point in connection with the action of opium,—the mode of preparation and combination is not a matter of indifference; while some of the opiate preparations have but a limited action, others are remarkably efficacious in the treatment of diarrhœa.

By far the two best preparations are diascordium and laudanum.[10] This old preparation diascordium, which originated with Tracastor, and which takes its name from one of its ingredients, *teucrium scordium*, contains a great number of vegetal substances all of which are efficacious in diarrhœa such as bistort, tormentilla, etc.; and it is probably to the association of these tannin principles with the alkaloids of opium that this elective

* Adair et J. Henly, Lapis calaminaris (carmia nativa) in alvi fluxibus cachecticorum (Gmelin, App. méd., 292). Bonamy, De l'Oxyde de zinc dans la Diarrhée (Bull. de Thérap., May, 1877, p. 251). Puygautier, De l'Emploi de l'Oxyde de zinc dans la Diarrhée, Thèse de Paris, 1874, n° 250. Jacquier, De l'Oxyde de zinc dans la Diarrhée, Thèse de Paris, 1878, n° 120.

action of diascordium in the treatment of intestinal fluxes is due. You can then use diascordium or Bouchardat's substitute, and administer this medicament in the dose of from one to eight grammes (fifteen grains to ʒ ii) without inconvenience, remembering that diascordium contains per gramme six milligrammes of extract of opium, and that Bouchardat's formula contains per gramme two milligrammes of morphine.

Laudanum is also an excellent form of opium for diarrhœa. The best preparation in use in the United States is the deodorized tincture of opium, a new and excellent officinal lately introduced into the pharmacopœia. The Confection of Opium is the best modern substitute for those complex and unscientific preparations formerly known as *theriaca* and *mithridate;* it is a combination of opium with spices which increase the stimulant and astringent action of the opium, and may be given in doses of from ten to thirty grains. For the *Laudanum of Sydenham,* so much in vogue in France, the American practitioner will substitute the *Vinum Opii* of the U. S. pharmacopœia, of which the composition and dose are essentially the same.*

It has been proposed to utilize the alkaloids of opium, and Rabuteau has even classed them according to their anexosmotic action. Of all the alkaloids of opium two only are available for this purpose, opposing as they do intestinal exosmosis, viz., narceine and morphine, and the action of morphine is superior to that of narceine. Till quite recently it has been the custom to give this alkaloid by the mouth, but Behier and still more lately, Vulpian, have shown that in hypodermic injections the action is much more marked, and Legagneur in his thesis has brought together numerous observations which seem in this regard conclusive.†

But what gives the best results in the treatment of diarrhœa is the association of opiates with astringents and inert powders. One of the best known of these preparations is the combination of diascordium ‡ with subnitrate of bismuth, under the form of ten-grain boluses administered in variable numbers three or four times a day.

I advise you also to employ an anti-diarrhœic potion which I often prescribe in my hospital service, the formula of which is as follows:

℞	Vini opii,	gtt. x.
	Subnitrate of bismuth,	gms. x.
	Peppermint water,	" x.
	Distilled lettuce water,	" lxx.
	Syrup of rhatany,	" xxx.

M. Dose—one tablespoonful when required.

* U. S. Dispensatory. The dose of vinum opii is the same as that of the tincture.—Trans.

† Legagneur, On Hypodermic Injections of Morphia in the Treatment of Diarrhœa, Thèse de Paris, 1866.

‡ The confection of opium may take the place of the diascordium.—Tr.

Local applications have an important part in the treatment of diarrhœa. These are mustard and other cataplasms, or even a simple layer of batting applied over the abdomen and covered with oil silk, which acts by maintaining the vital heat. It has been proposed also to cover the belly with a coating of collodion, and it has even been claimed that thereby the most obstinate diarrhœas can be cured. This is a means that is certainly safe enough, and which you can try if you like, without, however, expecting the marvellous results which have been attributed to it.

Lavements have a beneficial effect in the treatment of diarrhœa. You may employ, according to the case, simple emollient lavements of starch, or starch and laudanum. You may also medicate these lavements with some astringent substance, such as rhatany or tannin, and even sugar of lead." Barthez and Gueraud have called attention to the good effects of injections of Goulard's extract and water (a teaspoonful of liauor plumbi to eight ounces of water).

Within a brief time Bourdon and Chouppe* have strongly recommended to the profession powdered ipecac in lavement. Chouppe, has given a complex formula for these lavements which I propose thus to simplify:

Into eight fluid ounces of warm water, stir 150 grains of powdered ipecac, steep one minute, add a few drops of laudanum and administer as a lavement.

This is an excellent preparation which gives good results in the diarrhœa of children, and especially in that most dangerous form, cholera infantum. I have often had recourse to it, and have always derived benefit from it.

And since I am now on the subject of infantile diarrhœa, do not forget that this is one of the gravest and most frequent incidents in the patholcgy of infants, and there is not a day but you will see obstinate cases of it in our foundling hospital. If you will recall to mind how sensitive young children are to cold, and how liable, on the other hand, they are to diarrhœa from the least change in diet, you will readily understand the frequency of this symptom in the first periods of life.

The stools are at first lacking in consistency and resemble mashed eggs, then they become green; colicky pains of greater or less severity make their appearance, fetid gases are voided, the infant becomes emaciated, and if the diarrhœa is not arrested, it passes to the chronic stage and the child dies.

In some cases these morbid phenomena have an exceedingly rapid character; the stools become serous, they are constituted by a greenish serosity in which float matters resembling chopped spinach; the child's features are pinched, his eyes are sunken, his voice becomes extinct, his skin is cold

* Chouppe, Bull. de Thér., t. lxxxvi., and Progrès. Méd., 1874.

and death often supervenes in the course of a few hours; this is cholera infantum, so often observed at the time of weaning and of which you see so many instances in my nursling hospital.

As you observe, the diarrhœa of infancy is often a temporary trivial affair, due to exposure to cold or to some indiscretion or modification in diet; sometimes on the contrary, it is a persistent symptom, one of the precursors of that symptomatic aggregate which is described under the name of *athrepsia;* lastly, it is sometimes an event of extreme gravity, constituting cholera infantum.

In all these cases you ought to interfere energetically, and you should endeavor to moderate and arrest the diarrhœa from its very onset. It is always dangerous to let an intestinal flux in young infants become established, and while in the adult you can and ought to respect diarrhœas, it is not so with the diarrhœas of infancy which should never be allowed to continue, no matter what may be the cause. Some have, however, excepted from the general rule the abdominal fluxes of dentition, and basing themselves on the aphorism of Hippocrates, have affirmed that it will not do to stop this diarrhœa.* I cannot grant that this objection is well founded, and it has always been my practice when a teething infant has too profuse a diarrhœa, and especially when the discharges become green, to interfere with active treatment.

It is advisable then to combat these fluxes early, and I believe that from simple diarrhœa to the most advanced periods of cholera infantum there are only insensible transitions. To attain your end, employ subnitrate of bismuth and lime water, but be exceedingly chary of laudanum; Parrot rejects it altogether, and if you give it at all, do not exceed a drop or two. Children in fact, bear opiates badly.[12]

You can also try René Blache's method which gives good results, and consists in the admixture of equal parts of castor oil and syrup acacia, which may be flavored with cinnamon or anise. A teaspoonful of this mixture may be given after each discharge.†

Do not count too much on lavements, and in this regard I share the opinion of Parrot, who shows their complete inefficacy in the diarrhœa of infants—a diarrhœa which depends on functional troubles of the small intestine, and not of the colon; but above all have a surveillance of the diet. This is a capital point in the treatment of these intestinal fluxes of early life, and one which I have fully considered in the chapter on the dyspepsia of new-born infants.

As for cholera infantum, anti-diarrhœic medicaments are not sufficient,

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* Infants with abdominal fluxes during dentition very seldom have convulsions. Hippocrates, Liber de Dentibus.

† I have often added to each dose of this castor oil emulsion half a drop of laudanum. —Tr.

you must raise the vital forces of your little patients. Give them sweetened wine potions with old rum or brandy, rouse the flagging strength by brisk frictions of the whole body; even resort to the practice of Trousseau, who advised full mustard baths in these cases.[13]

And since I have taken on myself to trace as rapidly as possible the therapeutic indications pertaining to certain forms of diarrhœa, allow me to complete the subject in reminding you that there are diarrhœas tributary to a special treatment, diarrhœas of an infectious kind, resulting, as I have shown you, not only from the presence of special micro-organisms in the fæcal matters, but also from ptomaines. The penetration of the organism by these infectious substances determines symptoms very similar to those of uræmia, and it is to this symptomatic aggregate that Bouchard has given the name of *stercoræmia*. We can effectively treat these infectious diarrhœas by introducing into the digestive tube substances which destroy the agents or products of putrefaction.

Bouchard has highly recommended iodoform and charcoal powder; I much prefer the solution of bisulphide of carbon. In order to prepare this solution, you have the following formula:

Take of:

Pure bisulphide of carbon, ...	25 grammes.
Water, ...	500 "
Essence of peppermint, ...	gtt. xxx.

M. Pour into a flask of the capacity of 750 cubic centimetres, shake and allow the mixture to settle; the clear solution is to be employed.

You must take care to advise the patient to use only the supernatant liquid, and not to disturb the bisulphide of carbon that remains in the bottom of the flask. Recommend also to replace with fresh water any portion of the contents of the flask which shall be decanted away. You have thus a constant supply of carbon bisulphide water, which you can administer both by mouth,—giving a tablespoonful in a glass of water or milk—or in lavement, diluting the solution one half. By this means you destroy the fetidity of the stools, and, as I have often assured myself, you annihilate all odor.

By the side of these infectious diarrhœas, we should place the malarial diarrhœas. Jules Simon, Guyot, and Potain, have shown that in certain cases sulphate of quinine cures as by enchantment diarrhœas rebellious to every other medication. Therefore, whenever you discover in the etiology or in the course of the symptoms, traces of a malarial influence, do not hesitate to resort as speedily as possible to quinine.

This leads me to speak to you about the chronic diarrhœas of warm countries, so frequent in the colonies. Here the only efficacious treatment, at least when you meet cases of this kind in France, is milk and Vichy water. *Apropos* of milk, Talmy has shown that when this is lacking, as in sea voyages, one may employ condensed milk, and he has even advised the exclusive usage of sugar of milk, as being curative of this chronic diarrhœa. Lastly, more recently still, Feris has pointed out the great advantages of the peptones in the diarrhœa of hot countries.*

I shall not take up the subject of the diarrhœa of Cochin China, which is still under investigation, some affirming that it is parasitic, and that treatment ought to be addressed to the anguillula which is found in the intestine, others affirming that this nematoid plays only a secondary rôle and that all anthelmintic medication fails.

It remains for me simply to mention the mineral waters which are beneficial in diarrhœas. Plentiful as are the purgative waters, it must be confessed that mineral waters which are curative in chronic diarrhœas are few. The first and in fact the only one is Vichy, and yet you know well that this water is only to be used externally in baths, being rather harmful when drunk; then we have Plombieres, and waters which are applicable, not so much to the abdominal fluxes, as to the diatheses of which the diarrhœa is an epiphenomenon; and according as the individual is herpetic or arthritic, you should select different spas.

Such are, in brief, the means at your disposal for combating diarrhœa. In the next chapter I shall study a special flux, dysentery, the treatment of which claims particular indications.

NOTES TO LECTURE XXII.

[1] These are the principal divisions adopted by authorities in the classification of diarrhœa:

1. Inflammatory diarrhœa;
2. Bilious diarrhœa;
3. Diarrhœa by action of the muscular coat of the intestines, such as is determined by fright, wet feet, strong odors, moral affections, etc.;
4. Chronic apyretic diarrhœa;
5. Dry diarrhœa. (Broussais.)

Rostan attributes diarrhœa, like every other excess of the mucous exhalation to: 1, inflammatory action; 2, chronic disease of long date; 3, a particular organic disposition (only probable) of the mucous membrane; 4, the influence of the nervous system.

The Compendium of Medicine gives the following classification: 1, Idiopathic diarrhœa; 2, Symptomatic diarrhœa; 3, Critical diarrhœa.

Trousseau admits seven kinds: catarrhal, sudoral, nervous diarrhœas, diarrhœa due to excessive intestinal flux, diarrhœa due to excessive tonicity of the intestine, diarrhœa due to divers organic diseases of the intestine.

Spring adopts the following classification: crapulous diarrhrœa, toxic diarrhœa, supplementary diarrhœa, catarrhal diarrhœa, infantile diarrhœa, bilious diarrhœa, choleraic diarrhœa, ulcerous diarrhœa, depuratory diarrhœa, dyshæmic diarrhœa, nervous diarrhœa.

Germain Sée has taken as the basis of his classification the state of the

* He uses the solid peptones, giving 3 to 6 table-spoonfuls daily, together with a quart of milk.

fæcal matters, and gives mucous, serous, biliary and albuminous diarrhœas according as mucus, bile or serum, etc., predominates in the discharges.*

[2] Bismuth is obtained principally from Saxony. The subnitrate is obtained from the metal by dissolving it in dilute nitric acid and concentrating the solution, and then precipitating by adding a large quantity of water. The U. S. process is more complicated. (See U. S. Ph.) It is a white, insipid, inodorous powder, insoluble in cold water, blackening with H_2S. Regnauld thinks that this salt neutralizes sulphuretted hydrogen in the intestines, forming sulphide of bismuth, and setting free nitric acid, which may have a beneficial topical effect.

For the modes of purification, see the U. S. Pharmacopœia. The following are standard American preparations:

Take of: subnitrate of bismuth, pulv. cretæ co. cum opio., āā gr. v. Mix. One dose. In diarrhœa. Take of: subnitrate of bismuth, 20 grains; mucilage of tragacanth, ½ ounce; tincture of cinnamon, 10 minims; water to 1 ounce. Mix—One dose. Take of: subnitrate of bismuth, 80 grains; camphorated tincture of opium, 2 drachms; chalk mixture, 2 ounces; Mix. Dose—one fluid drachm in diarrhœas of children. Take of: bismuth subnitrate ℈j., pulv. opii grj., white sugar ʒ ii. Mix and divide into 4 powders. Sig. One as often as required to check diarrhœa. The French are fond of combining bismuth with chalk, magnesia, gum tragacanth, etc. Paterson's pastilles contain subnitrate of bismuth with magnesia, sugar, and gum arabic; each pastille weighs 1 gramme.

[3] Chalk is given as antacid, absorbent and antidiarrhœic in the dose of 2, 8 and even 16 grammes a day. In England the prepared chalk is much in use, and is the basis of numerous mixtures; the principal is known as *Chalk Mixture*, the ingredients of which are chalk, sugar, gum arabic, and cinnamon water, and of which the dose is a tablespoonful. The *compound chalk powder* (aromatic powder of chalk) consists of chalk, cinnamon, nutmeg, saffron, cloves, cardamoms, and sugar; dose ʒ ss to ʒ j; this powder is combined with opium in the *Pulvis cretæ aromaticus cum opii*, of which every two scruples contain one grain of opium. Dose —from ten to forty grains.

[4] THE EYES OF THE CRAY-FISH (*Occuli Cancrorum*).

These are concretions formed of carbonate of lime which are found in the stomach of the cray-fish, (*Estachus fluviatilis*) at the time of moulting, and which are destined for the renewal of the carapace. It is given in the same dose as chalk.

[5] THE "WHITE DECOCTION OF SYDENHAM." (See page 132.)

Thompson's modification of Hope's Diarrhœa Mixture deserves reproduction in this connection.—[Trans.

℞ Acid nitric, dilute,		ʒ iv
Tinct. camph., tinct. opii,	ā ā	ʒ iss
Syrup of ginger,		℥ i
Aquam Cinnamon, ad		℥ iv

M. Sig. Two teaspoonfuls in a little water. (Med. Record, 1876,

* Sauvages, Nosologie Médicale. Broussais, Histoire des Phlegmasies, t. ii. Rostan, Clinique Medicale, t. ii., p. 104. Spring, Symptomatologie, t. i., p. 184. Trousseau, Clinique Médicale, 1862, t. ii., p. 411. Gueneau de Mussy, Clinique t. ii., p. 92.

page 792.) Hope's Mixture is highly spoken of by Dr. Marsh in Medical and Surg. Reporter, March 7th, 1874. He has found it of signal service in diarrhœas.

[6] Tannin or tannic acid. A vegetable product, essentially astringent, existing in nut galls, oak bark, cinchona, catechu, kino, rose leaves, the raspberry and strawberry plants, potentilla, sumach, etc. The tannic acid of medicine is ordinarily got from nut galls. It is yellowish white, uncrystallizable, inodorous, slightly acid in its reaction, and of very astringent taste, soluble in water, less soluble in ether and alcohol; it precipitates albumen and gelatine.

Tannin combines with metals forming tannates. Tannin is employed as tonic and astringent in hemorrhages, mucous and serous fluxes, in profuse sweats and diarrhœas. It is incompatible with metallic salts, alkaloids, iron, antimony, lead, mercury, gelatine, albumen, lime water, etc.

GLYCERITE OF TANNIN.

Take of:

Tannin, ... 2 ounces.
Glycerine, ... ½ pint.

Rub them together, then heat gently until the acid is dissolved. Dose —10 to 40 minims.

PILLS OF TANNIN.

Take of:

Tannin, ... gr. ijss.
Mucilage of tragacanth, ... q.s.

For 1 pill. In hæmoptysis and night sweats. Dose—2 to 10 pills a day.

ASTRINGENT ELECTUARY.

Take of:

Tannin, ... 50 centigrams (7½ grains).
Deodorized laudanum, . . 10 drops
Conserve of roses, . . . 10 grammes (150 grains).

Mix. For one dose.

ASTRINGENT LAVEMENT.

Take of:

Tannin, ... 1 gramme (gr. xv.)
Deodorized laudanum, . . . 6 drops.
Water, ... 300 grammes (℥ x.)

Mix for a lavement.

POWDERS OF TANNIN AND OPIUM.

Take of:

Tannin, ... 2 drachms.
Powdered opium, ... 6 grains.
Sugar, sufficient.

Mix and divide into 6 powders.

Dose—one powder every 2 hours. In profuse diarrhœa. (Oppolzer.)

[7] KRAMERIA TRIANDRA, (*Rhatany*,)

Is a South American shrub. The root is officinal. It is long and branching, of a reddish color and has an astringent taste. The extract resembles kino. Rhatany is a powerful tonic and astringent, and is given in doses of 20 to 30 grains. The extract contains 43 per cent. of tannin. The officinal preparations, (U. S. Ph.), are the Extract, Infusion, Pulv. Catechu Co., Syrupus Krameriæ, and the Tinctura Krameriæ. The following non-officinal preparations are from the practice of English physicians:

Take of: powdered rhatany root ℥ ss, boiling water Oii. Boil down one third and strain. Dose—three tablespoonfuls every third hour. In obstinate diarrhœa. (Dr. Joy.)

Take of: tincture of rhatany ℥ i, aquæ calcis ℥ vi. Mix. Dose—a dessertspoonful three or four times a day. (Reece.) Take of rhatany in coarse powder ℥ iii, pulv. canella ℥ iii, dilute spirit Oii. Mix, digest for 10 days and strain through paper. Dose—one drachm. (Sprague.) The extract of krameria may be given in doses of from 5 to 10 grains, the Fluid Extract (U. S. Ph.), in doses of 10 to 40 ms., the syrup (U. S. Ph.), in doses of 1 to 4 teaspoonfuls. The tincture is given in drachm doses. Meigs and Pepper give a mixture of rhatany which is quite popular in the U. S. It is made as follows: Take of: tincture of rhatany, 1 drachm; tincture of opium, 6 drops; bicarbonate of sodium, 20 grains; syrup of ginger, 7 drachms; water, 2 ounces. Mix. Dose—a teaspoonful 3 or 4 times a day in infantile diarrhœa.

[a] Catechu is an extract from the wood of the Acacia Catechu, a tree indigenous to India. It consists mainly of tannic acid and extractive, and is powerfully astringent. The dose is 10 to 30 grains. The officinal preparations are the compound infusion, which contains catechu and cinnamon, (dose 1 to 2 ounces); the tincture, of which the dose is a teaspoonful; the compound powder of catechu, (catechu, kino, cinnamon, rhatany and nutmeg), dose—20 to 40 grains; and the catechu lozenges, which are made as follows, (we adopt the formula of the French codex):

Take of:

Catechu,	50
White sugar,	20
Gum tragacanth,	1

Triturate together, make a paste and divide into lozenges of 7 grains each. Dose—1 to 6.

The author's notes give the following preparations: 1, a *ptisan* made by infusing 8 gms. in Oij boiling water. Dose—two or three tablespoonfuls; 2, a *lavement* made by suspending 8 gms. catechu in Oss of warm water. Catechu is an excellent addition to chalk mixture, as in the following formula:

Take of:

Mist. cretæ,	f ℥ vss.
Tinct. catechu,	f ʒ vi.

Mix.

Take two or three tablespoonfuls after each liquid evacuation.

* The indigenous astringent plants containing tannin are very numerous. Among these we mention the following: the fragaria vesca, or strawberry, (rosaceæ); the tormentilla, (potentilla tormentilla) which is useful in decoction (℥ ss to the Oj), dose ℥ j to ℥ iii; bistort (polygonum bistorta), useful in decoction; the walnut, (juglans regia), of which a decoction of the leaves is a domestic remedy in diarrhœas; kino, the in-

spissated juice of pterocarpus marsupium (India), a very valuable astringent of which one preparation, the *compound kino powder*, is especially to be commended, (kino, cinnamon, and opium,—dose, 5 to 20 grains); blackberry root (Rubus Canadensis and Rubus villosus), a favorite domestic remedy in the U. S. which may be given in infusion, an ounce of the root being steeped (with a little cinnamon) in a pint and a half of water down to a pint, and given in wineglassful doses; red roses (Rosa gallica) which is a good astringent and enters into several valuable officinal preparations of the U. S. Ph., such as Infus. Rosæ Co., Confectio Rosæ gallicæ, etc.

[10] The formula of diascordium (which is probably seldom or never prescribed in the United States) is a very complex one; on account of its popularity in France this formula is here given in its entirety:

Extract of opium,	1
Dried germander leaves,	48
Red rose leaves,	16
Bistort root,	16
Gentian "	16
Tormentilla root,	16
Barberry seeds,	16
Ginger,	8
Long pepper,	8
Cassia lignea,	16
Canella,	16
Cretan dittany,	16
Storax,	18
Galbanum,	16
Gum arabic,	16
Prepared armenian bole,	64
Honey of roses,	1000
Spanish wine,	250

Dissolve the extract of opium in the wine; add the honey of roses liquefied, then little by little all the other substances in the form of fine powder, and stir well the mass so as to obtain a thorough admixture; keep the electuary in a tightly stoppered jar. Diascordium contains 2½ centigrammes of opium to every 4 grammes of electuary. Bouchardat's modification is as follows: (every gramme contains two milligrammes of morphine:)

	Grammes.
Morph. muriatis,	0.03
Tannin,	0.50
Tinc. tolu,	10.
Conserve of roses,	6.
Porphyrized phosphate of lime,	3.

[11] Devergie's lavement is as follows:

Acetate of lead,	4 grammes.
Carbonate of soda,	2 "
Vin. opii,	gtt x.
Water q.s. for 1 lavement.	

[12] The following potions are highly recommended by Parrot for infantile diarrhœa:

Take of:
Subnitrate of bismuth, ... 2 parts.
Syrup of blackberry, (syrup Rubi), ... 100 "
M. Dose—a teaspoonful every third hour before nursing.

℞ Subnitrate of bismuth, ... 3 parts.
Lime water,
Syrup rubi, ... ā ā 50 "
M. Dose—as above. This prescription is preferred when the stools are green. [The translator has substituted the *syrup rubi* of the U. S. Ph., for the *syrup of comfrey* of the Fr. codex.]

[13] In acute athrepsia Parrot administers every ten minutes, alternately, a teaspoonful of one or the other of the following mixtures, both of which are iced:

1. Old brandy, ... 1 part.
Water, ... 20 parts.
2. The second is a nutrient broth, made of lean beef without vegetables.

Twice or three times during the day the infant is immersed for five minutes in a warm bath at about the blood heat. Into this water a little bag of mustard flour may be allowed to soak; two ounces of mustard sufficing for six gallons of water.

LECTURE XXIII.

ON THE TREATMENT OF DYSENTERY.

SUMMARY.—Dysentery—Aspect of Fæcal Matters at Different Stages—Pharmaceutical Treatment—Blood Letting—Calmatives—Astringents—Calomel—Ipecac—Brazilian Method—Segond's Pills—Ailanthus Glandulosa—Cataplasms—Hygienic Treatment.

GENTLEMEN: I wish to devote this lecture to the study of the treatment of dysentery, and I do this for several reasons; first, because ulcerous colitis is a disease which you will often observe in your country practice; moreover it is a disease of our armies, and in accordance with the new regulations enforced by the recruiting service, which obliges nearly all of you to perform the office of military surgeon, you will doubtless often be obliged to apply the counsels which I shall give you to-day; but the dominant reason is that dysentery is a disease which demands an energetic treatment, a treatment, moreover, which is almost always successful if you have an opportunity to institute it at an early stage.

I shall not here detail the symptoms of dysentery, and shall refer you therefor to your text-books, and shall insist on only one point, and that a very important one, having a marked bearing on the diagnosis, prognosis and treatment: I refer to the state of the discharges. One may, in fact, say that the diagnosis of the disease is in the stools, and that it is from the aspect which these present that you are to obtain the data for your prognosis and the leading indications of your therapy.

At the onset the fæcal matters are glairy, spumy, presenting here and there grumous masses resembling frog spawn; there are streaks of blood, a little fat and a few scybala floating in the midst of the liquid; there is, moreover, no biliary coloration, and this is an important sign. There is a lack of odor, and in this respect dysenteric stools differ from ordinary fæcal matters; this is explained by the fact that the odor of fæces generally depends on alterations undergone by certain elements of the bile, and as bile is wanting in dysentery, the odor is lacking also; this is the first stage. In the second stage, the color of the stools is reddish; there is an admixture of pus and blood with membranous débris from the mucosa, resembling beef-washings or scrapings of the gut. Thus far the prognosis is favorable; you can and ought to cure the patient at these periods.

It is not so in the third period; here the resources of art are generally impotent, and your prognosis will be grave. In this stage the color of blood is more marked, and the stools have been compared to mashed raspberries; this is the last degree of the affection. In these three stages of the disease the biliary secretion is lacking, and this is an important circumstance from the point of view of prognosis and treatment, for the cure is assured when by an appropriate treatment you shall have restored to the fæcal matters the presence of bile.

The stools are more or less abundant, and accompanied by a spasmodic phenomenon described under the name of tenesmus, which may affect both rectum and bladder; *rectal tenesmus, vesical tenesmus.* The number of stools is sometimes great, and Trousseau, to characterize these stools, has made use of a very happy term, which ought to be perpetuated; he calls them the *sputa of the intestine.* Generally each discharge of fæcal matters is followed by a feeling of relief; in the interval the abdominal pains are keen, and are seated in the tract of the large intestine.

All these symptoms are accompanied by more or less grave general phenomena, and according to the predominance of this or that symptomatic aggregate we find numerous varieties of dysentery described, such as: bilious, hemorrhagic, typhoid, algid, choleriform, and rheumatic dysentery. Lastly, the disease may pass to a chronic state, and you have then to do with chronic dysentery. I do not purpose to enter into a discussion of these forms, and I shall come at once to the essential part of this lecture, the treatment of dysentery. We have two orders of therapeutical agencies, furnished us by hygiene and by pharmacy.

The pharmaceutical treatment varies according to the views held as to the nature of the affection. Some counsel antiphlogistics, and make chief account of the inflammatory nature of the disease; others urge the exhibition of calmatives, to allay both pain and diarrhœa; others emphasize the necessity of making it the physician's principal duty to combat the diarrhœa with powerful astringents, this may be called the anti-diarrhœa medication; lastly, a more rational system of treatment called the substitutive or evacuant medication has been proposed. I shall pass these kinds of treatment in review and discuss their value.

If there is a disease in which the doctrine of Broussais has produced most disastrous effects it is certainly dysentery. For a long time this revolutionary system imposed on army and naval physicians a pernicious therapy based on repeated blood-lettings, and you would not believe the innumerable quantity of leeches that were wont to be applied over the abdomen of patients, and the bleedings performed to combat the ulcerous colitis. This is a mode of treatment to be utterly and forever discarded; its only result is to augment the mortality, already so considerable, of this disease.

Calmatives, with opium at their head, whose end is to allay pain and arrest diarrhœa, are also to be rejected, for they give no favorable results. What I say of opium, recommended by Sydenham, I say of all its preparations, and I say the same of the solanum derivatives. At the same time, Leclerc of Tours and Hamon of Fresnay have vaunted, the one, the employment of belladonna, the other, cataplasms of the leaves of the potato plant. I believe that these means have but a doubtful utility, and I simply mention without recommending them.

I have, as you see, already condemned blood-letting and the calmatives; I must also condemn the anti-diarrhœic medication. Remember that we have not here to do with ordinary diarrhœa, and that the duty of the physician consists rather in encouraging the appearance of fæcal matters, which are very scanty in the stools of dysenteric patients, however abundant these evacuations may be. I recommend, then, neither the employment of astringents, nor of inert powders, although Monneret has claimed that with subnitrate of bismuth in the dose of seventy grammes (over two ounces) a day, the dysentery may be cured.

The true, the only rational treatment of dysentery consists in the employment of a substitutive method, enabling one to restore the bilious secretion and flow, that is to say, in the employ of purgatives. This was the practice of Stoll, Zimmerman, Degner, Pringle, Bretonneau, and Trousseau. It is, as before said, the only rational treatment, and can alone bring about a cure.

What purgatives should you employ? Do not forget that the large intestine is the seat of a severe inflammation, and that it is necessary to avoid all drastic cathartics having an irritating action on the mucous membrane; therefore you have at your disposal only the mild purgatives, salines, and cholagogues. Among the first have been vaunted manna and tamarinds, and it is with these substances that Sydenham composed his purgative potion, which has rendered so great service in the treatment of dysentery. Zimmerman preferred cream of tartar and tamarinds, Degner, manna, Stoll the neutral salts, and Baraillier, Rochelle salts.[1]

It must be admitted, that although this treatment is superior to the other kinds mentioned, these purgatives are nevertheless inferior to the cholagogue purgatives which I am about to study.

I have already had much to say about the absence of bile in dysenteric discharges; I have told you that you may regard your patient as cured when once the bile appears anew in the stools. You understand then the importance of cholagogue purgatives in the treatment of dysentery.

Among these latter agents Pringle has extolled rhubarb,[2] but calomel is far preferable. Much employed by the English, this mild mercurial is administered either in massive doses, (from seven to fifteen grains), or in minute doses,—from three to five grains a day, in powders containing $\frac{1}{4}$ of a grain given every hour. Without disputing the good effects of calomel, I consider it as inferior to ipecacuanha, the medicament *par excellence* of dysentery, and which is almost as much a specific for this disease as is quinine for intermittent fever.[3]

You know that this member of the Rubiaceæ has been long known as an anti-dysenteric remedy, and that it was in 1686 that a merchant of Paris, Grenier by name, put this drug into the possession of a physician of repute, Aforti, who, however, made but little trial of ipecac in dysentery, while Helvetius, his pupil, made numerous careful observations of the action of this medicament in this disease and derived great advantage from it. Helvetius cured many cases of dysentery, and kept the remedy secret, but Louis XIV., after having consulted his physician D'Aquin, and his confessor, father La Chaise, bought this secret from Helvetius for 10,000 louis in gold. Helvetius kept the entire sum, notwithstanding the protestations of Grenier.

But it is not enough to know that ipecac cures dysentery, you must also know how to administer it; and here you have one of the best instances that I could cite of the necessity of understanding, not only the properties of the medicament, but also its mode of administration. It is a singular circumstance that we both obtain ipecac from Brazil and derive from this country the method of using it, and it is this method which I shall now describe.

Take eight grammes (2 drachms) of powdered ipecac; infuse in 200 grammes ($6\frac{2}{3}$ ounces) of water, filter and administer in tablespoonful doses the first day, giving about a tablespoonful every two hours; the second day infuse anew the residue of your eight grammes remaining on the filter in 200 grammes of water, filter a second time and administer this infusion the second day; the third day infuse yet once more the dregs of your powder in 200 grammes of boiling water, but do not now decant or filter; stir well together and give the whole in doses of a tablespoonful at frequent intervals; if the stools are not changed, you begin the process again and continue it till bile appears in the dejecta.

The Brazilian method is complicated, and I much prefer the procedure of Delioux of Savignac, who has done so much for the elucidation and treatment of dysentery. This is the formula of Delioux reduced to the American system:

Take of:
Powdered ipecacuanha, ... ʒ i.
Boil 5 minutes in water, ... ℥ x.
Filter and add:
Tinct. Opii., ... ʒ ss.
Syrup of ginger, ... ʒ vijss.
Peppermint water, ... ℥ i.

M. Sig.—A tablespoonful every hour. The opium in this formula has for its object to cause the ipecac to be tolerated, for in order to obtain the anti-dysenteric action we must guard against the emetic action of the ipecac.*

* The translator has taken the liberty to modify somewhat Delioux's formula that it might be made available by American practitioners.

As before said, the ordinary dose of this preparation is a tablespoonful every hour, but care must be taken to make the intervals longer if vomiting should ensue. The entire potion, in grave cases of dysentery, ought to be taken in the twenty-four hours. In mild cases, however, you need not give but half the potion. You should continue the administration of the ipecac till bile appears in the stools. This effect is often obtained in the course of twenty-four hours; in other cases it is well to prolong the medication for two or three days. Berenger-Feraud, in his remarkable work on dysentery,* has proposed to vary the Brazilian method by giving the ipecac in suspension in cold water, a modification which requires no previous preparation, and gives good results.

How does ipecac act? According to some authorities, it destroys the special virus proper to the disease; according to others, it acts by stimulating the intestine and promoting the biliary secretion. Emetia, the active principle, seems also to have an action of its own in being eliminated by the intestine, and in locally modifying the intestinal ulcerations. However this may be, ipecac is the heroic remedy in dysentery. In certain cases, to increase its action, calomel is associated with ipecac, and this combination constitutes Segond's pills so much used in the marine service.[4]

It has lately been proposed to substitute for ipecac a plant to-day common in France, the ailanthus glandulosa or Japan varnish. The root is utilized in the following way: Triturate from one to two ounces of the fresh root in a mortar with five tablespoonfuls of water, then express the whole through a linen cloth; dose a dessertspoonful.[5]

This is a remedy employed by Robert in his navy practice. Giraud and Dugat-Estublier have shown the advantages of this preparation, which I was the first successfully to try in France. The ailanthus glandulosa is a powerful emeto-cathartic, whose action resembles that of ipecac, but its taste is very disagreeable and it needs the seaman's palate to be able to take so nasty a dose; I have given it in lavement, and have obtained good effects, which were nevertheless inferior to those of ipecac.

In this rapid enumeration of pharmaceutical means which you can employ in the treatment of dysentery, I have only mentioned the principal medicines, leaving one side those whose utility has not been established, such as nux vomica, counselled by Hagtroem, Hufeland, and Geddings of Baltimore, ergot of rye employed by Delioux of Savignac, and perchloride of iron, recommended by the same authority.

All these medicines have been abandoned. There are, however, others which you may use; I refer to tonics and stimulants. Thus it is that arnica has been considered by Stoll as a specific in dysentery:—he gave the powder of the root in the dose of a drachm every two hours, till an ounce and a half was taken. Cinchona has also been employed by all

* Berenger-Feraud. Theoretical and Clinical Treatise on Dysentery. Paris, 1883. (Consult also note 4.)

authorities as the tonic *par excellence*. You can add canella, which, according to Delioux, is one of the best stimulants in the adynamia provoked by the dysenteric flux; nutmeg and simarouba quassia ought also to be ranged in the same category.

The lavement is an important means of treatment in dysentery. As the disease is seated in the large intestine, and toward its inferior extremity, it is natural that it should have occurred to physicians to attempt to treat locally the ulcerations of the colon; hence it is that lavements of greater or less strength have been proposed, with the intent of topically modifying the seat of the lesions. One of the most simple is the astringent lavement, and it is one to which I have frequent recourse; I begin treatment by the administration of ipecac, and when the stools become bilious, I employ the sugar of lead lavement, containing a drachm of Goulard's extract to eight fluid ounces of water.

Trousseau has counselled a very active method, the nitrate of silver injection, and our regretted friend Dr. Gros was enthusiastic respecting the good results obtained by this agent in the dysentery of young children. In the case of infants a lavement is employed containing from one to two grains of nitrate of silver to four fluid ounces of water; in the case of adults, the dose is much larger; from five to eight grains to eight fluid ounces. Delioux of Savignac has modified this formula; he has made much use of an albuminous injection with nitrate of silver, but he greatly prefers the ioduretted lavements, which he was the first to recommend.

Lastly, do not forget that ipecac may be employed in lavements, which give, as I have already told you, good results in the choleriform diarrhœa of infancy;* you can utilize them according to the practice of Bourdon and of Chouppe in the treatment of dysentery.

Dysentery is, as you know, an epidemic disease, which is developed under multiple influences; meteoric, alimentary and infectious. Atmospheric variations constitute one of the principal causes of dysentery and promote this disease in two ways: under the influence of a very high atmospheric heat, or after a sudden fall in the temperature. This accounts for the fact that dysenteric epidemics have been chiefly observed in our climates during seasons exceptionally hot, such as characterized the years 1822, 1844 and 1846.

Diet also plays a certain part in the genesis of dysentery, and whenever this is insufficient or of bad quality, consisting for instance of green fruits or salted meats in excess, we see dysentery develop. It is, however, undeniable that it is to water of bad quality, and particularly to stagnant water, as Colin has shown, that we are to assign the principal part in the etiology of ulcerous colitis. Whenever the water sources destined for alimentary usages are fouled by vegetable or organic matters

* See the chapter on the Treatment of Diarrhœa.

undergoing putrefaction, you will see two diseases prevail which have many points of contact—intermittent fever and dysentery.

As for infectious causes, these result especially from vitiation of the air by overcrowding, and this it is which explains how it comes to pass that dysentery is *par excellence* the disease of thickly settled localities, the disease of armies; and as Colin has well said, its part in human mortality resembles that of the plague, yellow fever and cholera. There has never been a prolonged war in any part of the world that has not been accompanied with epidemics of dysentery. During the late war between France and Germany, dysentery made great ravages; the same may be said of the Crimean war, also of the Italian and Mexican wars. In America during the war of the Secession, out of 6,000,000 soldiers that entered the hospitals, 2,000,000 were cases of dysentery.*

Is dysentery contagious? This is a question which has been much discussed, and while Kreysig admits a dysenteric miasm, and Budd and Dounon affirm that there exists in the disease a contagion of parasitic nature, Colin on the contrary denies all contagion.

The prophylactic means readily suggest themselves from the details into which I have just entered. By appropriate clothing avoid sudden chilling; have great care about the diet; see that only water of good quality is drunk; any suspected water should be boiled; combat as far as possible the effects of overcrowding; such are the preventive measures to be taken to avoid epidemics of dysentery. Lastly, without taking part either for or against the doctrine of contagion, I believe it is a good practice to disinfect and to destroy as soon as possible the stools of dysenteric patients.

As soon as the outbreak of the disease is declared, you will take care to maintain sufficient aeration in the chamber or hospital ward of your patient, and you will redouble your endeavors to ensure entire cleanliness. You will insist that the patient shall not quit his bed to go to stool, but that he shall use the bed-pan, for in getting out of bed to go to the night chair he may take cold, and contract an intercurrent disease which will be fatal.

Heat is an essential element in the treatment of the dysenteric patient, whose temperature falls rapidly under the influence of the intestinal flux. You will see the patient shivering in his bed, curled up, with the clothing tightly wrapped around him, in order to lose as little heat as possible. You must then promote the bodily heat by all the means in use in such cases; bed clothing, frictions with warm cloths, stimulating drinks, hot poultices over the abdomen, warm-water bottles, baths and other excitants. Helye has even gone so far as to maintain that calorification is the sovereign treatment of dysentery.

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* Colin, Treatise on Epidemics.

You should watch with care over the alimentation of your patient. You will sustain him by wine and by foods which are absorbed in their entirety, and on this account leave but little residue, such as milk, beef tea, and even raw meat. Bodin of Pichonnerie, and Mondiere, have vaunted albumen, and have even claimed that by this alone one might cure dysentery. I believe this to be an exaggeration, and that albumen has but a secondary and very inferior place among anti-dysenteric remedies.[7]

In our climate, dysentery rarely passes to the chronic state; but it is not so in warm countries, and we find, unhappily too often, in France, such cases of chronic dysentery contracted by our countrymen in Cochin China and in Africa.

This affection claims a treatment based exclusively on hygiene; individuals affected with chronic dysentery must be rigorously subjected to a milk diet; I say rigorously, because after a slight amelioration the patient thinking himself cured resumes his ordinary diet, which causes a relapse, and the unfortunate victim of the disease finds himself continually passing from transient ameliorations to relapses more and more frequent, till death ends the scene. You will also order your patients to spend a season at Vichy; it is the only station whose water will give good results in such cases; and yet you should remember that these waters can only be used in baths, or if drunk at all they must be taken with great prudence.

Such, gentlemen, are the therapeutic considerations which I wish to present respecting the treatment of dysentery. I propose to devote the next lecture to the study of the treatment of certain affections of the rectum.

NOTES TO LECTURE XXIII.

[1] Zimmerman was in the habit of giving cream of tartar in the dose of an ounce, tamarinds in the dose of three ounces to adults, two ounces to children of the first dentition. These medicaments were mixed with one or two quarts of water. Barailbier in the treatment of mild cases gave every day half an ounce of Rochelle salts in potion.

[2] Pringle, after a commencing emetic, prescribes every day from 30 to 50 grains of rhubarb in fractional doses.

[3] Ipecacuanha. This plant is the Cephaëlis Ipecacuanha (Rubiaceæ.) It is a Brazilian shrub with a stem two or three feet long, though partly underground, and often procumbent at its base. The root is from 4 to 6 inches long, about as thick as a goose quill, generally somewhat branched, descending obliquely into the ground. There are several kinds of ipecacuanha, among which are these: 1. officinal or annulated ipecacuanha, (radix ipecacuanha); 2. striated or black ipecacuanha, radix psychotriæ); 3. the white or undulated ipecacuanha, (radix Richardsoniæ). The root, principally that of the annulated ipecacuanha, is the part which is offi-

cinal; it is in pieces two or three lines thick, presenting on its surface prominent rings or rugæ separated by narrow fissures. Its odor is nauseating, its taste bitter and a little acrid, its fracture is granular with whitish or grayish resinoid aspect.

Ipecacuanha owes its properties to emetia and to ipecacuanhic acid, an amorphous reddish-brown bitter substance belonging to the group of glucosides.

Emetia was discovered in 1817 by Pelletier and Magendie. It is an inodorous, colorless substance, of a bitter taste, very soluble in warm water, less soluble in cold water, soluble in chloroform, less in ether; it melts at 70° C.

Ipecac powder is an irritant; in contact with the skin deprived of its epidermis it produces a keen irritation and inflammation; in contact with mucous surfaces it occasions a redness, then an inflammation, which is sometimes very severe (as seen in animals poisoned by emetia.)

Taken into the stomach, ipecac produces, first nausea, then vomiting; when this does not take place one observes ordinarily a purgative effect. When it is not desired to obtain an emetic action, but only nausea, ipecac is given in one or two grain doses; to obtain vomiting, from 15 to 30 grains are required; the patient takes this dose in separate portions with a few minutes of interval, and as soon as vomiting commences, plenty of warm water is administered to favor the vomiting. To render the emetic effect more thorough, a grain of tartar emetic is often added to the potion.

Emetia given hypodermically has not been found to have as satisfactory results as ipecac powder given by mouth.

Given in very small doses, to wit, $\frac{1}{8}$ grain every hour or two, ipecac produces a state of malaise with profuse sweats and tendency to lipothymia.

As an expectorant, ipecac is given in doses of from $\frac{1}{2}$ grain to a grain four or five times a day.

Ipecac is incompatible with substances containing tannin.

COMPOUND SYRUP OF IPECAC. (French Codex.)

Take of:

Powdered ipecac,	30 parts.
Senna leaves	100 "
Wild thyme	30 "
Corn poppy flowers	125 "
Epsom salts	100 "
White wine	740 "
Orange flower water	750 "
Boiling water	750 "
White sugar	q.s.

Infuse the above ingredients, omitting the sulphate of magnesia and sugar, then strain and add the latter ingredients, heating until solution is effected. Dose—Half a fluid ounce to two ounces. (This is the famed Syrup of Desessarts.)

There are various officinal preparations. Those most in use are the Wine, Syrup, Fluid extract and the Troches. The syrup is an excellent preparation for infants. If given for emetic effect it is well to add a little powdered ipecac to the dose.

The troches of the U. S. Ph. are substantially the same as the *pastilles* of the French Codex.

[4] Segond's pills are made as follows:

Take of:

Pulv. ipecac,	0.40
Calomel,	0.20
Extract of opii,	0.05
Syrup of juniper q.s. for six pills.	

Berenger-Feraud gives ipecac in dysentery *ut seq:* Into a five-ounce bottle filled with cold water he adds ipecac powder ℨj; the bottle is well shaken and a dessertspoonful given at once; this dose is repeated every hour.

[5] Ailanthus glandulosa is a well-known tree in the United States, where it has been cultivated as a shade tree, its growth being rapid and its foliage abundant. In its general aspect and the character of its foliage it resembles a gigantic sumach. It is called in France "Japan varnish," though it is not the true Japan varnish tree, which is a sumach.

The parts employed are the bark and the root. The powder applied to the skin produces a slight vesication, and introduced into the intestine of a dog, causes purgation. When chewed the bark has a bitterish taste and causes shortly afterwards a sense of discomfort and feebleness, dazzling sensations before the eyes, with cold sweats and nausea (Dujardin-Beaumetz.)

After taking a moderate dose of the infusion, which is very bitter, nausea and sometimes vomiting supervene; there is a diminution in the number with a slowing of the heart's pulsations, which symptoms soon subside.

The leaves and the root are employed as anthelmintics, and it is under this head that the ailanthus is considered in earlier editions of the U. S. Dispensatory. Dugat-Establier, Robert and Giraud have tested the anti-dysenteric properties of the ailanthus. Dugat advises this mode of administration: Take two ounces of the fresh bark of the root, triturate in a mortar with the help of a few drachms of water. Express through a linen cloth. Stir well before giving, and order a teaspoonful to be taken in the morning fasting; the dose may be given in a cup of weak tea. Repeat this dose for three mornings. The diet the first few days should be milk, then little by little gruels, panada, etc. This regimen ought to be continued a fortnight. If at the end of that time the patient be not well the treatment is to be recommenced.*

[6] This is the formula for the albuminous nitrate of silver lavements. Dissolve the white of one egg in 6⅔ ounces of water, and add simultaneously two solutions, the one containing 7½ grains of nitrate of silver, the other as much of common salt.

Eimer's modification of Delioux's iodine lavement is as follows:

Take of:

Pure iodine,	4 to 8 grains.
Iodide of potassium,	q. s. to dissolve.
Distilled water,	1 to 3 ounces.

M. For a lavement which may be repeated twice in twenty-four hours.

* Robert, Archives de Medécine Navale, 1874. Girard, De l'Ailanthus Glandulosa, These de Paris, 1874. Dujardin-Beaumetz, Soc. de Ther., 1874. Dugart-Estublier, On the Employment of Ailanthus Glandulosa in the Dysentery of Warm Climates.

The nitrate of silver and iodine lavements are not the only ones which have been proposed in dysentery. Cinchona bark has been given in lavements; charcoal powder, (from half an ounce to an ounce of charcoal in a pint of a thick infusion of flaxseed); chlorinated lavements, (1 drachm of Labarraque's Solution in five ounces of water); injections of chamomile tea, etc. The latter have been very much vaunted by Delioux of Savignac.

[7] Bodin would administer every day as a drink a quart of water with the whites of six eggs. Mondiere gives a much larger quantity, and also gives the egg in lavement.

LECTURE XXIV.

ON THE TREATMENT OF HEMORRHOIDS.

SUMMARY.—Hemorrhoids—The Hemorrhoidal Veins—Their Course—Etiology—Mechanical Causes—Anal Spasm—Active Causes—Diathetic Causes—Symptomatology—Hemorrhoidal flux—Therapeutic Indications—Ought Piles to be Cured?—Hygienic Treatment—Pharmaceutical Treatment—Purgatives—Anti-hemorrhoidal Medicines—Hamamelis—Local Treatment—Forced Dilatation of the Anus—Operative Procedure—Surgical Treatment—Different Processes—Hemorrhoidal Swelling—Prolapsus of the Anus—Artificial Production of Hemorrhoids.

I DESIRE to devote this lecture to a few therapeutical indications pertaining to certain diseases of the rectum, and in particular to hemorrhoids, a disease which is very frequent and whose treatment deserves special consideration.

We have to-day a pretty clear understanding of those rectal and anal tumors described under the head of hemorrhoids, and for this knowledge we are largely indebted to the thorough studies of Gosselin and Verneuil. They are, as you know, varicose dilatations of the hemorrhoidal veins, and according as these varices pertain to the external or internal hemorrhoidal veins, we have what are called external or internal piles.

These hemorrhoidal veins are to-day well known. Gosselin, Verneuil, Dubreuil and Paul Richard and especially Duret,* have given us a very complete description of them. The internal or superior hemorrhoidals empty as you know into the inferior mesenteric, and therefore belong to the portal system. The external hemorrhoidal veins, on the other hand, are branches of the hypogastric and internal pudic, and therefore are a part of the general venous system. But the most interesting point connected with this anatomical arrangement is that these two venous systems, instead of having free intercommunication, as was formerly supposed, are united by but a very few small veins whose presence can only be demonstrated by quite fine injections.[1]

Do not forget, gentlemen, the presence of those muscular bands which

* Gosselin, Leçons sur les Hemorrhoides. Paris, 1866. Verneuil, Anatomie Pathol. (Bull. de la Soc. Anatom., 1855, t. xxx., p. 175). Dubreuil and Richard, Veins of the Rectum, etc., in Arch. Phys., t. i. Duret, On the Pathogeny of Hemorrhoids. (Arch. de Med., Dec., 1879, p. 643.)

have been demonstrated by Verneuil, Dubreuil, and Richard, and which surround the superior hemorrhoidal veins when these latter pierce the walls of the rectum to join the veins of the portal system. Do not forget, moreover, that those contractile rings which constitute the sphincter or rather the *sphincters* of the anus encircle the veins which connect the two venous hemorrhoidal systems, inferior and superior. You will see, as we go on, what important rôle belongs to these muscular zones both in the pathology and treatment of hemorrhoids.

Hemorrhoids are due to numerous causes. I cannot here give them all, but as etiology plays an important part in the therapeutics of these affections, permit me to mention the principal determining conditions.

We have first of all the group of mechanical causes, which produce what Verneuil calls *passive hemorrhoids*. These are the cases of obstructed circulation in the portal vein, such as is occasioned by intra-abdominal tumors, pregnancy, cirrhotic alterations of the liver; affections which are all to a greater or less extent accompanied by piles.

It is in the same group of mechanical causes that we should place constipation as a cause of hemorrhoids. Here the cause has a double effect: we have first the presence of fæcal matters, which impede the returning circulation of the intestinal veins; then the violent efforts of defecation, which augment the venous tension in the same part. According to Duret, straining at stool is the most influential factor in the pathogeny of rectal varices. Hemorrhoids when once produced hinder defecation, and in this way determine constipation, which in its turn fosters the hemorrhoidal condition.

Anal spasm, about which so much has been said, whether primary or secondary, acts also as a mechanical means by compressing the veins which make the superior hemorrhoidal system communicate with the inferior; it acts like the ligature which we apply round the arm to cause distension of the veins preparatory to blood letting.

In other circumstances hemorrhoids have an active cause, as when the rectal mucous membrane is under irritation, or when there are congestive diseases of the bladder or prostate gland in the male, of the uterus and ovaries in the female.

Lastly, hemorrhoids may be a diathetic manifestation, and it must be recognized that this is one of the most frequent conditions of their production. The diathesis which has the principal causal influence on hemorrhoids is without doubt the arthritic diathesis. Interrogate the majority of persons who have hemorrhoids, and you will find that they have either pronounced arthritic manifestations themselves, or else gouty or rheumatic parents.

The herpetic diathesis has also an etiological influence, but one which is less clear, and with respect to these diatheses, pathologists have even gone further and constituted or imagined a special diathesis, the hemorrhoidal diathesis.

It will not do to exaggerate the influence of diatheses in the genesis of hemorrhoids, and commit the mistake of Stahl, who made of these varices one of the most important points in pathology; and while granting the unquestionable influence of diathesis, we must also recognize the often dominant action of local causes.

If I have devoted so much time to pathogeny, it is because, as you now see, we have from a therapeutic point of view many problems to solve with regard to hemorrhoids. Ought we to cure them, or ought we to respect them? or on the other hand, are there circumstances where we ought to favor their development? These are important questions which I shall endeavor to answer, but in order to understand the subject in all its bearings, it is necessary briefly to sum up the symptomatology of hemorrhoids.

Hemorrhoids may remain during a whole lifetime, especially if external, in the state of little tumors which are not painful and occasion no inconvenience to the economy. In other circumstances these tumors increase in size, especially when they are internal; they embarrass defecation; they keep up a disagreeable sensation of itching and weight in the anus, and to such an extent as often to be a cause of hypochondriasis; moreover they produce a spasmodic irritation of the anus, and in many cases by their weight, and in consequence of hard straining at stool, they drag the rectal mucous membrane outside the sphincter, and determine prolapsus. Hence then the presence of hemorrhoids, spasmodic contraction of the sphincter ani, and prolapsus of the rectum are very likely to be found together, and demand a treatment that shall be directed to the removal of the hemorrhoids.[2]

Hemorrhoids may also be the seat of hemorrhages (bleeding piles). These fluxes are sometimes periodical, sometimes irregular, and give rise, it may be, to a flow of blood trifling in amount and beneficial in its effects; it may be to abundant hemorrhages, which considerably enfeeble and anæmiate the patient, thus constituting a veritable hemorrhoidal cachexia. Lastly, these varices may be the starting-point of inflammations more or less grave, and even of gangrenes. Such is, in brief, the symptomatology of hemorrhoids. We may now to better advantage venture upon the study of their treatment.

Will it do to cure all cases of hemorrhoids? Not by any means, and without partaking of the exaggerated views of a former age, I believe that we ought in a great many instances to apply to hemorrhoids only a palliative treatment.

We have first of all that large group of hemorrhoids arising from a gouty or rheumatic diathesis, where but insignificant local symptoms accompany the tumors; all that needs to be done in these cases is to direct the diet, order suitable exercise, insist upon great regularity in the stools, in order to maintain the hemorrhoids in a latent state, which in no respect inconveniences the economy.

Then comes a second group of hemorrhoids, with periodical congestions, and a flux which lasts several days. In these cases also I hesitate much to interfere, especially when the patients are of a certain age, between forty and fifty years, with manifest congestive tendency, and who find in this anal congestion and in these periodical fluxes a real relief for their headaches and cerebral congestion. I prescribe an active treatment, on the other hand, for patients who experience too abundant rectal hemorrhages, or in the case of whom the rectal tumors produce, either too severe pain in the region of the anus, or a spasmodic contraction of this orifice, or a prolapsus of the rectum.

But before stating the therapeutic measures which you may put in use, I wish to say a few words concerning the creation of hemorrhoids in certain individuals. I refer to persons of marked hemorrhoidal tendencies, who, after the suppression of their anal varices, see symptoms of greater or less gravity supervene. In such cases it is well to endeavor as quickly as possible to recall the piles. Sanguinious and plethoric individuals, with manifest congestive tendencies, and in whom the appearance of hemorrhoids appears to produce a real relief, belong to the same category.

Lastly, there exist a certain number of individuals in whom nervous manifestations of a complex order may disappear by the creation of hemorrhoids. I know how difficult of explanation is the bond which seems to exist between abdominal plethora and nervous troubles, I know also how obscure are the explanations given by Stahl and his school; but I none the less recognize the favorable action of piles in certain neuropathies, and I could cite you numerous instances drawn from the practice of my master, Dr. Moissenet, and from my own practice, in proof of this. As you see, from the point of view of treatment, we shall then have to study here not only the means proper for curing hemorrhoids, but also those which can provoke them, and this is what I shall now do.

Hygiene plays an important rôle in the treatment of hemorrhoids. To diminish these rectal and anal varices, you will recommend the patient to avoid all circumstances which may congest the pelvic organs, such as straining at stool, and remaining too long time in a sitting posture. There is another simple matter which I should mention: the sufferer from piles should not use ordinary paper with which to wipe the parts after a stool; better by far to bathe them with warm water. Another hint of importance—sexual relations should be moderate; you will also recommend him not to ride horseback. Such is the advice to give to hemorrhoidal patients.

The victim of piles should also abstain from food of too abundant or too excitant a character, and should always have care to include in his daily dietary vegetables and especially ripe fruits. But especial attention should be given to the bowels. A hemorrhoidal patient should go to stool every day, and Nelaton strongly recommended that the habit should be formed of a daily evacuation before retiring at night, so that the piles may go back while the patient is in a recumbent posture.

It is a good plan often to take a cold injection before attempting a movement of the bowels, and Garvin insists that a patient with piles should never go to stool without this precaution. These cold lavements play a very important rôle in the treatment of these affections, and it is well to make great account of them. You can also recommend perineal and rectal douches, which tonify these organs and may thus give good results.

Next in order come the pharmaceutical means which are addressed, some to the constipation, others to the hemorrhoids themselves, and to the pain as well as the bloody flux of which they are the seat.

As regularity of the bowels is an absolute necessity in order to stay the progress of the hemorrhoids, you must take care that constipation shall be obviated, and I refer you in this regard to the chapters on this subject; but do not forget that there is a group of drastic purgatives which irritate the intestine, and favor, rather than combat, the rectal varices. Aloes, which is especially prone to cause congestion of the rectal mucosa, ought to be absolutely proscribed.

You will then use the mild purgatives, saccharine or oleaginous. Van Ryn has even maintained that linseed oil has a special curative action in hemorrhoids.[3] You will employ also the saline purgatives, and it is in these cases that one may prescribe to advantage the purgative mineral waters. Sulphur has great repute as a laxative, and glycerine is to be favorably spoken of in this connection; according to David Young, in tablespoonful doses, morning and evening, it promotes freedom of the bowels, and causes piles to disappear.

After having secured regularity in the alvine evacuations, you can address your treatment to the piles themselves. Certain internal medicaments have been recommended as having a special curative action in hemorrhoids; thus it is that Lazare Riviere, Alberti, Hufeland, and more recently Teissier of Lyons, have vaunted the employ of yarrow,[4] while Berlemont of Joncourt, and Van Holseek have signalized the benefits of the lesser celandine (Ranunculus ficaria), as having also anti-hemorrhoidal virus.[5] Moreover cayenne pepper, (capsicum annuum), is the favorite remedy of such authorities as Allegre, while Brodie, the late distinguished English surgeon, has highly extolled the piper nigrum.[6]

With the exception of capsicum, which I have at times tested with a certain amount of success, I have no experience with the other substances just mentioned; they are none of them, however, dangerous, and you can at any time try them if you wish.

To all these substances, and at their head, should be added a vegetal production which has a great reputation in the United States in the treatment of hemorrhoids; I allude to the Hamamelis virginica. From the leaves and twigs of this shrub, which grows in abundance in the marshy lands which border on the Mississippi, there is made a hydro-alcoholat, (a product of distillation), to which Americans have given the name of extract of witch-hazel, or Pond's extract. With the same parts of the plants tinctures and other preparations are made, some of which are now officinal in the U. S. Pharmacopœia.

Recommended for the first time in 1832 by Merat and Delens as possessing special curative properties, the study of hamamelis has been again taken up during the last few years, especially by homœopathic physicians, and I have myself investigated the physiological and therapeutic action of this plant.[7]

It has been said that hamamelis possesses a hæmostatic and special elective action, the latter pertaining to the venous system, and that when administered internally it not only has a curative influence on hemorrhoids, but also on varices. I have, in fact, obtained in certain cases of hemorrhoids real curative effects from hamamelis, but I have completely failed in the treatment of varices.

The anti-hemorrhoidal action of hamamelis finds no explanation in its physiological effects, which in animals are absolutely nil. Moreover, you will find in the excellent thesis of my pupil Guy a detailed account of a great number of physiological researches, confirmatory of this statement. Hamamelis is destitute of all toxicity.

If you make use of hamamelis you can employ Pond's extract, giving it in teaspoonful doses three or four times a day, or, what is doubtless a better preparation, you may give the fluid extract of the U. S. Ph. in the same dose, or the French tincture, a very strong alcoholic preparation, in doses of ten drops as often as required.

Then come the various local means which may be employed in such cases, such as astringents, in lotions and ointments; lavements with acetate of lead, as counselled by Watson;[8] lotions of liquor plumbi, as recommended by Richard of Cantal; tannin ointments, which have been highly extolled by Herpin.[9]

All these means have for their end to diminish the congestion and distention of the walls of the veins, and they are applied to piles whether fluent or non-fluent, but especially to those which are the seat of a bloody flux; and, in such cases, to all the means which I have just enumerated, you may add the perchloride of iron, which is applied directly to the hemorrhoidal swellings, or employed in lavements.

Pain, as I have said, is a frequent symptom in hemorrhoids. It is generally due to a spasmodic state of the sphincters of the anus; hence it is that a great number of anodyne ointments have been advised in these cases. The poplar ointment[10] is highly vaunted without any very substantial evidence in its favor. Next come suppositories or pomades, with extract of belladonna or opium.[11]

But if the pain persists and becomes intolerable, as happens when the hemorrhoids are complicated with fissure of the anus, these means fail in most cases, and you are obliged to have recourse to an operation of a more radical kind which gives excellent results: I refer to dilatation of the anus.

Counselled first by Maisonneuve, who revived the procedure of Recamier, (who had before recommended and performed forced dilatation of the anus, and had himself borrowed the practice from the quack Moltenot,) this forced dilatation has now become—thanks to the contributions of Gosselin and Verneuil—one of the best modes of treatment, not only of anal spasm but also of hemorrhoids.[12]

Prof. Verneuil has, in fact, shown that in cases of hemorrhoids the contraction of the sphincters plays a predominant rôle; and it suffices for me to recall to your remembrance what I said at the beginning of this lecture on the disposition of the venous system of the anus and rectum, to enable you to understand the preponderant influence of contraction of the sphincters of the anus in rendering hemorrhoids turgescent and painful.

So then, if you have to do with painful hemorrhoids, or with sphincteralgia—that is to say, those paroxysms of pain which accompany spasm of the anus—or with those fissures which are so frequent in women after confinement, you should resort to anal dilatation. It is one of the most simple of operations, which every physician should know how to perform.

Anæsthesia is always indicated preparatory to dilatation, which can hardly be practised without ether or chloroform. Place your patient then in a recumbent posture and administer your anæsthetic; turn him on his side; let your assistant raise one of the thighs, then introduce back to back your two thumbs into the anus, and forcibly stretch them as widely apart as you can, or till the palmar surface of the thumbs touches the tuber ischii on each side. Verneuil and Richet prefer dilating with the speculum, either Ricord's or Cusco's, which is introduced shut into the anus, and then opened wide and withdrawn. Then you replace the patient on his back, and apply cold compresses to the anus, and at the end of a few days your patient is well. Do not forget to give a purgative the evening before the operation, and a lavement a little while before dilatation. Such is the operation of forced dilatation of the anus, which in the majority of cases if not in all will give you a complete cure, whether of hemorrhoids, sphincteralgia or fissure of the anus.

There are, however, cases where the size of the hemorrhoids is so great that it is necessary to resort to more formidable operations, which belong more especially to the domain of surgery. I cannot here without departing from the province of these lectures expatiate at any length on the surgical means which are put in usage in such cases, and shall only touch upon them briefly.

There is first of all compression, which Burns has so much vaunted, and which is only employed at the present day for prolapsus of the rectum; next comes incision, recommended by Boinet, and which consists, as its name indicates, in free punctures by means of a bistoury of the most voluminous piles.

It has been of late proposed to make injections of carbolic acid into the interior of these varicose swellings, and Edmund Andrews of Chicago, Kelsey in the American Journal of Medical Sciences, and others in the United States, have reported very favorably of this method of treating hemorrhoids. A prominent hemorrhoid is selected, and from five to ten drops of a mixture of the melted crystals of carbolic acid and glycerine are injected into its substance by means of a hypodermic syringe. The operation is comparatively painless, and the hemorrhoid soon shrinks away, with very little sloughing. Notwithstanding the success of this method in the United States, it has not yet come into general favor in France.[13]

The ligature is of much more ancient origin, since it goes back to the days of Hippocrates; it has been employed especially in England and the United States, but it has not come extensively into use in this country. Another process consists in excising the hemorrhoids, whether with scissors, according to Dupuytren's method, or with the écraseur, according to Chassaignac. This operation had a great reputation for a while, but since the improvements effected in galvano-cautery appliances, and especially since the employment of dilatation, it has considerably gone out of vogue.

Cauterization has been largely resorted to in the treatment of hemorrhoids; by this means the serious hemorrhages are avoided which sometimes follow the cutting operations. Surgeons have employed for the removal of piles cauterization with red-hot iron, a mode which goes back to the most remote antiquity, and is still in use in our day; also cauterization by the galvano-cautery, which has been especially vaunted by Verneuil; finally certain chemical substances in a solid or liquid state have been utilized for the purpose of destroying hemorrhoidal swellings. Thus Sedillot and Amussat have employed Vienna paste, while Houston of Dublin, and more recently still Gosselin, have recommended the monohydrated nitric acid.

In other cases one may combine cauterization with crushing, according to the practice of Richet, who has invented a cautery forceps for this purpose; the scissors of the new Paquelin thermo-cautery may be used for the same object.

What is the relative value of all these operations? I can hardly pronounce an opinion from my own personal experience in such matters, which is rather limited. What I can affirm, however, is that it is not best to resort to these procedures till the hemorrhoids have resisted all other modes of treatment, and in particular dilatation, and till the patient finds his piles such a source of annoyance that he cannot pursue his regular occupation.

While admitting that in the majority of cases the ablation of the hemorrhoids does not entail any grave complication, whether as a sequel of the operation, or as a consequence of the suppression of an habitual bloody flux, it must be remembered nevertheless that often as a result of these operations certain evils arise, such as strictures of the anal orifice, which are exceedingly inconvenient. While a pupil of Chassaignac, I often had occasion to see this misfortune follow the perhaps rather too numerous applications which my excellent master was in the habit of making with the admirable instrument with which he has endowed surgery—I allude to the écraseur.

Hemorrhoids are often accompanied by the protrusion of a rim-like swelling externally, and this takes place whenever the patient performs heavy lifting, or strains at stool. Ordinarily the piles return of themselves, but it sometimes happens that the reduction becomes very difficult, and the patient may be unable to accomplish it himself; in such an event you may be called in to assist. You will almost always succeed in reducing the piles by slow and methodical pressure, but under other circumstances you will be obliged to wait some time before attaining this result, and then you may be compelled to have recourse to the application of compresses wet with cold water. Ice has even been proposed in order to diminish the turgescence of the varices, and thus render the return of the hemorrhoidal tumors more easy.

In aged persons there is sometimes associated with these hemorrhoids a prolapsed condition of the rectum, and they cannot make the least effort without the immediate protrusion of a considerable extent of the lower bowel. You should in these cases recommend cold-water injections, astringent lavements, (swabbings of the rectum with perchloride of iron have even been proposed); you will make your patients wear abdominal belts with anal pads, which, being applied tightly over the lower outlet, tend to keep the rectum in its place.

You know that in young children prolapsus of the rectum is quite frequent. In these cases the disease may be successfully treated by lavements and lotions of cold water, by electricity, or by subcutaneous injections of strychnine around the anus after the custom of Foucher and Dolbeau.[14]

Basing himself on the contractile power upon the muscular fibre of ergot of rye, Vidal has proposed to treat the hemorrhoido-rectal prolapsus by subcutaneous injections of ergotine, which are made around the anus. This is a perfectly safe measure to which one can always resort before proceeding to the graver operations.

I come now to the last subject demanding our attention to-day, namely, the creation of hemorrhoids, or their recall. While there are no grounds

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whatever for the popular belief in the efficacy of rectal varices—whence the French epithet, *veines d'or,* golden veins—I nevertheless think that in many cases it is well to maintain a congestive state of the anal and hemorrhoidal veins. You will obtain this effect by the use of a medicament which is truly heroic in such cases. I refer to aloes, which you may administer internally in the form of pills (the pil. aloes of the U. S. Ph. contains equal parts of aloes and soap, and is the most available form), or which you may employ externally in the state of suppository or pomade, as Dupuytren recommended. A drachm of Socotrine aloes is rubbed up with an ounce of lard, and applied three or four times a day in frictions to the anal region. Trousseau used to speak in praise of suppositories of tartar emetic,—two to five grains of the latter to a drachm of cacao butter for one suppository, which was introduced into the rectum.

You can also conjoin to these means aromatic fumigations and warm sitz baths, but you should remember that while it is easy enough in persons predisposed to piles by heredity to induce or augment a hemorrhoidal condition, it is very difficult to obtain this result in persons who have no tendency to this affection.

NOTES TO LECTURE XXIV.

[1] This is the anatomical distribution of the veins of the rectum and anus, according to Gosselin, Verneuil and Duret. The superior hemorrhoidals, which empty into the inferior mesenteric, are distributed to the mucous membrane of the rectum as far as the margin of the anus, and communicate by means of a very few and extremely minute vessels with the middle and inferior hemorrhoidals, which come from the hypogastric and internal pudic. Duret has described in this connection three venous plexuses; sub-sphincterian, peri-sphincterian, and rectal.

The rectal veins seem to arise two centimetres from the periphery of the anus by little oval pouches or ampullæ; then they ascend, flexuous, parallel, and close together, about ten or twelve centimetres, where they suddenly bend on themselves and perforate the rectal wall perpendicularly; as they pass through the muscular coat they are surrounded by button-hole-like muscular bands which are deprived of protecting fibrous rings.

At their lower part, and on a level with the ampulla or pouch, of which we have just spoken, the rectal veins are connected with a little venule which passes through the sphincters of the anus to empty into the external hemorrhoidal vein. (See the plates accompanying Duret's work.)

[2] Gosselin has described external and internal hemorrhoids. He divides the external into three subdivisions: 1, flaccid hemorrhoids; 2, turgescent hemorrhoids; 3, indurated external hemorrhoids.

He makes two groups of internal hemorrhoids: 1, internal hemorrhoids properly so-called, *i.e.*, those concealed within the rectum; 2, procident hemorrhoids, which may be reducible or irreducible.

Here are some of the characters of the different hemorrhoids:

The flaccid external piles are always situated outside of the anus; they are solitary or multiple, and their size varies from that of a pea to that of a chestnut; they are always sessile, that is to say, they have no pedicle; they contain no blood; which is due to the fact that at some period of their evolution a clot formed in a dilated vein and was then absorbed.

The external turgescent kind is only seen at certain periods; as for the external indurated, they result from the disappearance of the veins and from hypertrophy of the fibrous stroma which surrounds them.

The internal non-procident hemorrhoids are constituted simply by dilated veins, and by the non-hypertrophied rectal mucosa which immediately covers them. Gosselin insists on the non-alteration of the mucosa in internal hemorrhoids. These latter may be reducible or irreducible, according to circumstances.*

[3] Dr. Van Ryn was in the habit of giving internally a large dose of linseed oil (2 ounces) morning and evening.

[4] Yarrow (achillea millefolium) is a very common field plant (*achillea*, from Achilles, who is said to have employed this weed as a vulnerary).

Several French authorities have highly vaunted the use of yarrow in intestinal fluxes; it is given internally in the form of infusion or the expressed juice.†

[5] The Lesser Celandine (ranunculus ficaria) has been recommended by Berlemont of Joncourt; an infusion of the root is given internally. Infuse two ounces in a quart of water, and give a wineglassful t. i. d. Van Holdseek endorses this treatment.

[6] Allegre has proposed *capsicum annuum* (cayenne pepper) in piles, and the commission nominated by the Academy has recognized the benefits of this treatment. Cayenne pepper is given in the form of pills or powder, in the dose of 5 to 15 or even 20 grains a day.‡

[The confectio piperis, or confection of black pepper, "Ward's paste," once acquired some reputation in Great Britain as a remedy in piles and ulcerations of the rectum. To do good it must be continued, according to Brodie, for two, three or four months. The dose is from one to two teaspoonfuls three times a day.]

[7] The Hamamelis Virginica, otherwise known as witch-hazel, is too well known in the United States to require description here. It is a shrub from 5 to 15 feet high, and grows in almost all parts of the United States. It is remarkable for the late appearance of its yellow flowers; the fruit, which is a nut-like capsule resembling the hazel nut, is often mingled on the same plant with the new blossoms; from this circumstance the name *hamamelis* is derived; (αμα at the same time, and μηλον fruit.)

Thus far chemical analysis has revealed no alkaloid in this plant; the active part seems to be an essential oil discovered by Mougin. There is also considerable tannin in the bark.

Besides Pond's extract, so popular in the U. S., and which is simply a

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* Gosselin, Lessons on Hemorrhoids. Duret, in Arch. de Med., 1879.

† Teissier of Lyons. On the Treatment of Hemorrhoidal Fluxes by yarrow (Achillea Millefolium). (Bull. de Ther., t. lii., p. 170.)

‡ Comptes Rend. de l'Acad. de Med., 1865.

distillate, there is a fluid extract, also a tincture, which should be made of the fresh bark, and is entitled to more confidence than the distilled extract; the dose is 5 to 20 drops t. i. d. The fluid extract is given in teaspoonful doses every two hours.

Pomade for Piles.

Take of:

Tincture of hamamelis, ...	3 parts.
Vaseline, ...	30 "

M.

Suppositories of Hamamelis.

Extract of hamamelis, ...	2 grains.
Cacao butter, ...	75 "

M. One suppository.

Hamamelis was introduced into therapeutics in 1832 by Merat and Delens. It was first known in Europe in 1736, being brought there by Bollinton. From time immemorial the Indians have made use of it in the treatment of certain tumors as a discutient. R. Hughes, a homœopathic physician, was the first to indicate its use in varices and hemorrhoids. Ludlam commended its utility in orchitis. Hale has made a special study of its multiple curative virtues from a homœopathic point of view. Musser of Philadelphia has highly recommended it for varices, and advises its internal administration. Serrand and Tison (1881–1883) were the first to introduce hamamelis into France, the former insisting on its benefits in affections of the larynx. In 1884 Dujardin-Beaumetz, at the Society of Therapeutics, communicated the results of his experience with this new remedy, and Guy has embodied these results in his thesis.*

° Watson advises for bleeding piles lavements of sugar of lead— ʒ ss to ℥ ij of water. He also speaks highly of a lavement of colophony 1 part, of honey 5 parts.† Richard of Cantal makes applications to the anus of a compress soaked in the following solution: Liq. Plumb. diacetatis, ʒ i. aquæ f ℥ iv. M.

° Herpin's ointment for ordinary non-fluent piles is as follows:

Tannin, 1 part, cold cream ointment, 5 parts.

As a purgative, he recommends a teaspoonful every morning of a mixture of equal parts of flowers of sulphur, calcined magnesia and sugar of milk.

[Van Buren's laxative for hemorrhoids, much in use in the U. S., is as follows:

Take of:

Sulphur, ...	ā ā ℥ ss.
Sulphate of magnesia, ...	
Calcined magnesia, ...	
Sugar of milk, ...	
Pulv. anise, ...	ʒ ii.

M. Dose—a teaspoonful in water at bed time.] Herpin orders a diet

* Guy, Thèse de Paris, 1884, and Boston Medical and Surgical Journal, 1885. Dujardin-Beaumetz, Bull de la Soc. de Ther., May, 1884. Ludlam, U. S. Med. & Surg. Jour. Hale, Materia Medica, etc., 4th Ed., vol. I., p. 345. Hughes, Elements of Pharmacodynamia, etc. Tison., Bull. de Thér., April 15, 1883.

† Gaz. des Hôp., Dec., 1846.

consisting largely of fruits, and especially strawberries, which he considers as especially beneficial in hemorrhoids.*

[10] The unguentum populeum (French codex) is made by bruising in a marble mortar and boiling in 2000 parts of lard with a gentle fire till the moisture is dissipated: 250 parts each of the fresh leaves of the black poppy, deadly nightshade, henbane, and black nightshade; then adding of the dried buds of the black poplar bruised, 375 parts; digesting for twenty-four hours, straining with a strong expression, and finally allowing the ointment to cool. It is an anodyne ointment much employed in Europe. The virtues of poplar buds are analogous to turpentines and balsams.

[11] Calmative suppositories are made as follows: Ung. populeum, gm. i.; ext. hyos, gm. 0.30; cacao butter, white wax, ā ā gm. ii. For 1 suppository. ℞. Ext. opii, gm. 0.10; ext. stramonii, gm. 0.10; cacao butter, gm. viii. For 2 suppositories. ℞. Ext. rhatany, gm. 0.50; muriate of morphia, gm. 0.02; cacao butter, gm. iv. For 1 suppository.

[12] In 1838 the tribunal of Orleans condemned a charlatan by name of Moltenot, who, for the first time, performed sphincteric dilatation under the name of *massage cadencé*. In the same year Recamier took up again the practice and applied it to the treatment of spasm of the anus. This procedure was repeated in 1847 by Maisonneuve under the name of forced dilatation of the sphincter. In 1849 Monod, before the Society of Surgery, advocated forced dilatation. Bernet in 1850, Lepelletier and Kunemann in 1851, defended this method as of great utility in sphincteralgia and hemorrhoids. Verneuil also advocated it for piles in 1874, and his pupil Cristofari in his thesis has described the method of his master. Fontan lastly, in 1876, made forced dilatation the subject of a memoir before the Society of Surgery, in which the merits of this simple surgical expedient in the treatment of hemorrhoids were ably defended.†

[13] According to Edmund Andrews of Chicago, the method of hypodermic injections of phenic acid has been applied by over 300 physicians to 3300 cases of hemorrhoids. He regards this method of treating piles as less dangerous than the others, while being quite as sure as any. The injections of six or eight drops of equal parts of strong carbolic acid and glycerine are made into the substance of the hemorrhoid; generally not more than two or three are treated at one time, sometimes only one, with a week or ten days of interval before another is injected, and so on.

[I have found it in several instances to be a very certain and comparatively painless way of getting rid of hemorrhoids. If they are internal,

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* Herpin on the Treatment of Non-Fluent Hemorrhoids, Bull. de Thér., t. lx., p. 392.

† Recamier, On the Extension of Massage and of Cadenced Percussion to the Treatment of Muscular Spasm, Revue Méd., 1838; Lepelletier, Gaz. de Thèr., 1849; Maisonneuve, Clinique Chir., t. ii., p. 500; Monod, On Forced Dilatation as a Means of Treating Fissure of the Anus with Constriction of the Sphincter, Bull. de la Soc. de Chir., May, 1842; Cristofori, On the Surgical Treatment of Hemorrhoids, etc., Th. de Paris; Fontan, On the Treatment of Hemorrhoids by Forced Dilatation of the Sphincter, 1875; Anger, Report on the Memoir of Fontan (Bull. de la Soc. de Chir., 1877).

inject a few drops of the above-mentioned solution into the most prominent of the piles, as they come down. The pile so injected soon shrivels up and disappears. Trans.]

Professor Verneuil uses the galvano-cautery. The patient is anæsthetized or not, as he prefers; is placed on his side near the edge of the bed; the piles are drawn down with a double tenaculum, and the large ones selected for the operation. The galvano-cautery knife is held like a pen, and when duly heated by the current is made to penetrate gradually the hemorrhoid in a direction parallel to the rectum, and to a depth of 6 to 15 millimetres. The point of the instrument is made to perform a slight movement of circumduction in the interior of the tumor to increase the size of the eschar. For a tumor the size of a filbert one puncture suffices. The operation is all through in four or five minutes; the eschar is comparatively slight, and the after treatment is almost nothing. Compresses wet with cold water allay inflammation and swelling. In ten or twelve days the sloughs separate, and only a little circumscribed induration remains. There is no possibility of subsequent stricture.

Gosselin prefers the older operation with strong nitric acid. It is applied by means of a mop of lint or asbestus fastened upon a wooden handle, care being taken to avoid touching the surrounding skin, which indeed had better be smeared with resin cerate. The caustic is not allowed to remain long in contact with the tumor; after two or three seconds the mucous membrane whitens and the desired effect is produced.

Richet's favorite method (a combination of crushing and cauterization) is as follows: The hemorrhoidal swelling is transfixed in several points of its circumference by a silver wire which is twisted around several portions of the tumor at its base, pediculating them. Then the skin of the anal periphery, having been previously protected by a wet compress or by collodion, the base of each pedicle is seized between the blades of the forceps heated to a white heat, and in less than five seconds, by the pressure joined to the cauterization, each portion of the hemorrhoid is reduced to the state of a thin shred of blackened tissue completely charred. Care must be taken (and this is the important point) to leave a little healthy tissue between each portion which is cauterized. The operation being completed, the ligatures are withdrawn, and compresses wet with cold water are applied to the charred parts.

[In my own experience the ligature is the most certain and satisfactory method of disposing of internal piles, and it was the favorite method of the late Dr. W. H. Van Buren of New York. (See his work on Diseases of the Rectum). Translator.]

"Schwartz was the first, in 1836, to recommend preparations of nux vomica in the treatment of prolapse of the rectum, and Duchaussoy counselled the hypodermic method, a method which was soon adopted by other physicians. The needle is inserted one centimetre from the anus, and plunged to the depth of half a centimetre; about $\frac{1}{12}$th of a grain of strychnia is then injected.

Gosselin has proposed electro puncture. Lastly, surgical modes of treatment have been proposed; ablation of the irreducible parts has been tried, and the excision of a portion of the mucous membrane; in other cases cauterization of the mucosa with a hot iron or with caustics has been practised. Dupuytren and others have counselled removal of a considerable portion of the skin immediately contiguous to the anus.

In 1876 Vidal first advocated the treatment by ergotine injections. He was in the habit of employing a solution of ergotine, $\frac{1}{6}$th, of which from 5 to 15 drops were injected 5 millimetres from the anus. Guyon, Ferrand and others have obtained good results from this method.*

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* Vidal, Traitement du Prolapsus Rectal par les Injections Hypodermiques d'Ergotine. Detourbe, Du Traitement du Prolapsus Rectal et de la Procidence Hémorrhoïdale par les Injections Hypodermiques d'Ergotine. Thèse de Paris, p. 261, 21 Juin, 1880. Jette, Du Traitement du Prolapsus Rectal par les Injections Hypodermiques d'Ergotine. Thèse de Paris, 1882.

LECTURE XXV.

ON THE TREATMENT OF INTESTINAL WORMS.

SUMMARY.—Intestinal Worms — Their Treatment — Oxyures — Anthelmintic Lavements—Glycerine Lavements—Suppositories of Mercurial Ointment—Lumbricoides—Migration of Lumbricoides—Calomel—Corsican Moss—Worm Seed—Santonine—Tænias—Their Frequency—The Unarmed and the Armed Tænia—Development of Tænias — Tænifuges and Tænicides — Pumpkin Seeds—Kousso—Kamala—Male Fern—Pomegranate Bark—The Pelletiérines—Their Physiological Action—Their Mode of Administration—Tannate of Pelletiérine—The Bothriocephalus.

GENTLEMEN: I desire to terminate these lectures on the treatment of diseases of the intestines by some suggestions concerning certain affections for which you will often be consulted, and which have a great interest from a therapeutic point of view, since they almost always end in recovery under a judicious treatment; I refer to verminous diseases of the intestines. In studying this question I shall avail myself freely of the recent labors of Van Beneden, Laboulbène, etc., and especially of the work of Davaine, which is a most valuable contribution to helminthology.

I shall in this chapter only speak of the oxyuris, lumbricus, and tænia, leaving one side the trichocephalus[1] and the ankylostema duodenale,[2] which you will probably never see; I shall also say nothing about the anguillula stercoralis,[3] discovered recently in connection with the diarrhœa of Cochin China. This is a subject pertaining to another climate than our own, and demands new researches.

The oxyuris[4] is a little white worm thin as a thread—hence the name thread worm—nine to ten millimetres long, which inhabits the rectum of little children, where these entozoa, which are endowed with rapid movement, determine a more or less severe irritation. These worms are sometimes found in innumerable numbers, and are matted together in balls in the rectum, which is the seat of predilection, if not the exclusive seat, of these vermin. In little girls these worms leave the anus and penetrate the vulva or vagina, where they produce an itching which often provokes habits of masturbation. We know but little of the origin and development of these ascarides; we are also ignorant of the influence which regimen has on their development. To destroy these pin worms, whose habitat is so easy of access, you should resort to a purely local treatment, and for this purpose you need only use lavements and suppositories.

As for lavements, some advise simply injections of cold water, others add common salt, others sugar, while still others, imputing anthelmintic properties to garlic, recommend clysters impregnated with this substance. Delasiauve has proposed lavements of ether, Lallemand, the natural sulphur waters; lavements of soot have also been recommended. For my part I prefer glycerine lavements, the glycerine being diluted with an equal quantity of water.

At the same time, in children where the administration of lavements is difficult, or in cases where these worms are in innumerable quantity, there is another remedy superior to glycerine, namely mercurial ointment. This you can introduce into the anus in the state of pomade, or under the form of little suppositories. Dumas of Montpellier made use of a lamp-wick smeared with mercurial ointment, and Legroux recommends in rebellious cases to introduce with the syringe the same ointment in a melted state.

All these means rapidly bring about the cure of thread worms, only there is a liability to relapse. Hence it is a good plan in such patients to examine the anus frequently, and energetically to combat this affection, which seems to be nothing, and which yet, by the itching which it occasions, by the vaginitis which it develops, by the bad habits which it encourages, may produce serious disorders in the health of children.

Quite different is the treatment of the lumbricoides or round worms.[3] Here it is no longer the rectum, but the first portion of the intestine which is the seat. This worm is larger than the thread worm; it is twenty to thirty centimetres in length; it is reddish white, and resembles, as you know, an earth worm. It has its seat in the small intestine, but may migrate to other parts, and you will find in the work of Davaine an interesting account of these migrations.

What it is well to remember is that this lumbric is of itself incapable of perforating the intestinal parietes, and that if it has occasionally been found at some distance from its habitual seat and outside of the intestine, this can only have arisen from some alteration (softening or ulceration) of the digestive tube before or after death, which has caused the intestinal walls to give way so as to enable the worm to escape. These round worms often find access to the stomach, and are ejected by vomiting, or they may penetrate the large intestine and be voided in the stool.

On an average there are generally found from three to five of these worms, but sometimes large numbers inhabit the small intestine. What we know about their development is that they are probably communicated by drinking water. In fact the dejecta of persons affected with lumbrici contain an enormous quantity of the ova of these worms; and as these eggs may remain five or six months in the water without losing their vitality, it is easy to see that whenever fæcal matters become mingled with the water which serves for drinking purposes, as is frequently the case in the country, the conditions are favorable for the development of lumbrici.

These intestinal worms determine symptoms which are but little pro nounced, and it is not generally till the child is sick or at the onset of some grave affection, that you will see these lumbrics voided in greater or less quantity by vomiting or by stool. However this may be, as soon as the presence of the worms is made manifest, the advice of the physician is sought.

To combat these worms an internal medication is needed, and without more than mentioning milk and garlic, which old nurses always counsel in such cases, I will enumerate the principal medicines which have a real curative action. We have first of all calomel—already considered in a previous chapter under the head of cholagogue purgatives—the medicament par excellence in diseases of the liver, where it is much employed for its special action on that gland. But what particularly interests us here, is that this mild proto-chloride of mercury is a good vermifuge. It may be given in the dose of from five to fifteen grains with the precautions before mentioned.

Then comes Corsican moss,[6] which is composed, as you know, of several species of algæ, and in particular of *officinal coralline.* You make an infusion or decoction of this plant; if you prefer the infusion, you steep for several hours one drachm of the moss in a gill of water, reducing it about one half and give the whole quantity; the decoction, containing the same proportion, need be boiled only a few minutes. The dose for an adult is two or three times the above quantity. Corsican moss is to-day abandoned, not because its effects are bad, but because a substance has been found which is very much superior, namely, santonine.[7]

Santonine, the active principle of European wormseed—once employed as a vermifuge—is given in the dose of two to five grains. Baillet has made a careful study of this anthelmintic, which is generally well taken by children, to whom it is administered in the form of lozenges of one third of a grain. This medicament has not generally any toxic action, but if given in too large doses, or in certain idiosyncrasies, it may have unpleasant effects (vomiting, colic, syncope), and produce a curious optical illusion—objects are seen colored yellow; the urine also presents a characteristic yellow tint. Guermonprez of Lille has shown that santonica and santonine do not always give satisfactory results; he prefers the evacuant method with purgatives.

It remains for me to speak to you of the tænia or tape worm, which ought to receive a more lengthy attention from us, not only by reason of the grave symptoms which it may determine, but also because it often presents a serious resistance to therapeutic efforts. We shall here study two varieties of these cestoids, the tænia, and the bothriocephalus.

In man there have been observed three kinds of tape worm; the *tænia solium* or round tænia, the *tænia mediocanellata* or unarmed tænia, and the *tænia nana*.

I shall concern myself with only the two first, which are the most often observed; and it must be acknowledged that, during the last few years, it is the second variety, the unarmed tænia, which has been most frequently met with. You are all acquainted with the great distinction which differentiates these worms:—the tænia solium, with its rostrum being armed with that double circle of hooklets which surmount the four hemispherical cup-like suckers constituting its head; the unarmed tænia, on the contrary, being destitute of hooks and of rostrum. You know also the larger size of the tænia inermis, and the elongated neck of the tænia solium as compared with the shorter neck of the unarmed tænia. But what from the point of view of diagnosis presents the greatest interest, is the possibility of detecting the worm and its species before its entire expulsion under anthelmintic treatment from the intestine. We are able to-day to make the diagnosis quite easily.

We will suppose it to be a case where the patient witnesses segments of the worm voided without his knowledge or will. You may be persuaded that you have to do here with the unarmed tænia. Examine then with care the segments thus voided. If you find the genital apertures, which are, as you know, on the sides of proglottides of tape worms—if, I say, you see these genital pores irregularly alternating on the two sides, sometimes on the right, sometimes on the left, you have to do with the unarmed tænia. Lastly, the microscope enables us to recognize the disposition of the female organs, and if the divisions of the uterus are very numerous and fine, you have a new proof of the existence of the unarmed tænia. In the tænia solium, in fact, the genital pores are regularly alternate, disposed, the one on the right, the other on the left, and the uterus has coarser divisions, presenting an aspect less dendritic—less branched and less crowded. Such are the characters which enable us to recognize the variety of the tænia before the expulsion of the worm.

The natural history of these tape worms presents a great interest, and this it is which enables us to know the origin of these worms, and to explain their frequency in man. Already, in the lectures on Diseases of the Stomach, I have alluded to the principal points of interest in this study, which I desire to complete to-day.

It was Fortassin, in 1804, who was the first to show the relation which exists between the presence of tape worms and the diet of certain individuals. To-day we know the reason of this relationship, and modern heminthologists, in pointing out the different states which the worm has to go through before attaining its definitive form, have given us the key to this interesting subject.

These worms must, in fact, before attaining their perfect condition—that is to say, that of the tænia—pass through an intermediate vesicular state in the body of another animal; and a man has only to introduce into his digestive tube meat containing these cysts to cause the development within him of a tape worm—the armed tænia, if it comes from the cysticercus of pork, the unarmed tænia if it be derived from the cysticercus of beef. We give, as you know, the name *measly* to animals thus diseased, and you will see, when we complete this study by that of hydatid cysts, that man, contracting the disease from measly meat, may himself become measly by imparting the disease in his turn to other animals.

Some doubt has, however, lately been raised respecting the absolute necessity of the passage of these worms through the intermediate or vesicular stage in another organism, and Megnin has maintained that the unarmed tænia may undergo all its metamorphoses in the intestine of man or of animals. This is a question which I cannot decide. However this may be, a careful inspection of butchers' meat will cause the rejection of any that is measly, and, at any rate, prolonged boiling will prevent the production of tape worms by killing the germs, and this is the only prophylactic treatment of any avail.

But when once the tænia has found lodgment and undergone development, what are you to do? These parasites must be killed and expelled; but before attempting the study of tænifuges, I must give you a general idea of the mode of action of these medicaments.

All medicines designed to act as tænifuges must first poison the worm, or at least put it in such a state that it can no longer make use of its cup-shaped suckers; then it is necessary to take advantage of this stupefaction, or state of apparent death, by expelling the worm in the stools, and this as quickly as possible, in order that it shall not again have time to root itself to another part of the intestine. You see, then, that these vermifuges have two distinct actions: first a toxic action on the worm, second an expulsive action by which the parasite is got rid of. It is necessary that these two effects should be simultaneously exerted, or that the second should immediately follow the first, and all the art of the therapeutist consists in bringing to the front the tænicide and the tænifuge.

Generally anthelmintics of this group are tænicides, and the tænifuge action is obtained by a purgative, which is administered along with the tænicide, or a short time after. But do not forget that it will not do to wait too long; the worm may recover from its stupefaction, and again hook on to the mucous membrane, and all your pains are lost. As a general rule, it will not do to let more than an hour elapse between the administration of the tænicide and that of the tænifuge.

There are still some general remarks applicable to all these substances. In order that the medicament may have an action on the worm, the digestive tube must as far as possible be free from alimentary matters. Hence the necessity of purging the patient the evening before, and of requiring him to take the medicine fasting. The patient is generally kept on milk diet the day before, and goes without his supper.

It is, moreover, absolutely necessary in order to a complete cure, that the entire worm, head and all, should be got rid of. In order to attain this result, we require the patient to go to stool in a vessel full of warm water, which prevents the tractions which often separate the head from the rest of the body of the worm.

Having once taken these precautions, what vermifuge will you employ? I shall be brief under this head of anthelmintics, and shall only mention medicaments which have been well tested. I shall pass over the substances derived from a foreign flora, such as saoria, tatzé, mussenna, also the uncertain anthelmintics such as the salts of tin, phenic acid, petroleum, salicylic acid, ether, sabadilla and spirits of turpentine. I shall but mention nux vomica, recommended by Prof. Masse of Bordeaux, and I come now to pumpkin seeds, vaunted by Tyson in 1683, and on which Mongeny of Bordeaux has written a good monograph.[8] According to Heckel, the anthelmintic property of pumpkin seeds does not belong to the entire seed, but is limited to one of the coverings of the perisperm, and results from the presence of a resin to which has been given the name *peporesin.*

However this may be, pumpkin seeds are excellent as an anthelmintic for children. You prepare with these seeds, by bruising them, a pasty mass which is sweetened, and which children readily take; or the crushed seeds deprived of their outer coating may be made into an emulsion by rubbing them with sugar and a little water. The dose of the seeds for an adult is about two ounces, to be taken in the morning fasting, and followed in an hour by a dose of castor oil. Unfortunately this anthelmintic, so easy to take, is often inefficacious, and the head is but exceptionally voided.

We must give a far higher place to kousso,[9] which was for a long time the only efficacious anthelmintic remedy, but is to-day virtually abandoned. An infusion is made with the flowers of kousso, by steeping half an ounce in eight fluid ounces of distilled water; the whole should be infused in a covered vessel for fifteen minutes, and taken in one dose. This infusion, whose odor and taste are very disagreeable, was always taken with difficulty, and the patient would very often vomit before having swallowed the draught. The high price of kousso on the one hand, its nasty taste on the other, and, more than all, the discovery of medicaments quite as efficacious and easier to take, have conduced to the abandonment of this drug.

It was for a time the custom to substitute for the above-mentioned remedy kamala (or kameela), which is administered in powder or in tincture. This is a very good medicament, being both tænicide and tænifuge, but it is now very little used in France.[10]

It is not so with the male fern (*Aspidium filix mas*), of which an ethereal extract is made, which gives excellent results in the treatment of tænia.[11] Thanks to the improvements which have been effected in the preparation of this extract by Peschier and by Kirn, we have here a very active medicament; in the dose of from three to four grammes (ʒ ss to ʒ i) it gives results which are generally satisfactory, but it is necessary to associate with it a purgative; and Crequy has made an excellent combination which consists in inclosing in a capsule half a grain of calomel with from five to ten drops of the ethereal extract of male fern. The patient is made to take twenty of these capsules in the course of an hour, amounting in all to ten grains of calomel and a fluid drachm of the oil of male fern.

To little children, who cannot take these capsules, you can administer this ethereal extract in potion, taking care to associate with it a purgative.

Lastly, gentlemen, these ethereal extracts serve as the basis of several well known anthelmintic remedies, and particularly of Peschier's pills or boluses, which are daily employed on the banks of the lake of Geneva.

I come now to pomegranate (Punica granatum), whose anthelmintic properties, although known to the physicians of antiquity, had been quite forgotten till the appearance of the work of Gomez, in 1823, restored this incomparable tænicide medicament to therapeutics. Since this time the decoction of pomegranate bark has been very generally employed, and signal success has attended its use. Prof. Laboulbène, who has given special attention to the treatment of tape worm by pomegranate, considers this as the surest and most efficacious remedy. Quite recently, in an excellent monograph, Dr. Marty has shown that the twigs as well as the roots of this tree possess anthelmintic properties.[12]

But the recent discovery of Tanret, who has succeeded in isolating the alkaloids of pomegranate, has given a marked progressive impetus to the therapeutic application of this tænicide, and as I have made a special study of these different alkaloids, permit me to sum up in a few words the present state of the subject.

Tanret has found four alkaloids in the pomegranate. To these he has given the name of Pelletiérines in honor of the distinguished chemist Pellétier, to whom we owe the discovery of quinine and so many other natural alkaloids; and, to distinguish these different pelletiérines from each other, he has designated them by the names of pelletiérine, isopelletiérine, pseudo-pelletiérine and methyl-pelletiérine. Only the two first are employed as tænicides.

I have experimented on animals and on man with the divers alkaloids of pomegranate, and my pupil, Dr. De Rochmure, in an excellent thesis on the subject, has reported the results.* These experiments have shown us that the pelletiérines determine identical toxic symptoms in animals, and that the only difference between them consists in the intensity of the

* De Rochmure, Thése de Paris, 1879.

phenomena. In this respect pelletiérine is the most active; next in the order of toxicity comes isopelletiérine, then pseudo-pelletiérine, and lastly, methyl-pelletiérine; and to show the ratio of toxic power of these different alkaloids, I call your attention to this fact, that it takes seventeen centigrams of pelletiérine to cause the death of a hare in from ten to fifteen minutes, while the quantity of isopellétierine, pseudo-pelletiérine and methyl-pelletiérine necessary to bring about the same result in the same time is respectively twenty, forty, and fifty centigrams. One drop of a ten per cent. solution of sulphate of pelletiérine will kill a frog in a relatively brief space of time, while a leech immersed in a $\frac{2}{1000}$ solution of pelletiérine dies at the end of ten minutes.

On examining the subject more attentively, I found that pelletiérine was destined to increase the number of poisons which act like curare, and hence are called *curarizers;* it limits its influence to the extremity of the motor nerves, of which it destroys the neurility, while preserving muscular contractility and general sensibility intact. But let us now return to our special subject, which is the therapeutics of tænia, and see how we are to utilize these alkaloids, under what form, and in what dose.

At the outset of our experiments we combined the four alkaloids in the state of sulphate, and, despite signal successes, we had occasion to note several failures. I then requested Tanret to add a little tannin to the preparation, in order to bring it as near as possible to the state in which the alkaloids are found in pomegranate bark, which contains tannin principles in great quantity, and we decided henceforth to administer thirty centigrams (five grains) of sulphates of pelletiérine and isopelletiérine in a solution containing fifty centigrams (eight grains) of tannin. It is this mixture of sulphates of pelletiérines in a tannin solution that we call, rather improperly, tannate of pelletiérine.

Among these different alkaloids which the analysis of their physiological effects has enabled us to classify in the ratio of their toxic power, which possess anthelmintic properties? This is a question which Beranger-Feraud has answered in a positive manner.* Making comparative experiments with these different pelletiérines, he has observed that while pseudo-pelletiérine and methyl-pelletiérine never cause the expulsion of tape worms, even in large doses, pelletiérine and isopelletiérine, on the contrary, whether alone or given together, always gave satisfactory results.

As you see, by reason of all these researches, the question was being reduced to greater and still greater definiteness; the addition of tannin was already a step in advance. Thanks to the investigations of Beranger-Feraud, we were able to discard, as devoid of tænifuge properties, methyl-pelletiérine and pseudo-pelletiérine; there remained the question as to

* Beranger-Feraud, On the Tænifuge Action of the Four Alkaloids of Pomegranate. (Bull de Ther., t. xcviii., p. 337-387.)

the desirability of giving a purgative in connection with the pomegranate alkaloids. It occurred to me at the commencement of these researches that it would be well to associate a purgative with the pelletiérines. Taking a hint from what Criquy had done for oil of male fern, I combined therefore in the same potion the compound tincture of jalap, sweetened with syrup of senna, and the mixture of sulphates of pelletiérines with tannin. The results obtained did not confirm my previsions, and I returned to the previous method of giving the purgative half an hour after the ingestion of the pelletiérine. I consider the German tincture of jalap as the best preparation to give in such cases, and I do not hesitate to administer an ounce of this tincture, because the presence of the tannin on the one hand, and on the other, the paralyzing effect of the pomegranate alkaloids on the muscular fibre of the intestines, oppose the action of the purgative. I admit, however, that good results are obtained with castor oil, one to two ounces half an hour to an hour after the administration of the alkaloids. Beranger-Feraud prefers infusion of senna.

Whatever may be the purgative which you may employ, give it at the latest half an hour after the administration of the pelletiérine, and these, in brief, are the rules which you should follow in order to be almost sure to obtain the expulsion of the worm. Make your patient take a mild purgative the evening before, and nothing but milk for his supper; the following morning administer to him fasting 30 centigrams (five grains) of the sulphates of pelletiérine and isopelletiérine in solution with fifty centigrams (eight grains) of tannin; ten minutes after give a tumblerful of water, then, at the end of half an hour, a purgative, and lastly, require the patient to sit at stool in a vessel nearly full of warm water. A few minutes after the ingestion of the medicament, the patient experiences slight vertigo, and the tape worm is voided, as a rule, four hours after the administration of the remedy.

In the cases (which are likely to be very few) where you meet with failures, that is to say where the pelletiérines have caused the almost complete expulsion of the worm, but without the head, it will not be best to resort immediately to the administration of another dose, but to wait a certain time, two or three months for instance, and what I say here applies not only to the alkaloids of pomegranate, but to all other tænicide medicines as well.

Since we have established these rules of treatment, and wherever patients have scrupulously complied with them, we have had numerous successes, and in nine cases out of ten we obtain the worm with the head. I think myself warranted in affirming that the pelletiérines thus administered are an excellent remedy for tape worm, if not the very best, at least in the adult, for, till I have had more experience, I should not dare to advise this medicament for children.[13]

Excuse me, gentlemen, if I have so long dwelt on this special action of the pelletiérines, but the most of you have followed this year, in my hospital service, the numerous trials which we have made with these alkaloids on patients affected with tape worm, and our experiments on animals with these same alkaloids, and it seemed important to sum up for you the principal results of those experimental researches.

In finishing what pertains to the treatment of tænia, I ought to have mentioned a new tænifuge much employed by the natives of Fouta Djallon, under the name of *Gogo*, and which Prof. Heckel has recognized as belonging to the family of Amomaceæ, and which he has done me the great honor to name after me, the *Phrynium Beaumetzi*. But the trials which I have made with this plant have not been sufficiently thorough, so that I may pronounce as to the real value of this new tænifuge.[14]

I pass now to the study of the bothriocephalus, a tape worm which is very common in certain countries, and especially in Switzerland, so much so, in fact, that when you see a bothriocephalus you are almost warranted in affirming the Swiss nationality of the patient.[15]

It is not known what is the cause of their frequency. Carl Vogt, in a communication which he made at the International Congress of Geneva, says that he has never observed any parasites in the fishes of the lake, and particularly in the *fera*, commonly reputed to be the transmitter of the bothriocephalus. This worm demands the same treatment as the tænia. I am aware, however, that the preparations of male fern have been proved to be of the greatest utility; nevertheless even at Geneva pomegranate bark has been employed with success, and in France the expulsion of this worm has been obtained with pelletiérine.

Whether you have to do with a tænia or a bothriocephalus, the cure can not be considered as complete till the head of the worm has been obtained. Nevertheless there have sometimes been exceptions to this rule, and for my part, I know a number of individuals who, notwithstanding the most careful searching, have not been able to find the head with the fragments of tænia expelled, and who at the same time have been completely cured. It is easy, moreover, to understand that, considering the extreme tenuity of the filiform extremity of these cestoids, the head may escape the most careful inspection.

However this may be, you ought not to repeat your attempt to expel the tape worm after a failure to find the head, till the patient shall have passed segments in his stools, voluntarily or involuntarily, as generally happens two or three months after first voiding portions of the worm.

Such, gentlemen, are the considerations which I wished to present concerning intestinal worms. I have now completed the diseases of the intestines, and propose to devote the coming course of lectures to the treatment of affections of the liver and kidneys, hoping therein to find still more convincing proofs of the utility of Clinical Therapeutics.

NOTES TO LECTURE XXV.

[1] The trichocephalus hominis is a nematoid worm with an elongated body formed of two parts, the anterior longer than the posterior filiform, the posterior somewhat protuberant. The male is 87 millimetres in length; its posterior part is rolled up, and bears at its extremity a sort of cylindrical sheath from which issues the spicule. The female is 30 to 50 millimetres long; the posterior part protuberant and but little incurved; the tail with blunt point.

The trichocephalus was discovered in 1761. It may exist at any age, but it is more common in the adult, especially in those who succumb to typhoid fever.

It is communicated by drinking water, like the ascarides. The ova, swallowed with the water, undergo development in the intestine, and give rise to the trichocephalus. This worm has for its seat of predilection the cæcum of man.

[2] The ankylostoma duodenale is a nematoid worm, discovered at Milan in 1838 by Dubini. It is well known in Egypt. This worm occupies the duodenum and jejunum of man. It is a cylindrical worm from 6 to 9 millimetres long, of an ashy gray color. The head is rounded at the top; the mouth is elliptical, and furnished with unequal conical papillæ, terminated by hooks, which enable the worm to fasten itself to the walls of the intestine.

[3] The anguillula stercoralis, a little nematoid worm, was discovered in 1876 by Normand of Toulon. It has been found in abundance in the intestinal secretions of patients affected with the diarrhœa of Cochin China. This worm is 1 millimetre long and 0.04 millimetres in breadth. As many as 100,000 have been found voided in the stools of one day in a person suffering from this diarrhœa.

Another worm of a similar kind, though larger, the anguillula intestinalis, has been found by Normand in the discharges of patients affected with the diarrhœa of Cochin China.

Laveran and Libermann of Paris have made a study of this verminous diarrhœa in soldiers returning from Cochin China.

The treatment which has seemed to succeed best is a milk diet long continued.

[4] *Oxyuris Vermicularis.* Synonyms: Ascaris vermicularis, seat worm, pin worm, maw worm, thread worm, ascarides. Is a little white cylindrical or almost fusiform worm.

The female, which is ordinarily seen in the greatest abundance, is a white cylindrical worm, tapering towards both extremities. The head end is thickened, and is provided with three prominent labial papillæ enclosing the mouth. The posterior end extends from the anal aperture in a long and straight, narrowed and conical, sharp-pointed tail. The double uterine tube, distended with eggs, terminates in a vagina, the external aperture of which is situated ventrally near the anterior third of the body. The smaller male hardly tapers behind, but is incurved, and ends in a short, blunt, conical tail.

The lumbricus, (ascaris lumbricoides), is a white or yellowish cylindrical worm, with a body more attenuated before than behind, presenting transverse striæ, and four longitudinal sulci. The male is 15 to 17 centimetres long, the female 20 to 25 centimetres. The tail of the male is arched and furnished with two short, sharp-curved spiculæ; that of the female is straight, without spiculæ; the vulvar orifice is situated in front, in the middle of the body.

The ova are 0.075 millimetres long and 0.058 millimetres in width, and invested with two envelopes; the total number in a single female has been estimated at 60,000,000.

The head of this nematoid worm presents a mouth furnished with three fleshy valves, one superior, and two lateral; these have papillæ provided on their free border with microscopic teeth-like indentations serving for mastication. A muscular and fusiform œsophagus succeeds the mouth; the stomach is thin and membranous; the intestine is slightly sinuous and terminates in a transversal anus, placed at the posterior extremity of the body.

Lumbrics may exist in greater or less number in the same individual; ordinarily there are but two or three, but sometimes hundreds.

It is in children about the age of five or six years that they are oftenest met with. All children may be infested by them, but they are more likely to be found in feeble, scrofulous children, and such as are subjected to a bad hygiene or faulty alimentation. They are exceptionally met with in adults. These worms are common in all countries and climates; no classes and no ages can be said to be exempt from them.

Some authorities have described verminous epidemics, (Bouillet, Brand, Pringle, etc.)

Drinking water seems to be the principal mode of transmission of the lumbricus through the eggs. In fact, being expelled with the fæces, which sometimes contain them in thousands, these ova may be carried by the rain or overflowing cesspools into streams, wells, or other sources of drinking water, and thence find entrance into the human body; the ova, obtaining lodgment in the intestine, undergo development into lumbrici. To obviate this danger, potable water should be first filtered or boiled.

The ascaris lumbricoides lives in the small intestine; it is sometimes found in the stomach and large intestine, but its place of election is the small intestine. In exceptional cases it has been found not only in the stomach, but also in the œsophagus, the nasal fossæ, the ear, the lachrymal passages, the larynx, the trachea, the pancreatic and biliary ducts, the peritoneal cavity, etc., (Leidy in Pepper's System of Medicine.)*

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* Gruveilhier, Dict. de Méd., et de Chirurg. pratiques, Entozoaires. Levacher, Guide Médical des Antilles, Paris, 1834. Daquin, Observations sing. sur des affections vermineuses (Journ. de Méd., Chirurg, Paris, 1770, t. xxxiv.) Bouillet, Hist. de l'Acad. roy. des sciences, 1730. Brand, Sur une dysenterie vermineuse. Act. de Copenhague, 1677-1679. Pringle, Observ. sur les maladies des armées, part I, chap, iii., trad., Paris, 1855. Marie, Journ. de Méd. de Sédillot, t. xxi, Paris, 1806. Bourges, Journ. de Méd. de Sédillot, t. xxxvi, 1809. Davaine, Recherchés sur le dèvelopp. et la propagation du trichocéphale chez l'homme et de l'ascaride lombricoïde (Comptes rendus de l'Acad. des Sciences, t. xlvi, 1858.) L. Aronssohn, Mém. sur l'introduction des vers dans les voies aériennes (Arch. gen. de Méd., 2e série, 1828, t. x). Guersant, dict. de médecine, 1828, t. xxi. Andral, Anat. path. Paris, 1829, t. ii. Blondin, Anat. topograph. Paris, 1826. Tonnelé,

[6]Corsican Moss.

This is a mixture of nearly twenty-five different species of algæ. The specimens seen in commerce vary according to the source from which they are derived. Corsican moss has a very strong and disagreeable marine odor, and a very salty taste.

According to Beuvier's analysis, it contains in 100 parts:

Vegetal gelatine,	60.2
Vegetal stroma,	11.
Calcium sulphate,	11.2
Chloride of sodium,	9.2
Carbonate of lime,	7.5
Iron, magnesia, silica, phos. lime,	1.7

There are also traces of iodine.

Pharmaceutical Forms.

1. Decoction or infusion; half an ounce to 5 or 6 ounces of water. To be drank freely.
2. The powder. Dose 15 to 120 grains (1 to 8 grams) in sweetened water or milk.
3. Jelly, dose one or two ounces. 4. Syrup, 1 to 3 ounces. The decoction is also given in lavements; one to two ounces.

Vermifuge Potion.

Take of:

Corsican moss, simple syrup, of each	1 ounce.
Boiling water,	6 ounces.

Infuse the moss an hour, strain, express and add the syrup. Take the whole at one dose, or in two doses.

Vermifuge Milk. (Bouchardat.)

Take of:

Corsican moss,	1 part.
Boiling milk,	20 parts.
Sugar,	4 "

Infuse and express. To be given freely to children of from one to five years of age.

Anthelmintic Powder. (Bouchardat.)

Take of:

Corsican moss,	20 parts.
European wormseed,	20 "
Calomel,	3 "

Dose—7 to 30 grains.

Réflexions et observ. sur les accidents produits par les vers lombrics (Journ. hebd. Paris, 1829, t. iv). Thomæ Bartholini, Epist. medicin., cent. I, épist. lxii, 1644, Hagæ Comitum, 1740. Broussais, Hist. des phlegmasies chroniques. Paris, 1826, 4e èdit. t. iii. Lieutaud, Historia anatomica-medica sistens, obs. 907. Vasa Biliara lombricis obturata. (Parisiis, 1767, t. i.) Fauconneau-Dufresne, Précis des maladies du foie et du pancréas, Paris, 1826. Laënnec, dict. des sciences Médicales, article Ascarides. Lebert, Traité d'anat. patholog. gén. et spéc. Paris, 1857, t. i. Davaine, Traité des entozoaires, 1860.

[7] EUROPEAN WORMSEED. (*Santonici Semen, Semen Contra.*)

A product of the *artemisia contra*, which grows in the East, and consists, not of the seeds, but of the small globular unexpanded flowers of the plant, mixed with their broken peduncles; it has a strong odor resembling camphor, and aromatic taste.

Wormseed contains a volatile oil and a resinous extractive matter, but owes its peculiar virtues to santonine, a bitter principle discovered by Kohler in 1830.

Santonica may be given in powder or infusion. The dose in substance is 10 to 30 grains, which should be repeated morning and evening for several days, and then followed by a brisk cathartic. It is little used in the United States, having given place to the fruit of *Chenopodium anthelminticum*, which is universally known there by the name of wormseed.

SANTONINE.

The active principle of santonica was discovered by Kohler, a pharmacist of Dusseldorf. It crystallizes in rhombic prisms, is inodorous and nearly tasteless, producing afterwards a slight sense of bitterness. It melts by a moderate heat, at a higher heat volatilizing in dense white irritating vapors. Santonine becomes yellow on exposure to the light, though its chemical composition is unchanged. It is nearly insoluble in cold water, but is quite soluble in boiling alcohol, and to some extent in cold alcohol; the alcoholic solution is very bitter and disagreeable.

As a vermifuge, santonine may be given in the dose of 2 or 3 grains once or twice a day to children, and in twice that quantity to adults. It is conveniently administered in syrup. Santonine is much prescribed in the form of lozenges made with sugar and gum tragacanth, each lozenge containing $\frac{1}{6}$th grain; the dose would be from 5 to 20.

LOZENGES OF SANTONINE. (French codex.)

Take of:

Santonine in fine powder,	40
White sugar,	2000
Cochineal,	1
Mucilage of tragacanth,	180

F. S. A. tablets, each weighing $7\frac{1}{2}$ grains.

The *Santonine pills* each contain 1 grain of santonine rubbed up with honey and extract of liquorice. The French pharmacists also make vermifuge biscuits with a full dose of santonine incorporated into a little dough, and baked in the form of a biscuit.

Guermonprez says that santonine is not always indicated in the treatment of ascarides lumbricoides, and that it is injurious rather than beneficial if the worms are old, and in considerable numbers. He gives beforehand, for several days in succession, three times a day, large doses of some bitter preparation, as wine of cinchona, and then a calomel or castor-oil purge. Kuchenmeister affirms that the lumbricoides may live forty-eight hours in a strong infusion of santonica.

[8] Pumpkin seeds—the seeds of Cucurbita Pepo. This plant has but lately been introduced into the U. S. Ph. The common pumpkin is a plant too well known to need description. The seed consists of a firm brittle coating, and a white oily kernel; it contains a fixed oil, an aromatic

principle, sugar, gum, and an acid soluble in water and alcohol, for which the name citrullic acid has been proposed. The seeds of the pumpkin have been long used in the treatment of tape worm. In the year 1820, Mongeny, a physician of Cuba, published the results of his experiments with the flesh of the pumpkin as an anthelmintic, while Brunet and Lamothe of Bordeaux verified the statements of Mongeny as to the efficacy of the remedy in tænia, employing, however, a paste made from the seeds in the quantity of an ounce and a half with as much sugar. Some physicians do not peel the seeds at all. According to Davaine, the dose of pumpkin seeds recently hulled may be raised to three ounces and even more; in children from an ounce to an ounce and a half suffices. The medicine is administered in one dose, or in teaspoonful doses every hour. An hour or two after the last dose the patient is given one to two ounces of castor oil.

According to Heckel, the active part resides in the anhistous membrane of the perisperm. Half an ounce of this pellicle mixed with sugar is sufficient to cause the expulsion of a tape worm.

[9] Kousso, (*Brayera anthelmintica*). The flowers and tops of an Abyssinian tree, 20 feet high; the properties of these flowers, which have a decided anthelmintic action, were first studied by Brayer, a French physician at Constantinople. Analysis shows the flowering tops to contain: tannin, an acrid and bitter resin (Wittstein, 1840), an active principle koussin (Pevesi, Bedall, 1858), a volatile oil, (Willing), fatty matters, wax, etc. Kousso has a disagreeable and nauseous odor.

The flowers are given in the form of powder mixed with half a pint of warm water, the mixture being allowed to stand 15 minutes, then stirred up and taken in two or three draughts at short intervals. The medium dose of the powder for an adult is half an ounce. It may be necessary to follow this dose by a brisk cathartic. The *Infusum Cusso* is officinal.

[10] Kamala.—The powder and hairs obtained from the capsules of Rottlera tinctoria. Synonym—Mallotus Phillipinensis. The kamala is a tree from 15 to 20 feet in height, growing in Hindostan, in several of the East India islands, in Arabia and Australia. The fruit is a three-valved capsule, about the size of a small cherry; these capsules contain externally numerous little red glands, which when bruised give the powder which is called kamala, which is employed as a dye stuff, as well as a tænicide.

Anderson has obtained from kamala a resinous substance in the form of minute crystalline plates, of a yellowish color, insoluble in water, and little soluble in cold alcohol, but soluble in ether; to this substance he has given the name *rottlerin*. The ingestion of kamala gives rise sometimes to nausea and slight colic, (Mackinson, Anderson, Gordon). The powder may be prescribed suspended in water; dose one to three drachms; in the latter dose it sometimes acts violently. The worm is generally expelled dead at the third or fourth stool. (U. S. Dispensatory). Anderson of the British navy recommends the tincture (six ounces to 16 fluid ounces of alcohol); dose, 1 to 4 fluid drachms, Blondeau (Soc. de Ther. 1875), has given with success six drachms of the tincture, without nausea or colic supervening.

Davaine has found kamala efficacious against the bothriocephalus. He prefers the tincture to the powder, and gives it to little children in drachm doses, to adults in tablespoonful doses, along with peppermint (or some other aromatic) water, and orange syrup.

℞	Tinc. Kamala, ...	20
	Peppermint water, ...	120
	Syrup of orange, ...	20
M		

To be taken in four doses, an hour apart. If the worm is not voided within two hours after the last dose, give an ounce of castor oil.

[11] Filix Mas. Male fern. The officinal part is the rhizoma of the plant, (aspidium).

This plant, which is very common in South Africa, is used as food by the Kaffirs. The leaves are used for making mattresses and cushions, recommended for scrofulous, debilitated and rachitic children. The root or rhizoma is alone medicinal. It is more active when fresh than in the dried state, and contains, according to Morin, volatile oil, fixed oil, (stearine and oleine), tannin, gallic acid, acetic acid, crystallizable sugar, starch, gelatinous matter insoluble in water and alcohol, woody fibres and ashes. Peschier has noticed in the ethereal extract a colorless crystalline substance which Luck has called *filicic acid;* the ethereal extract contains also a fatty oil, which is saponified and furnishes filixoid acid.

According to Peschier, the buds contain volatile oil, brown resin, fatty matters, (solid and liquid), various odorous principles and extractive matters.

Male fern is given in decoction, in water or white wine: 1 to 2 ounces to the quart, to be reduced by boiling to a pint; in powder, 1 to 3 drachms in emulsion; in resinous extract, and in ethereal extract prepared with the shoots or buds exhausted by ether (Peschier of Geneva). The *oleo resin* of male fern (extractum filicis liquidum) of the U. S. Ph., is made by subjecting the powdered rhizoma to the action of ether in a percolater. It is an ethereal extract of the fern root, consisting mainly of oily and resinous matter, and is much used in Europe under the name of *oil of male fern.* The dose is 30 to 40 drops, one half to be taken at night, the other half in the morning, and followed at the interval of an hour by an ounce and a half of castor oil (Mayer of Geneva.)

Trousseau's method of administration was as follows: milk diet the first day; the second day, in the morning fasting, a drachm of oil of male fern in four doses a quarter of an hour apart; the third day, a fluid drachm of the oil in four doses a quarter of an hour apart, then two ounces of syrup of ether, and half an hour afterwards three drops of croton oil in the white linctus [or in castor oil.]

Limousin's capsules contain each 7½ grains of extract of male fern and one grain of calomel. The patient takes 16 of them, two at a time every 10 minutes.

VERMIFUGE BOLUSES. (PESCHIER.)

Take of:

Ethereal extract of male fern, . . .	2 decigrammes.
Powdered root of male fern, . . .	5 "
Conserve of roses, q.s. for a bolus.	

Dose—10 boluses at once. To be taken after a scanty gruel diet for two days. After swallowing the boluses, the patient drinks a cup of male fern tea, and two hours afterwards, he takes an ounce of castor oil.

[12] It is the bark of pomegranate root which almost all authorities have recommended; Merat, Bourgeois, Davaine, Tarneau, Ranson, Cauvet.

Marty has shown, however, that the bark of the stems of the pomegranate possesses anthelmintic properties as certain as those of the bark of the roots, and that these properties also exist intact in the medium-sized branches.

The decoction seems to be the preferable preparation; it is made as follows:

Take of:

Fresh bark of the root, or of the stems of pomegranate, . . 60 grammes (℥ ii).
Hot water, ... 750 " (℥ xxv).

Reduce the bark to small fragments, and pour on the hot water; let macerate twenty-four hours, then evaporate down to 500 grammes (Oj.)

The ethereal extract and the aqueous extract do not give satisfactory results.*

Alkaloids of the Pomegranate.

In a note communicated to the Academy of Sciences, March 31st, 1829, Tanret points out the existence of four alkaloids in the pomegranate.

To obtain these alkaloids, Tanret begins by treating first with water the powder of the bark mixed with milk of lime, then by chloroform.

To separate the different alkaloids, he avails himself of the property which bicarbonate of soda has of decomposing the salts of two of them, while it is without action on those of the two others; he also puts to profit the great hygrometricity of two of their sulphates.

Thus, treatments by bicarbonate of soda and caustic soda give two mixtures, which are transformed into sulphates and allowed to crystallize. The crystals being spread upon blotting paper, the deliquescent sulphates, (owing to the vapor of water in the air) penetrate the paper, whence they are extracted by an after process; the others remain crystallized upon the paper. Having the salts, the alkaloids are easily separated.

In operating in this way, there is obtained with bicarbonate of soda a liquid and dextrogyrus alkaloid, and a crystallized alkaloid without action on polarized light; with caustic soda two liquid alkaloids, the one lævogyrus, the other without rotatory power. These alkaloids are all volatile.

Tanret has designated the two alkaloids not displaced from their salts by bicarbonate of soda under the name of pelletiérine ($C_{16}H_{15}NO_2$) and of isopelletiérine, and he has described those which are displaced by bicarbonate of soda under the name of pseudo-pelletiérine, $C_{18}H_{15}NO_2$ and methyl-pelletiérine, ($C_{18}H_{17}NO_2$).†

The experiments which Dujardin-Beaumetz and De Rochmure have made with pelletiérine have been made on frogs, hares and leeches.

The leech, in solutions of 2.1000, rapidly loses the property of contracting its suckers; in two minutes it loses its power of attaching itself to objects, and in fifteen minutes all its movements are annihilated, nor can it be recalled to life. When the experiment is tried with isopelletiérine, it takes five minutes after the immersion to deprive the buccal sucker of all its properties, and twenty minutes to annihilate all movements; the leech can be revived.

* Leopold Deslands, Arch. de Méd., 1833. Bourgeois, Gaz. des Hôp, 1854. Laboulbène, Bull. de Thér., 1878. J. Marty, On the Relative Value of the Different Preparations of Pomegranate Bark in the Treatment of Tænia. Bull. de Thér., t. xliv., 1878.

† Tanret, On the Alkaloids of Pomegranates, 1880.

With methyl-pelletiérine it is at the end of nine minutes that the leech loses the power of attachment; it can be restored to life.

With pseudo-pelletierine, a leech placed in a solution of some strength does not lose its power of movement till after twenty minutes of immersion, and may be recalled to life.

In frogs, half a drop of a ten per cent. solution of pelletiérine does not destroy life, and the animal presents only a general paralysis lasting about three hours. In these cases the hyoidian respiration is not completely suspended, and the heart contracts as ordinarily, although slightly enfeebled.

With more than half a drop, *i.e.*, with one drop, two drops, three drops, the frog is killed, and the phenomena of poisoning are the more violent, and death is the more rapid, the larger the dose injected.

The toxic symptoms consist first in a nervous excitation, manifesting itself by convulsions and contractions, then in an exhaustion of the motor powers, showing itself under the form of complete and definitive muscular resolution. The limbs—especially those nearest the seat of the injection—are first affected, then the abdominal muscles, those of the hyoid apparatus, and lastly, the heart, which is arrested in diastole. The reflex movements survive the voluntary movements, but are soon extinguished. Death supervenes in a space of time which varies according to the dose injected, between one and six hours; it is still more tardy when the poison is administered by mouth. In the hare, pelletiérine in the dose of 15 to 20 centigrams (2 to 3 grains) kills in a few minutes. The toxic phenomena, when the dose is but minimum, consist in a simple muscular paresis; in the dose of 2 or 3 grains, in a progressive paralysis affecting first the inferior members, then the anterior part of the body, ears, neck, thorax, and lastly, the heart. The voluntary movements disappear before the reflex movements. Respiration is at first less ample and is precipitated; then the movements become slower and more painful; finally, they are completely suspended. The heart still beats, but in a tumultuous and disordered manner; then it becomes feeble and is arrested. Death is preceded by a few convulsions. A slight elevation of temperature is noticed at the close.

In man when the dose is reached of 40 centigrammes ($6\frac{2}{3}$ grains) of pelletiérine, there is observed vertigo, ocular troubles, and muscular paralysis; the vertigo and ocular disturbances are manifestly connected with a marked congestion of the vessels of the fundus oculi, a congestion which extends to the entire encephalon.

Attentive examination of the toxic phenomena, and very numerous experiments on frogs, show that pelletiérine acts like curare, and that all the physiological experiments that have been made with the latter may be reproduced with the salts of pelletiérine.*

[13] In 33 cases of tænia treated by tannate of pelletiérine, as reported by Bochmure, there were 30 completely successful, one a probable success, and two failures.

The expulsion of the tænia took place on an average four hours after taking the pelletiérine.

Beranger-Feraud has given an interesting table respecting the action of the different tænifuges administered at the hospital St. Mandrier at Toulon. This table is as follows:

* Dujardin-Beaumetz, On the Physiological and Therapeutic Action of the Salts of Pelletiérine. Bull. de Thér., t. cxviii., 1880, p. 433.

BERANGER-FERAUD'S TABLE.

	SUCCESSES.	FAILURES.	TOTAL.
Calomel, ...		2	2
Garlic, ...		4	4
Powder of male fern, ...		5	5
Oil of male fern, ...		2	2
Eucalyptus, ...		8	8
Pumpkin seed, ...	4	77	77
Extract of kousso, ...		3	3
Kousso in powder, ...	14	159	173
Pomegranate leaves, ...	1	4	4
Pomegranate twigs, ...		7	7
Dried root of pomegranate, . .	23	154	177
Bark steeped in 8 ounces water, .	1	16	17
Powdered bark of pomegranate, . .		6	6
Sulphate pelletiérine and isopelletiérine, ...	7	13	20
Tannate of pelletiérine, . . .	61	17	78

As is seen by this table the advantage indisputably belongs to tannate of pelletiérine.*

[14] According to a manuscript note sent me by Prof. Heckel, the natives of Fonta Djallon make use of the rhizoma of gogo in this way: they boil two ounces of the coarse powder of the root in half a pint of water, reducing it about one half, and they swallow the decoction, dregs and all. Several hours after, they take a dose of castor oil.

This substance is said to be a certain tænifuge when the fresh plant is used, but it is much less active when in the dried state.

[15] Bothriocephalus latus, or the broad tape worm. This worm, ribbon-like, and jointed, composed of a very great number of ring-like segments, is six to twenty yards long. It differs from the tænia solium by its head, which has no hooks or proboscis, and has no oval or oblong suckers; its head is oblong, with two lateral elongated suckers; its segments are wider than they are long. The genital orifices are situated in the median line; the penis is short, smooth, prominent, and situated above the vulva.

It is so common in Geneva that Odier, a physician of this city, has said that "the tænia lata is so prevalent with us that at least a fourth of the inhabitants have it, have had it, or will have it." It has been observed also on the borders of the Baltic in Switzerland, in St. Petersburg, in Finland, and in Holland. This cestoid worm, of a grayish black color, has its seat in the human subject in the small intestine. It may develop, though very rarely, in the same individual, in conjunction with the tænia solium.

We know but little about the evolution of the bothriocephalus. Reasoning from analogy, it is supposed that the free embryo of this worm sojourns in the water and finds a lodgment in fishes, and especially in those of the genus salmon. Bertolus has maintained that the *ligula nodosa*, which is found in species of the genus salmon, represents the intermediate phase between the embryo and the proglottis.

* Beranger-Feraud, The Tænia at the Hospital St. Mandrier. Bull. de Thèr., t. xcix., p. 49.

Knoch and Leuckart have, however, claimed that the parasite may develop in its entirety in the same individual. In administering to dogs embryos of the bothriocephalus, Knoch affirms that he has found adult worms in the digestive tube of these animals, but Davaine thinks these statements need to be confirmed by other experiments before they should be accepted.

[Recently Braun of St. Petersburg, after determining the presence of scolices of bothriocephalus in the muscles, liver and organs of generation of the pike, trout, and eel pout, by feeding these to cats and dogs, succeeded in rearing worms which differed in no respect, except in being smaller, from the bothriocephalus of man. Such being the case, it becomes evident that a man may ordinarily become infested with the parasite by eating raw or insufficiently cooked fishes of the kind mentioned.*]

* Davaine, Des Cestoids, Dict. Encyclopæd. Méd. Pepper's Syst. Am. Méd., Vol. II., p. 939.

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