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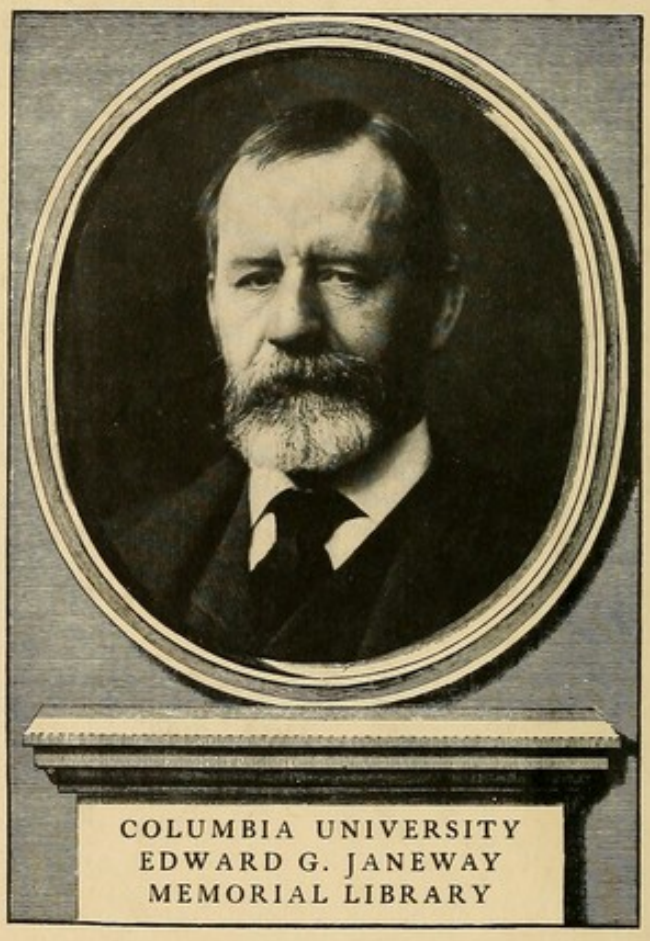
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Prof. E. B. Jourray

With the Compliments of the Translator

March 13. 93

THE DISEASES OF THE STOMACH

BY

DR. C. A. EWALD

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DIRECTOR OF THE AUGUSTA HOSPITAL, ETC.

AUTHORIZED TRANSLATION FROM THE SECOND GERMAN EDITION
WITH SPECIAL ADDITIONS BY THE AUTHOR

BY MORRIS MANGES, A. M., M. D.

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NEW YORK CITY, ETC.

WITH THIRTY ILLUSTRATIONS

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1892

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AUTHOR'S PREFACE TO THE AMERICAN TRANSLATION.

I FEEL highly honored that the *Klinik der Verdauungskrankheiten* should have been thought worthy of being independently rendered into English on both sides of the Atlantic; for, in addition to the present translation by Dr. Manges, another is being issued by the New Sydenham Society of London.

I am greatly indebted to Dr. Manges for the excellent manner in which he has performed his task. At the same time I wish to state that I have carefully read his manuscript, and have made many additions to it. In this way I believe I have included the very latest investigations on this subject. Hence the volume is not merely a rendering of the second German edition, but it practically represents the third German edition, which will soon appear.

. . . . . .

I trust that the work will meet with a friendly reception among my American colleagues, and that it will lead to further investigations in this interesting and difficult field.

C. A. EWALD.

BERLIN, *March 5, 1892.*

TRANSLATOR'S PREFACE.

The present work represents Volume II of Professor Ewald's *Klinik der Verdauungskrankheiten*, a treatise which has been received with so much favor abroad that two editions were called for within nine months, and translations made into the Russian, Italian, and Spanish languages.

I have not included Volume I, since it has already been rendered into English by Dr. Saundby. A second edition of this part, which treats of the physiology of digestion, has just been issued in connection with the English translation of the present volume by the New Sydenham Society of London.

The two parts are entirely independent of each other. The important references to it have been condensed and included in the translator's foot-notes.

The numerous additions by Professor Ewald have not been specially indicated, as this would have interfered with the unity of the work, and would, moreover, have caused unnecessary confusion.

The new matter which I have incorporated into the text and foot-notes is inclosed in [ ].

All of the illustrations have been redrawn, while some have also been modified. Figures 2, 5, and 11 to 15 inclusive have been added by me.

I am indebted to Dr. L. M. Michaelis for assistance in the preparation of a portion of the work.

M. Manges.

941 Madison Avenue,
New York, *April 1, 1892.*

PREFACE TO THE FIRST GERMAN EDITION.

The following lectures, which are intended for the use of general practitioners, are based upon the stenographic reports of my remarks at the *Feriencurse für praktische Aerzte.* This volume is the second part of the *Klinik der Verdauungskrankheiten*, the first part of which discussed the physiology of digestion in its practical relations. It will therefore be justifiable to simply mention briefly and give the final results of many subjects which have been freely discussed during the past few years; for the general practitioner desires to know, not the source of discoveries, but their final, acknowledged results, which will be useful to him at the bedside.

It may, perhaps, seem hazardous to publish these lectures now, at a time when this branch is being so thoroughly and enthusiastically investigated with new methods, that almost every day additional results are being published, which are to bring us nearer to a complete understanding of the difficult and complicated problems of the pathology of the stomach. But it is just through this active rivalry that our knowledge of the subject has been so enriched on the one hand, and on the other so cleared up, that the time seems to have come to collect these facts and to draw general conclusions from them, without having to fear lest the morrow will disprove what we have taught to-day.

With this in view I have examined what has been accomplished in the past few years, and have endeavored to separate what is of permanent value from that which is merely of secondary importance. Since many points are still undecided, the future alone can tell how far I may have succeeded in this effort, and also how many of the factors upon which we now depend will remain undisputed. At all events, wherever it was possible, I have endeavored to pass

judgment dispassionately by means of the results of my personal examination, experience, and opinion. But nothing is better adapted to prevent overvaluation of our modern acquisitions than a study of the older writers, especially those of the first half of the present century, in the literature of which an abundance of splendid practical observations has been stored up. I must not neglect, however, to acknowledge to what great extent we are especially indebted to Kussmaul and Leube, who so successfully inaugurated the new era in the investigations on the diseases of the stomach.

In these lectures no attention has been paid to the digestive disorders of children, in so far as they occur independently and peculiarly in them; neither has gastromalacia been considered as a separate lesion—the former, because there is no lack of splendid and complete works on the diseases of children; the latter, because softening of the stomach is more interesting from a pathological standpoint than it is in its anatomical aspects; while, moreover, its claims to be included among the diseases of the stomach seem more than doubtful.

I am indebted to my brother, Prof. Richard Ewald, of Strasburg, for the comprehensive review of the innervation of the stomach.

The illustrations, except where otherwise stated, have been drawn by myself from original specimens.

May this, the second and pathological portion of the *Klinik der Verdauungskrankheiten*, enjoy the same friendly and favorable reception which was accorded to the first part! This would be an inducement to me to publish at an early date the third part, which shall treat of the diseases of the intestines.

C. A. Ewald.

Berlin, *Whitsuntide, 1888.*

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DISEASES OF THE STOMACH.

LECTURE I.

METHODS OF EXAMINATION.—DETERMINATION OF THE ACIDITY AND ACIDS OF THE CONTENTS OF THE STOMACH.

GENTLEMEN: In undertaking to discuss the diseases of the digestive tract in the following lectures, I must, at the beginning, impose definite limits upon myself, and must refrain from attempting to exhaust the entire subject. If I attempted to speak of everything which lay within the extensive province of the diseases of the digestive tract and its adnexa, I would go far beyond the limits of these lectures, and individual facts would be slighted at the cost of the whole. The diseases of the mouth, œsophagus, and of those organs which, like the spleen and liver (although closely connected with the intestinal tract through the portal vein), display no true or exclusive digestive activity, will be treated only in so far as they directly influence the functions of the stomach and intestines, and the normal or abnormal action of which is not to be distinguished therefrom. I shall, therefore, mainly confine myself to the diseases of the stomach and intestines, and shall thus follow the universal custom, which, although improperly, generally includes only the affections of these two organs, under the expression, *Diseases of Digestion.*

But you must not expect these lectures to be a systematic, consecutive, and finished text-book. Our literature contains not a few splendid works of this character which treat this theme in an excellent and exhaustive way. In the following pages I wish to emphasize this difference between a text-book and a series of lectures, both in the form and in the subject-matter. The text-book must systematize the pathological processes, must classify them nosologically,

and from the sum of individual observations and facts must construct the so-called "typical case" of the various forms of disease. I shall take a more modest, I might almost say a more intimate, point of view. I too shall make use of my material to delineate general pictures of disease, but as far as possible I wish to restrict myself to distinct, personally observed, and characteristic cases; to lay stress on the special features of individual cases which impress a distinct character upon them; to show their relation to the generally accepted facts; and at the same time I desire to express my personal views on the subjects at issue.

I should incur the reproach of dealing in commonplaces were I to emphasize how much of this is due to the acquisitions of my own experience, including the results of both personal observation and reading and study. Accordingly, if I should fail to quote everything and anything that the industry of recent years has yielded, you will ascribe such omissions to my desire to avoid all superfluous literary ballast which is nowadays so easily paraded. That anything of importance has escaped my notice is hardly possible.

But you, gentlemen, who, in renewing your attendance at lectures and hospitals, bring with you a riper experience and an acuter judgment than the students in their first "semestres," what can be more to your purpose than to obtain and make use of the personal experiences of your lecturer as much as possible, and to profit thereby in proportion as you are able to criticise them by means of the knowledge already acquired in practice?* I trust I may succeed in presenting to you in a suggestive way both what is already well known as well as what is novel.

The diagnosis of the diseases of the stomach is based, as in other organs, subjectively upon the statements of the patient, and objectively upon the results of our examination. I shall disregard the former, as this will be discussed in the description of each disease. For the latter we may utilize, first, the so-called *methods of physical*

* [This course of lectures was delivered at the *Feriencurse für practische Aerzte* at Berlin. This is a series of post-graduate lectures given in April and September of each year by the extraordinary professors and privat-docenten of the University of Berlin. They last one month, and precede the opening of the regular term.—Tr.]

examination—i. e., inspection, palpation, auscultation, and mensuration; secondly, *the analysis of the chemical, absorptive, and motor functions* of the organ—in short, the investigation of the digestive activity of the stomach.

The physical methods are so well known that they may be summarily dismissed, and we may at once pass to the consideration of the examination of *the functions of the stomach.* Although it is part of my task to discuss the pathology of the stomach, it is nevertheless obvious that pathological deviations from the normal can only be recognized and properly treated after the normal conditions are thoroughly understood; hence I must also briefly consider this topic. Formerly this was hardly possible, so long as we were restricted to the inadequate external signs and the subjective complaints of the patients; but now a very important factor in the methods of examination has been supplied since we have learned to obtain the contents of the stomach at any time in an easy and rapid way, which is also convenient and safe to the patient.

This is accomplished by means of the hard or soft stomach-tubes, and with the general use of these instruments the new era in the pathology of the diseases of the stomach began.

Before entering into the discussion of our theme, permit me to make a few brief introductory remarks. The methods which have recently enabled us to obtain a better knowledge of the chemical processes in the stomach have thrown a light upon the pathology of dyspepsia and the irregularities of gastric digestion which is analogous, comparing a small matter with a great one, to what the ophthalmoscope did in its day for the retina, and the laryngoscope for the interior of the larynx. It was inevitable that this method should soon be favorably received, and that it should have been very extensively used during the past few years in hospital and general practice. I wish, however, to warn you not to lay too much stress upon these procedures as belonging to a specialty. During the course of these lectures you will be enabled to convince yourselves that the technique of the methods which are in use is by no means difficult to carry out, and is within the scope of every physician who as a student has learned to titrate, to test acid and alkaline solutions, and to place a test-tube in a warm

chamber. Naturally, fewer persons are engaged in original investigations. Hence the examinations do not require the skill characteristic of a specialty, which can only be acquired after continuous occupation with that specialty. But, to obtain and analyze stomach-contents do not lie beyond the scope of the dexterity and ability which every physician ought to possess. It may happen that one is consulted especially by patients with stomach troubles because he has occupied himself chiefly with the study of these conditions, and has hence acquired the reputation of possessing a special experience. But this alone is not sufficient. Physicians and the public are here influenced not by the special but by general medical knowledge; this is certainly not acquired if a physician immediately after graduation sets himself up as a specialist for stomach diseases. In the course of these lectures you will see how closely the diseases of the stomach are related to those of other organs, how complicated this relation is, how often the symptoms are deceptive, how frequently in an apparent stomach disorder entirely different organs are really involved! Hence it is my firm conviction that it is impossible to find truly profitable and satisfactory special occupation in the treatment of the diseases of the stomach alone, because the field is too small and the technique is so easily learned and is so limited in its scope. I wished to premise these remarks because such questions are frequently put to me.

It is worthy of note that the use of the **stomach-tube** is by no means, as is supposed, a recent acquisition.* We may disregard the crude manipulations of Fabricius ab Aquapendente and Rumsaeus (1659), who discovered a "stomach-brush" to remove the mucus from the stomach, "so that at that time there was no beer-company at which some did not apply it themselves after drinking heavily, either the same night or on the following morning after having snored out their intoxication through the open mouth, if they were distressed with the thick phlegm in the throat." † In the latter half of the previous century John Hunter introduced cathe-

* Leube. Die Magensonde. Die Geschichte ihrer Entstehung und ihrer Bedeutung in diagnostischer und therapeutischer Hinsicht. Erlangen, 1879.

† J. Chr. Kundman. Seltenheiten der Natur und Kunst, etc., 1737. Quoted by Leube.

ters into the stomach, but only to inject irritating substances into it. The English surgeon, F. Bush, was the first to attach a pump to the stomach-tube to evacuate the stomach in a case of opium-poisoning; this discovery is attributed by others to Weiss, an instrument-maker. The stomach-siphon was first proposed by Arnott* in 1829, and then by Sommerville, but passed into oblivion. Kussmaul† again directed the attention of the profession to the stomach-tube in his publications in 1867 and 1869, on the treatment of dilatation of the stomach. Meanwhile it had been occasionally recommended, as in France by Blatin, in 1832, and by Canstatt,‡ and was also used here and there. It was always a standing, though only privately uttered, claim of Prof. Frerich's clinic that the pump had regularly been used long before Kussmaul's publications. But, as is well known, in disputes as to priority in scientific matters, the time at which the subject in question is made public is decisive, and hence Kussmaul deserves the credit of having again called the attention of the whole medical profession in an impressive way to the use and benefits of the stomach-tube. At the *Naturforscherversammlung* at Rostock, in 1871, Leube asserted the possibility of using it for diagnostic purposes, and, as later developments proved, opened up an excellent means of examination. Yet in his early investigations Leube as well as his predecessors exclusively used a stiff tube or a rubber tube with an elastic but more or less rigid whalebone stylet. This procedure has many inconveniences and disadvantages. Instead of this, I was the first to show that a very soft tube without any stylet, provided it had a thick wall and a sufficient firmness, could be easily introduced into the stomach in the great majority of cases requiring examination.# As occurs so frequently, this was the result of chance. In 1875 a man who had poisoned himself with prussic acid was brought to the Frerich clinic. The stomach had to

* Quoted by Alderson, On the Dangers attending the Use of the Stomach-pump. Lancet, January 4, 1879.

† Kussmaul, in Bericht über die 41. Versammlung deutscher Naturforscher und Aerzte zu Frankfurt a. Main, 1867; and Ueber die Behandlung der Magenerweiterung durch eine neue Methode mittelst der Magenpumpe. Deutsch. Archiv für klin. Medicin, Bd. vi, S. 455.

‡ Canstatt, in his Jahresbericht for 1841.

Ewald. A Ready Method of washing out the Stomach. Irish Gazette, August 15, 1874, and Berlin. klin. Wochenschr., 1875, No. 1.

be washed out at once. None of the stiff tubes which were then in use was at hand, so I cut off a piece of gas-tubing, rounded off the sharp end, cut out two eyelets, oiled the tube, and, although the man was unconscious, I easily succeeded in reaching the stomach. A similar procedure was published later by Oser.* It has been successfully tried on many patients, so that now it is quite universal only to use soft, specially prepared tubes made of smooth, vulcanized rubber. They have been used in France since 1880, and are known as *tubes Faucher*.†

The expressions œsophageal sound, œsophageal tube, stomach-sound, siphon-sound, stomach-pump, stomach-tube, etc., are indiscriminately used by writers, and not in their true meaning. Sounds, strictly speaking, are solid instruments whose density permits the transfer of the sense of touch into deep and inaccessible places. Hollow instruments can only be indirectly used for sounding, if their walls are thick enough, as, for example, the use of a catheter for exploring the bladder. The same is true also of the so-called stiff œsophageal and stomach tubes, which may be used to explore the œsophagus and stomach if they are rigid enough and are rounded off at the end. But this use is merely secondary, as their true function is indicated by their name "tubes"—i. e., to allow the passage of fluids. It is an abuse of language to speak, as Leube does, of a siphon-sound (*Hebersonde*) instead of a stomach-tube or simply a stomach-siphon. In the following pages I shall speak of all solid instruments as sounds, and of the hollow tubes with more or less rigid walls as stiff œsophageal or stomach tubes (*Schlundrohr* or *Magenrohr*), and of the flexible tubes (made of silk or rubber) simply as stomach-tubes (*Magenschlauch*).

If the tube is introduced to obtain the contents of the stomach, it is naturally of primary importance that these can easily enter and leave the tube; this is accomplished by having as many and as

* L. Oser. Die mechanische Behandlung der Magen- und Darmkrankheiten. Wiener med. Klinik, 1875; and Die Magenausspülung mittelst des elastischen Schlauches. Wiener med. Presse, 1887, No. 1.

† [Faucher's tubes are about 60 inches long; the external diameter is $\frac{2}{3}$ to $\frac{3}{3}$ inch; the walls are of such thickness that the tube can be bent without effacing its lumen. At one extremity is a lateral eye with two orifices; to the other extremity a funnel holding about a pint is attached. Welch.—Tr.]

large openings as possible in the lower portion. The ordinary stiff tubes and most of the soft ones in general use till now have one or two openings, eyelets or fenestræ, as they are called, near the lower end; this is usually a blind end formed by a closed tip made of a harder material. Unless the tube is very carefully cleansed, all kinds of organic substances may accumulate here and decompose. To avoid these objections I have the tubes made of different thicknesses, with the lower end open, and, following Schütz's suggestion, have one large fenestra very low down and a number of smaller openings about the size of a large pin's head (Fig. 1). In this way the contents of the stomach may easily enter the tube from all sides, and can be very readily obtained.

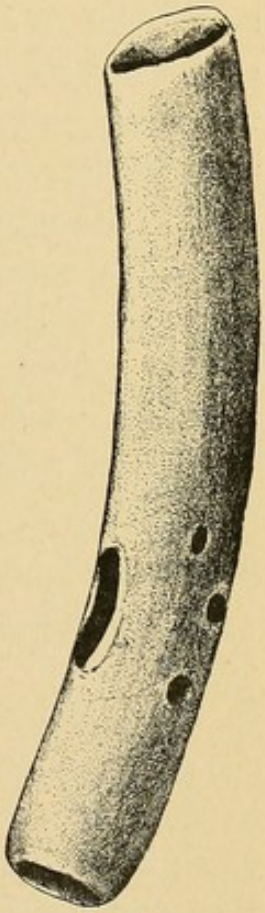


Fig. 1.

Recently tubes made of braided silk varnished over have been introduced; they are somewhat firmer than the soft rubber tubes, but are much less rigid than the stiff ones. At my suggestion they have been made after the same model as that above.

It is self-evident that the softer the instrument which is introduced into the stomach and the more rounded its edges are, the less will be the danger of injuring the mucous membrane; this occurs more easily and has actually taken place with stiff instruments. Another advantage of the flexible tubes is that, in introducing them, as I shall presently show you, it is absolutely unnecessary to introduce the finger into the patient's mouth, thereby sparing him the always unpleasant gagging, and obviating the danger of the physician having his finger bitten.

Under certain conditions it may be impossible to pass a soft instrument through the œsophagus, even though it be free from obstruction; then there is also the active resistance of the insane, etc.; finally, we may encounter mechanical obstructions, such as unusual narrowing of the entrance of the œsophagus, due to bony protuberances or to a posterior displacement of the hyoid bone or

nervous spasm of the œsophagus. In such cases it is necessary to use a more rigid tube, and, according to the resistance to be overcome, we may try either one of the above-described silk tubes, or a so-called red English tube made of catgut varnished over. I no longer use the black French bougies, which were formerly so popular, as they wear out too easily.

The majority of the above instruments are 75 ctm. [29½ inches] long, so that, having been introduced into the stomach, only a small piece is left projecting between the teeth, as we may usually reckon the distance from the incisor teeth to the fundus ventriculi as being 60 to 65 ctm. [23½ to 25½ inches]. For further manipulations, this small projecting piece may be lengthened before or after its introduction by attaching a small piece of glass tubing with a suitable length of rubber tube of the same size; or, if the upper end of the stomach-tube is funnel-shaped, we may insert a hard rubber stop-cock, one side of which has a conical end with a screw thread, while the other side is a smooth tube over which soft rubber tubing may be slipped. For cases of dilatation of the stomach I have had extra long tubes made with a length of 95 ctm. [37½ inches].*

All stiff instruments which are introduced into the œsophagus or stomach, as the sponge-probang, bougies, etc., ought to be held in the right hand like a pen; the left index-finger is passed into the patient's mouth and depresses the tongue, the tip of the finger passing to the epiglottis if possible; the tube is then passed *rapidly* along the left index-finger *to the posterior pharyngeal wall*, and then, and not before, by raising the right wrist the point of the instrument is depressed into the œsophagus. The more quickly and boldly you manipulate, the more easily will the tube pass, and the less will the patient be annoyed. The danger of entering the respiratory passage is greatly exaggerated, and the detailed accounts given about it in most text-books are quite superfluous. Under normal conditions the entrance to the larynx is at once reflexly closed by the epiglottis. But even in paralysis or anæsthesia of the larynx, and other conditions interfering with the functions of the

* These tubes can be obtained at Miersch, Berlin W., Friedrichstrasse 66.

epiglottis, only the greatest clumsiness will cause the tube to enter the larynx instead of the œsophagus. But even if it should occur —just as some "doctors" have extracted half of the intestines through a rupture of the uterus—the marked dyspnœa and cyanosis of the patient and the entrance and exit of air through the tube would at once show that a "mistake" had been made. At the first introduction of any œsophageal instrument patients often become markedly cyanotic, because they believe they can not breathe, and therefore hold their breath spasmodically. Such occurrences must not be confounded with the above. Holding the breath may easily be differentiated from a true dyspnœa by getting the patients to breathe rhythmically while we count for them.

In introducing flexible tubes, it is superfluous, as Oser showed, to apply oil, vaseline, or glycerin to the outside of the instrument. It need only be dipped in warm water, as the abundant secretion of saliva by the patient will lubricate it sufficiently. Let the patient open his mouth, push the tube on to the posterior wall of the pharynx (the tube is sufficiently rigid to permit this), and then ask the patient to swallow; the tube is grasped by the muscles of deglutition and passes without any difficulty into the upper end of the œsophagus, its passage through the introitus œsophagi being distinctly felt; then, by gently pushing the tube, it speedily reaches the stomach. At times a slight resistance is felt at the cardia, frequently not. By this method we avoid the manipulations in the patient's mouth which are unpleasant both to the latter and to the physician. The procedure is much simplified and the unpleasantness and excitement are so much lessened that, among the many patients examined by me during the past few years, I have found very few cases in which I could not introduce the tube. With a little patience on the one hand, and determination on the other, we may succeed even in nervous and anxious subjects. The patients' conduct during this procedure has afforded me an excellent test of the strength of their nerves, and, as the ancients expressed it, of their sanguine and lymphatic temperaments. In very sensitive persons, the local sensation may be entirely abolished by painting the posterior pharyngeal wall with a 10 to 20 per cent cocaine solution a few minutes before introducing the tube, yet I

have hardly ever found this necessary. But, even without its use, I may safely assert that this procedure is much less distressing to the patient than a laryngoscopic examination without cocaine, as the latter at first sets up a much greater irritation.

Having introduced the tube, our next task is to obtain the contents of the stomach. Here, also, the past few years have witnessed a great simplification. Originally, the stomach-pump was used; this instrument consists of a pump with two tubes—one below, the other at the side; the fluid is drawn up through the former, and then by turning the piston, or by some similar arrangement of the valves, it is evacuated through the latter. Other even more complicated apparatus has been devised which, as the proverb reads, make five quarters out of a mile! Among these may be mentioned Jaworski's stomach-aspirator, a contrivance as incomprehensible as it is needless, which accomplishes no more than any pump will do, and is based upon the same principle, but which requires such an array of bottles and glass tubes as from the very beginning to preclude its practical use. On the other hand, a good and simple method consists in passing the stomach-tube as usual, and then attaching a piece of rubber tubing, at whose other end a large pyriform rubber bag [like Politzer's bag] is inserted. The bag is inserted after it has been squeezed together; in expanding it aspirates the stomach-contents so long as subjected to the ordinary atmospheric pressure. The bag may also be used for the reverse; namely, by filling it with air or water, attaching it to the tube, and then by squeezing it gently we may succeed in dislodging any pieces of food which may obstruct the lumen of the tube, as is recognized by the cessation of the resistance caused by the plug. Boas* has recently suggested the use of a rubber bulb with a short rubber tube on either side; one of these is attached to the stomach-tube by means of a small piece of glass tubing; on the other is a pinch-cock (Fig. 2). A vacuum is obtained by compressing the bulb while the cock is open; when the latter is closed the contents of the stomach will be sucked up into the bulb. The cock is now opened while the tube on the other side of the bulb

* I. Boas. Allgemeine Diagnostik und Therapie der Magenkrankheiten. Leipzig, 1890. S. 106.

is compressed; by squeezing the bulb, whatever has been aspirated may be expelled into a vessel held under the free end of the tube with the cock.

[Einhorn* has devised his *stomach-bucket* for obtaining small quantities of stomach-contents. This consists of a small, hollow,

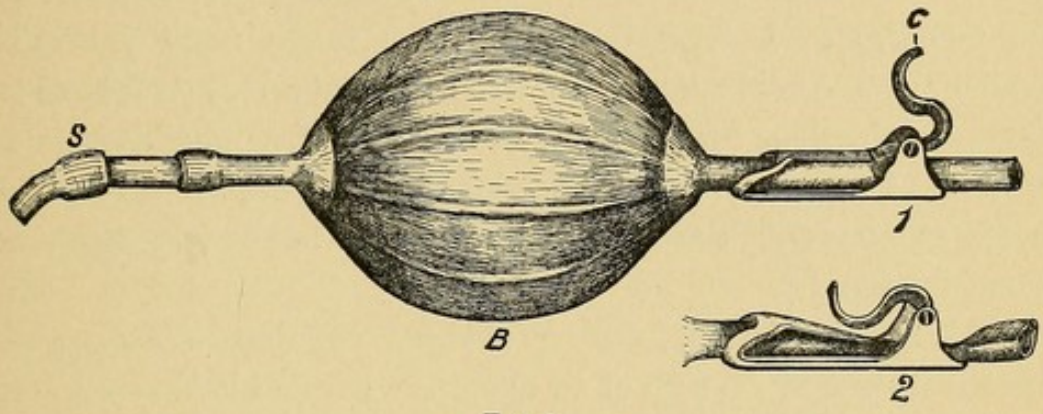


Fig. 2.

silver capsule, with an opening at its upper end. A long silk thread is attached to a thin bar, which is stretched across this opening; the thread carries a knot at 40 ctm. (16 inches) to indicate when the bucket is in the stomach. The patient is directed to open his mouth widely, the bucket is placed on the root of the tongue, and with a single swallow it passes into the stomach. It is removed by traction on the thread. Not infrequently the opening is plugged by mucus; this may be prevented by placing a thin disk of gelatin over it. Sometimes only mucus is brought up; the bucket must then be passed again. This method is not applicable where large quantities of stomach-contents are required.]

But usually all these manipulations are unnecessary. Some time ago Dr. Boas and myself showed that the stomach-contents could be obtained at any time by means of the abdominal pressure, since the straining of the patient suffices to drive the contents of the stomach into the tube, provided they are sufficiently fluid, so that the lumen of the tube is not occluded.† Since then the method has been tried

* [Einhorn, New York Medical Record, vol. xxxviii, p. 63. Its use is condemned by Boas, *loc. cit.*, 2d ed., p. 112.—Tr.]

† Ewald und Boas. Beiträge zur Physiologie und Pathologie der Verdauung. Virchow's Archiv, Bd. ci, S. 325–375; ib., Bd. civ, S. 271–305.

by many others "with excellent results," and has been designated the *Ewald Expression Method* (*die Ewald'sche Expressionsmethode*). It is true that some one may now and then have observed that the stomach-contents were forced from the tube during acts of coughing, etc.; yet Boas and myself may claim the credit of having systematized the method, and, by its means, of having greatly simplified the technique. I think that this claim is the more justifiable, since by the combination of the flexible tube and "expression" these examinations for the first time fulfilled the requirements demanded of every good method, namely, to operate *cito*, *tuto*, and, as far as possible, *jucunde*. This is surely not unimportant, but even fundamental.

This method should, however, always be avoided in cases where there is danger of rupture of an aneurism, brittle blood-vessels, etc., on account of the somewhat violent contraction of the muscles of the abdomen which it entails. But such cases, like the one which I communicated to the Berlin Medical Society (reported in the *Berl. klin. Wochenschrift*, July 28, 1890), are the exception, and may be avoided by the use of the proper precautions, or must be looked upon as the unfortunate and inevitable complications which may arise in the routine application of any method in medical practice. It is a safe rule to avoid this method in any case in which force must be used for expression, and to have recourse to aspiration as soon as the outflow ceases to be smooth and easy.

Recently C. Albutt* wrote as follows concerning washing out of the stomach: "This troublesome and disgusting performance offends the more refined class of patients, and in dealing with them the physician is too soon persuaded to lay it aside, or altogether to forbear the use of the stomach-pump." If he will try the method just described, his results will be more encouraging. I could easily mention the names of very distinguished people who willingly allowed the introduction of the tube and the washing out of the stomach; and I consider the diagnostic importance of the "expression method" to be so great and the safety to be so absolute, a very

* C. Albutt. On Simple Dilatation of the Stomach, or Gastroectasis. Lancet, November 5, 1887.

few cases excepted, that I would reproach myself had I neglected to resort to it in any doubtful case.

Epstein * has even applied the treatment with the stomach-tube very successfully in very small children, even in infants; the tube was, of course, of a corresponding size—i. e., a Nélaton catheter, Nos. 8, 9, and 10 (French). Leo † has used this method for the systematic study of the functions of the stomach in suckling infants.

It sometimes happens that, although the stomach is full, none of its contents can be obtained by any of these methods. This may be due to an occlusion of the fenestræ of the tube, either by a prolapse of the mucous membrane, or they may be plugged—both of these occur very rarely with my method; or the tube may have been introduced too far and has curled around along the greater curvature, and thus the end is above the level of the contents of the stomach, as is shown in Fig. 3. This is easily remedied by withdrawing the tube a little (Fig. 3).

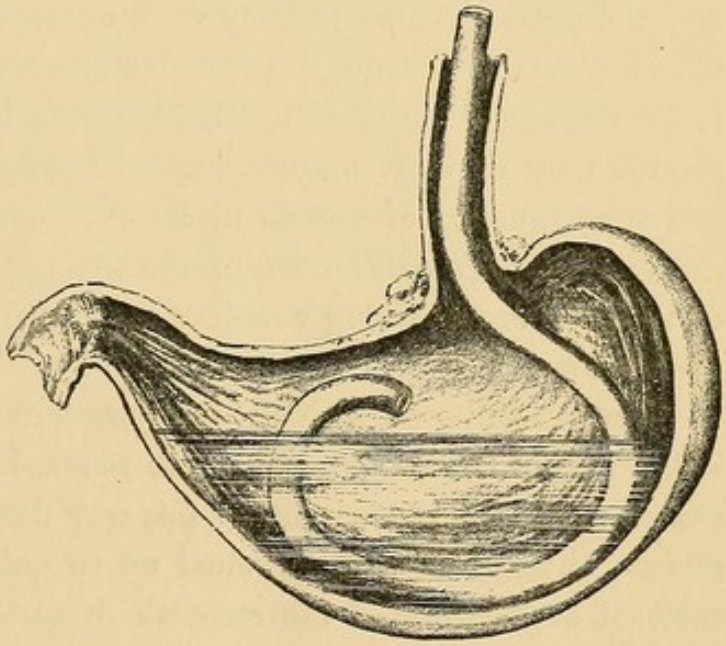


Fig. 3.

In rare cases it may also happen that at a time after the test-breakfast when the stomach is usually full, the organ is found empty, and hence nothing can be expressed. In such cases the transfer of the ingesta into the intestines is unusually rapid—a condition which will be referred to in the discussion of the gastric neuroses.

I shall now demonstrate to you on a patient how easily this

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* Epstein. Ueber Magenausspülung bei Säuglingen. Archiv für Kinderheilkunde, 1883, Bd. iv, S. 325.

† Leo. Ueber die Function des normalen und kranken Magens, etc., im Säuglingsalter. Berl. klin. Wochenschrift, 1888, No. 49.

method of expression, as I have called it, is carried out. (Demonstration.) Although very rapidly done on this patient, yet I must not neglect to tell you that in some cases it is not successful. Thus this may happen where the abdominal walls are so relaxed that their pressure can not be brought into play; then there are also some persons who have so little control over their muscles that they can not bear down when they are told to do so. Hence this method of expression may not be successful, or at least not till after several attempts; yet, taken all together, this occurs in scarcely five per cent of the cases.

Are the passage of the tube and the washing out of the stomach, as thus described, dangerous? You know that when the stiff tubes and the pump were exclusively used, numerous cases were reported where pieces of the mucous membrane were torn off, as by Wiesner,* von Ziemssen,† Leube,‡ Schliep,# and others; yet they were followed by no evil consequences, at least so far as hæmorrhages and the formation of gastric ulcers were concerned. This may be due to the strong contraction of the walls of the stomach, which at once closed any bleeding vessels and approximated the edges of the denuded areas.

The possibility of such an occurrence, and in fact of any severe lesion of the mucous membrane, is reduced to a minimum by the use of the flexible tube; and in this way there has been removed a serious objection which prevailed up to quite recently against the internal exploration of the stomach in certain conditions, such as cancer and ulcer, where bleeding occurs easily. A very unpleasant complication is regurgitation of food alongside of the tube; this may even lead to suffocation, aspiration-pneumonia (*Schluckpneumonie*), etc.‖ This may be guarded against by the local or internal use of cocaine in very nervous patients. The choking sensation is

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* Wiesner. Ueber die Behandlung der Ectasie mittelst der Magenpumpe. Berliner klin. Wochenschr., 1870, No. 1, S. 3.

† V. Ziemssen. Zur Technik der Localbehandlung des Magens. Deutsch. Archiv für klin. Med., Bd. x, S. 66.

‡ Leube. Die Magensonde. Erlangen, 1879, S. 25.

Schliep. On the Stomach-pump in the Treatment of Chronic Gastric Catarrh and Dilatation. Lancet, December 14, 1872.

‖ Emminghaus. Einiges über Diagnostik und Therapie mit der Schlundsonde. Deutsch. Archiv für klin. Med., Bd. xi, S. 304.

much less marked after the test-breakfast (*Probefrühstück—vide infra*), for its intensity is manifestly regulated by the amount of the ingesta, and the masses raised are smaller as well as less offensive. It ceases, as a rule, after pouring some water into the stomach, since the irritation of the mucous membrane by the tube is thus removed.

I have never met with any serious accidents, neither large hæmorrhages nor any other mishap; and can agree with Leube's statement that, "taken all in all, the passage of the tube into the stomach is to be considered an operation without risk";* but I would modify it by substituting for "taken all in all" the expression "if the necessary care be taken."

It is self-evident that in the examination of the contents of the stomach a method which is as uniform as possible should be followed. The activity of the gastric secretion depends, *mutatis mutandis*, upon the food eaten. The quantity is abundant if a good opportunity is offered for free secretion. An abundance of food calls forth a greater activity of the glands than a scanty diet, till the food present is saturated with the secreted juice. Therefore, different results will be obtained if the examinations are made after varying intervals and after different kinds of food. The neglect of this point was the cause of the great discrepancies between the various writers up to a short time ago; hence it is absolutely indispensable that the interval after the meal and the diet should always be the same, if the results are to be of any value for comparison.

The question naturally arises, What is the normal course of the secretion in human beings? A continuous series of experiments on the successive phases of digestion in animals, as well as in human beings, had never been made till Dr. Boas and myself made ours on the latter some years ago. First of all we corroborated the results of Tiedeman and Gmelin (1826) and others that there is normally no gastric juice in the stomach when fasting; that some kind of irritation of the gastric mucous membrane is necessary to produce the secretion, either by the simple introduction of a sound

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* Leube, *loc. cit.*, p. 40.

or tube, as in very nervous persons, or by giving some water, pepper, etc. Thus, for example, Edinger * found that in 13 out of 15 cases there was no trace of hydrochloric acid, and in the other two a "by no means positive" trace of it. He used the old method of Spallanzani, in which the subjects swallowed pieces of sponge compressed to the size of a pill, and attached to a silk thread. Concerning this it must be stated that, in persons who have not eaten for an unusually long time, the introduction of the tube may not cause a secretion of gastric juice, but instead a regurgitation of bile and other contents of the duodenum. This is not a normal occurrence, as will easily be perceived from the standards to be given later on. Schreiber † and Rosin, ‡ after very thorough experiments, have recently claimed that the secretion in the stomach is continuous. At all events, it was found that in 14 out of 15 persons examined for this purpose from 2 to 50 c. c. [f ʒ ss. to ℥ jss.] of a fluid containing hydrochloric acid could be expressed from the stomach when free from food; the fluid was usually clear as water, with very little potash and no remnants of food; in a few cases it was colored green or yellow. Likewise, in 10 out of 11 persons who had fasted seven hours, some of them even the greater part of the day, a fluid containing hydrochloric acid could always be obtained by expression, repeated at a few hours' interval. Schreiber thinks he can exclude the possibility of this secretion having been produced at the time of the introduction of the sound or tube; yet he does not state whether it is the product of the entire period of fasting (i. e., for instance, that secreted continuously during the whole night), nor does he make it clear when the secretion begins. Leo # and Kinnicutt ‖, who found hydrochloric acid, "almost without exception," in the stomachs of fasting suckling infants, consider

* Edinger. Zur Physiologie und Pathologie des Magens. Deutsch. Archiv für klin. Med., Bd. xxix, 1881.

† J. Schreiber. Die spontane Saftabscheidung des Magens im Nüchternen und die Saftsecretion des Magens im Fasten. Arch. für experim. Pathologie und Pharmakologie. Bd. xxiv, S. 365.

‡ H. Rosin. Ueber das Secret des nüchternen Magens. Deutsche med. Wochenschr., 1887, No. 47.

Leo, *loc. cit.*

‖ Kinnicutt. Diagnosis of Diseases of the Stomach. Transactions of the Association of American Physicians, vol. v, p. 216.

it a residue of the previous process of digestion; while Rosenheim * agrees perfectly with my results, and states that normally the stomach contains only traces of hydrochloric acid (never over 0·04 per thousand †). I can not admit that Schreiber's experiments are convincing, and that the glands of the stomach, unlike all other secreting glands, are active without any specific stimulation, somewhat like a steam-engine "going dead slow." I still consider that the simple act of introducing the tube in most persons who have not become accustomed to it by long practice causes a reflex *from the mouth downward*, and this reflex action will suffice to call forth a more or less marked secretion of gastric juice. Furthermore, *this will occur more readily* the longer the person has remained hungry beyond the usual time of eating, exactly as happens in the salivary glands of dogs, which, when a piece of meat is held before them, secrete the more abundantly the longer they have been starved. Proof of this was afforded me in five patients who were accustomed to the passage of the instrument. I passed the tube while the patients were in bed a short time before breakfast, but I obtained only small quantities of clear mucus, at times of a yellow color. This mucus, although having a feeble acid reaction several times, never gave a reaction with the tropæolin or the phloroglucin-vanillin tests. It may be objected that these were patients with diseased stomachs; yet they always secreted gastric juice with hydrochloric acid after taking food. At all events, the contradictory results given by the above writers show that idiosyncrasy causes some to react more easily than others, and, as we shall see later on, this may under certain conditions even lead to a pathological increase of the secretion.

The food should be as simple as possible; it is well typified in the so-called *test-breakfast* (*Probefrühstück*). On an empty stomach the patients take an ordinary dry roll and a definite quantity—$\frac{1}{3}$ litre [about $\frac{2}{3}$ pint]—of fluid, of either simply warm water or

* T. Rosenheim. Ueber die Säuren des gesunden und kranken Magens bei Einführung von Kohlenhydraten. Virchow's Archv, Bd. cxi, S. 419.

† [0·04 per thousand, or 0·04 pro mille, as it is usually expressed in German, equals $\frac{1}{25000}$. This is a very convenient way of expressing these high fractions in the decimal system. They can easily be converted back into fractions by remembering that 1 pro mille (or 0·1 per cent) equals $\frac{1}{1000}$.—Tr.]

weak tea [without milk or sugar]. (Tea sometimes has a feeble acid reaction, depending on the province from which the tea-leaves come.) According to König's analysis, such rolls contain 7 per cent nitrogen, 0·5 per cent fat, 4 per cent sugar, and 52·5 per cent non-nitrogenous extractive substances, to which 1 per cent ash must be added. The roll is thus a mixture of the various nutritious ingredients, and is made up here [Berlin] of a tolerably uniform weight, about 35 grammes [540 grains]. The test-breakfast thus includes albuminoids, sugar, starches, non-nitrogenous extractives, and also salts; the tea belongs to that group of foods which are of considerable importance to the gastric secretion. Klemperer recommends substituting ½ litre [a pint] of milk instead of the tea, in order to subject the stomach to a severer test. As yet I have not been able to obtain any special advantage from this. By means of this breakfast we can offer the stomach all the ingredients which are usually taken, with the great advantage that they are liquefied in a relatively short time, or at least they are softened sufficiently to permit their passage through the tube; while if solid food like meat is given the openings in the tube are very easily plugged.

This also explains why many can not dispense with the stomach-pump, which naturally gives greater suction-power. My method has the additional advantage of great cleanliness. Even should the patient vomit, as occurs occasionally in a very few cases, the vomit does not consist of fatty, offensive, and viscous masses, as when a large meal is taken, but only of comparatively clean morsels of bread. These are the advantages of the method. On the other hand, it must not be forgotten that such a moderate meal makes a a very slight demand on the action of the viscus, and a stomach which may prove capable of digesting this moderate meal may not secrete enough for a more complicated diet. This objection applies with even greater force to the one-sided administration of small quantities of albumen only (the whites of one or two hard-boiled eggs), as proposed by Jaworski. It is for this reason that I deny the value of such a meal to test all the digestive functions of the stomach. If we have given the trial-breakfast, and still desire to apply severer tests, nothing forbids the use of another

kind of food to ascertain whether the latter is also properly digested.*

Larger meals, like the *test-dinner* (*Probemittagbrod*), to be taken at noon, have been employed by other observers (Leube, Riegel). The test-dinner consists of an ordinary [German] midday meal of bouillon, barley or flour soup, a moderate piece of meat, and some bread. Naturally a uniform quantity should be given at these meals—about 400 grammes [about 13 fl. oz.] of soup, 60 grammes [2 oz.] scraped beef, and 50 grammes [1⅞ oz.] wheat bread. This is not so easily carried out, and the same interval should also be allowed to elapse before the examination. Furthermore, the large quantity of acid salts taken in the food, as shown by Einhorn,† may cause quite a serious error if the absolute quantity of HCl is unknown and the total acidity is computed as HCl. In my method digestion is at its height within one hour after eating, and all the constituents can be demonstrated; but in the large meals either no digestion at all or very little will have taken place in that time. You must wait four to six hours, according to the state of the food, or at times upon the condition of the organ, till you can obtain all the ingredients properly digested; and as the fluid portions of the food are absorbed much more rapidly than the solids, the contents of the stomach after a time become more and more like mush, so that it may easily happen that at this time a sufficient quantity of the stomach-contents can not be obtained. The longer period of waiting is of less importance, since, after all, we are looking for comparative results; yet so great have been the advantages of the test-breakfast that I have not discovered any reason for seeking further, especially as numerous trials—even in carcinoma of the stomach, let it be well noted—have shown *that the same results are obtained with it as with the more complicated meals.* It is especially convenient where large numbers of examinations must be made, and hardly anything else could be used in

* [As the result of eight examinations on healthy subjects, Boas says that one hour after taking a roll and 300 c. c. [f ℥ x] of water, about 40 c. c. [f ʒ 1⅛] should be obtained by expression; the amount may vary 15 c. c. [f ℥ ss.] either way; otherwise the result is pathological. Boas, *loc. cit.*, p. 115.—Tr.]

† Einhorn. Probefrühstück oder Probemittagbrod? Berl. klin. Wochenschrift, 1888, No. 32.

consultation practice, where the patient's general condition is determined on one day and early on the following morning he may come for the examination of the stomach, and thus the inconveniences of the procedure are reduced to a minimum.

If the fluid obtained by expression after the test-breakfast is filtered, the filtrate is a clear, at times yellowish or yellowish-brown, watery fluid, like the specimen which I now show you, which was obtained by expression this morning.

You know that the stomach during digestion normally has acid contents, the acidity being due to hydrochloric acid, and the intensity of which depends upon the functional activity of the organ and the stage of the digestive process. But the nature of the acid which imparts this acidity changes also. *It is therefore necessary to determine first whether the stomach-contents are acid, then how acid they are, and finally the nature of the acid which produces the acidity.* During the normal digestion of the test-breakfast the following three stages may be observed, *provided the reagents to be presently described are employed.* As early as ten to fifteen minutes after eating, the stomach-contents obtained are acid; the acidity depends either upon acid salts or free acid, or both. Examination of the free acid with our usual reagents shows it to be lactic acid. Up to thirty to forty-five minutes the lactic acid predominates, while the color-tests for hydrochloric acid are negative. Then comes a stage in which distinct traces of HCl can be demonstrated, coexisting with the lactic acid. Finally, the latter disappears entirely, so that normally after the first hour only HCl can be found. Of course, this must not be understood as meaning that it is then only that its secretion begins. On the contrary, it probably begins at once after the entrance of food into the stomach; but at first it can not be demonstrated with the customary reagents, because a portion of it is in combination, and also on account of the presence of acid salts which interfere with the delicacy of the usual reagents. The amount of free HCl rises during the course of digestion, and reaches its maximum, which generally seems to be higher after an abundant meal than after a light one (2 to 3·3 per thousand [$\frac{1}{500}$ to $\frac{1}{300}$] against 1·5 to 2 per thousand [$\frac{1}{600}$ to $\frac{1}{500}$]). This difference in the quantity of the secretion bears no relation to

differences in its reaction to disturbing influences; in other words, disturbances of digestion, as I have already said, occur in the one case as well as in the other, because they depend not on absolute but on relative values—of course within certain limits, above or below which they must not go.

The above results are typical, and can be demonstrated with the processes soon to be described. The clinical and practical importance of these three stages of acidity lies in the fact that changes in them enable us to recognize pathological conditions. The validity of this will not be affected by the fact that Cahn and von Mering,* Ritter and Hirsch,† and Rosenheim,‡ with the aid of complicated methods of detecting traces of lactic acid, succeeded in demonstrating this acid in the later stages of digestion. At all events, it is possible, as I myself have ascertained in several cases, to find small traces of lactic acid at a time—at the end of the first hour, for instance—when for all practical purposes the tests to be described later (page 33) no longer give a positive result. But in this lack of sensitiveness lies the value of this test. For we have no method by which an excess of lactic acid could be quickly estimated; hence the value of a reaction which, as in the case here, only becomes evident when there is a pathological increase of lactic acid in the stage of digestion under discussion. I am therefore justified in maintaining that the value of this division of stomach digestion into three stages, as proposed by Boas and myself, is not diminished by the above-mentioned results, even should their occurrence be constant.

The acid reaction of the stomach-contents may, under certain conditions, depend throughout the entire process of digestion, not upon free acids but upon the acid salts of the ingesta, especially the acid phosphates. Usually these salts play an insignificant part as compared to the free HCl, but under pathological conditions they may become important.

Therefore the simple fact that the chyme reacts acid to litmus

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* Cahn und v. Mering. Ueber die Säuren des gesunden und kranken Magens. Deutsch. Archiv f. klin. Med., Bd. xxxix, Hefte 3 u. 4.

† *Loc. cit.*, p. 434.

‡ Rosenheim. Ueber Magensäure bei Amylaceenkost. Centralblatt für d. medicin. Wissensch., 1887, No. 46; and Virchow's Archiv, Bd. cxi, S. 414.

does not show whether the acidity is due to free HCl or acid salts. Under all conditions it is important to ascertain how acid the stomach-contents are—i. e., to test the acidity with volumetric solutions and the burette (titration).

Testing Total Acidity.—Titration* is most conveniently performed with a deci-normal solution of caustic soda, the end-reaction being determined with litmus-paper or phenol-phthallein. The latter is not as accurate as the so-called *Tüpfelmethode*—i. e., the alternate testing with red or blue litmus-paper—but it is much more convenient and rapid, while it is sufficiently accurate for general practice. Should the reaction of the stomach-contents be alkaline, the degree of alkalinity may be determined with a deci-normal acid solution. Phenol-phthallein is a buff-colored powder, freely soluble in alcohol, making a slightly opalescent solution, which remains colorless in acid or neutral solutions, but assumes a carmine color in alkaline solutions. The procedure is simple: a Mohr's burette is filled with the deci-normal solution of caustic soda; 5 or 10 c. c. of the filtered stomach-contents are poured into a small glass beaker, and one or two drops of the alcoholic solution of phenol-phthallein are added. The solution in the burette is very gradually added till the red color which appears in the contents of the beaker no longer disappears on shaking, but remains permanently. A slight turbidity or yellowish color of the stomach-contents does not interfere with the delicacy of the reaction; it is also to be noted that the addition of the phenol-phthallein gives a slightly milky appearance to many stomach-contents.† In the

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* [The description of the technique of titration and other strictly chemical procedures lies beyond the province of this work. Those who desire further information than is given in the text will find these methods fully described in the Handbook of Volumetric Analysis, by Edward Hart; New York, John Wiley & Sons. In all these volumetric methods the metric system is obviously alone employed. —Tr.]

† Where titrations are not made daily, Kleinert's burette will be found very convenient. This burette differs from the ordinary form with glass stop-cock in having the latter at the upper end above the zero-mark of the scale, while the lower end is somewhat drawn out, and is ground, to permit its being closed with a glass cover. The burette is filled by dipping the lower end into the standard solution to be used and sucking at the upper end while the stop-cock is open. By closing the latter the atmospheric pressure will keep the column of fluid in the burette. To titrate, we simply turn the stop-cock above instead of below, as usual. After

specimen we are now examining 6·1 c. c. of the deci-normal solution were added to the 10 c. c. of stomach-contents. As a rule, the acidity of the contents of the stomach obtained one hour after the test-breakfast ranges between 4 to 6 or 6·5 c. c.; results above or below these limits are pathological. It is a matter of convenience to express the acidity in percentage according to the amount of the deci-normal soda solution used; thus, for example, 61 per cent acidity would mean that 100 c. c. of filtered stomach-contents were neutralized by 61 c. c. of a deci-normal soda solution. This prevents any misconception that the acidity depends on free hydrochloric acid. If we are sure that the acidity depends on the latter and not on salts or any other acids, we may express the value as HCl. One cubic centimetre deci-normal soda solution is equivalent to 0·003646 HCl. When 10 c. c. of stomach-contents are used, multiply 0·03646 by the number of cubic centimetres added from the burette till the contents of the beaker were neutralized; this will give the percentage of HCl in the stomach-contents under examination. Thus in the present specimen the actual percentage of HCl is 0·22 per cent; this result is within the normal limits (0·14 to 0·24 per cent).

To determine whether the acidity depends on free acids or acid salts, the aniline dyes will be found the most useful; of these the best is *Tropæolin OO—l'orangé Poirier* of the French. This powder, when dry, has a beautiful orange color; in saturated watery or alcoholic solutions it is a dark yellowish-red; in the presence of traces of free acid—even as little as about 0·25 per thousand [1 in 4,000]—it changes to dark brown, but acid salts make it straw yellow. I shall take a small quantity of the reagent and add a few drops of dilute HCl (containing about 0·05 per cent pure HCl); as you see, the solution at once assumes a deep, dark-brown color. If some acid sodium phosphate is added to the tropæolin solution,

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use, the lower extremity is closed with the well-greased glass cover. In this way we avoid the annoying drying of the stop-cock and also the alteration due to exposure to the air which occurs in the ordinary form in the drops of fluid in the lower end, if the burette is not in continual use; this change is due to the formation of carbonates.

the color turns not brown, but a light straw yellow. Thus tropæolin enables us to determine whether free acids (hydrochloric or lactic) are present.

The dye called *Congo-red*, which was introduced by Hoesslin,* has a similar action; its solutions assume a peach to a brownish-red color. The addition of a free acid changes it to a sky-blue. It is more delicate than tropæolin, and will react to a fluid containing but 0·02 per thousand. Acid salts produce no change.

[*Benzopurpurin* was introduced by v. Jaksch;† it is used on strips of filter-paper which have been dipped into a saturated aqueous solution of benzopurpurin 6B, and dried. Such a strip is dipped into the stomach-contents, and if the paper at once assumes a deep blackish-blue color, then there is more than 0·4 per cent HCl; if the color is more of a brownish black, then it may indicate either organic acids or a mixture of these acids and HCl. To differentiate, the strip of paper is placed in a test-tube with ether: if the color remains unchanged, only HCl is present; if it disappears, then only organic acids are there; if it becomes less marked, then both kinds of acids are present.]

In these tests, as well as all the other reactions to be mentioned later, there must be an excess of the fluid to be tested over the color solution; otherwise delicate changes might escape notice. The best method is to pour 5 to 10 drops of the color solution into a small test-tube, and then add 1 to 2 c. c. [15 to 30 drops] of the filtered stomach-contents. The delicacy of all these reactions is markedly affected by the presence of salts and albuminoids, especially albumose and peptone. Certain salts, as, for example, sodium chloride, enter into combinations with the dyes which are very stable, even though they are not true chemical compounds, and not even the addition of small quantities of acid suffices to break them up again; on the other hand, albumen and its derivatives form unstable combinations with a portion of the free acid, and thus also disturb the reaction. Yet, at all events, we can roughly estimate

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* Von Hoesslin. Ein neues Reagent auf freie Säuren. Münch. med. Wochenschr., No. 6, 1886.

† [Von Jaksch. Klinische Diagnostik innerer Krankheiten. 2. Auflage, 1889, S. 123.—Tr.]

whether we are dealing with free acid or acid salts, and can obtain an approximate idea of the amount of free acid by the intensity of the reaction.

Let us test whether this specimen, whose acidity is 61 per cent (= 0·2 per cent HCl), contains free acid. I shall first add some to the Congo-red solution; it assumes a pale-blue color, but its intensity is much less than this control test with a 0·2 per cent hydrochloric-acid solution. The same difference is observed in the reactions with tropæolin. Therefore, along with the free acid which is present in this specimen there are also acid salts.

How can we determine the nature of the free acids?

For the Determination of Hydrochloric Acid, we must first consider those aniline dyes which in aqueous or alcoholic solution react with distinct changes of color to free acids in general, and to free hydrochloric acid as well. From the chemical composition of methyl-violet, Klemperer * concludes that, so far at least as this dye is concerned, loose combinations are formed which are easily split up again by every kind of organic or inorganic bases and by the albumens and their derivatives, so that the original color returns; or, in other words, as I have already expressed it, these substances mentioned above have a greater affinity for hydrochloric acid than methyl-violet has. Of tropæolin and Congo-red I have already spoken. Another dye is *methyl-violet*, which is used in an aqueous solution, which is diluted till it has a reddish-violet color. The addition of even 0·024 per cent of HCl to the solution changes the tint to a sky-blue, which you will observe has a different color than the original when I hold both tubes up to the light.

Emerald, *smaragd*, or *malachite green* is also employed; its solutions are dark green, playing somewhat into a bluish-green. The addition of free HCl changes it to a beautiful moss-green. This dye is probably identical with *vert brillant*, so warmly recommended by Lépine. But my experience has been that smaragd-green is not as delicate as methyl-violet or Congo-red. Even less delicate is *fuchsin*, also called *rubin;* its solutions are bright red, but turn yel-

* G. Klemperer. Zur chemischen Diagnostik der Magenkrankheiten. Zeitschrift f. klin. Med., Bd. xiv, S. 156, 1888.

low on adding an acid; but a relatively large amount of acid is needed to produce this change. It is only after adding a large quantity of a solution which has double the amount of acid used in the former tests that the color begins to assume a lighter shade and finally becomes yellow.

The best dyes for general use are Congo-red and tropæolin, either in solution or as test-paper, like those which I now show you; these test-papers are made by dipping strips of filter-paper into a saturated solution of the dye and allowing them to dry. The reaction is made more distinct by carefully warming them over a flame (Boas); Congo-red paper in the presence of small quantities of free acid assumes a lilac color at the place heated. The same result may be obtained by pouring a few drops of the color solution into a porcelain dish and distributing it into a thin layer by rotating it to and fro (Uffelmann). Then a few drops of the fluid to be tested are added, heat is gently applied, and a good reaction is readily obtained. Kahler* recommends sucking up some of the filtered stomach-contents into a fine glass tube, and then carefully adding [by suction] a few drops of the color solution, so that two layers are formed. The reaction is manifested by a delicate ring at the line of contact of the two fluids. It depends upon bringing together suitable quantities of the fluid and the dye in such a way that the change in color may be visible; where the quantities are small this can naturally be done more easily in a porcelain dish than in the bottom of a test-tube. The principle is the same, however.

The reaction of these aniline dyes toward hydrochloric acid is somewhat uncertain, because they are decolorized by other acids, especially the organic; as I have already shown, their delicacy is also affected by other substances. Unfortunately, these substances are the ones which we always encounter in the stomach-contents during ordinary digestion—i. e., albumen and its derivatives, saliva (an albuminous and saline fluid), chlorides, and phosphates; what I said while discussing the demonstration of free acid

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* Kahler. Ueber die neuen Methoden zur Untersuchung des kranken Magens. Prager med. Wochenschr., 1887, No. 32 u. 33.

is also true here. They either simulate or prevent the change of color. I shall now show you on a solution of methyl-violet that they can simulate decolorization. If to a solution of this dye I add some diluted white of egg you will see that the reddish-violet solution will assume a distinctly different blue color. A slight difference in this color and that produced in a control test with hydrochloric acid may be observed, yet this can only be detected when the two tubes are held alongside of each other, and when only pure hydrochloric acid is employed. I shall now pass around a third tube, in which both HCl and albumen have been added, the result being a shade between the other two. By holding the tubes up to the light, the difference and similarity can be distinctly recognized.

The derivatives of albumen act in exactly the same way, namely, the various albumoses, syntonin, propeptone, peptone, leucin, and, finally, certain salts, especially sodium chloride, which is so abundant the food. If to a methyl-violet solution some concentrated common-salt solution (even a 5 to 10 per cent solution will suffice) is added, the reaction, when some acid stomach-contents or pure HCl is poured in, is much less distinct, or may even be absent. On the other hand, the bluish color of the methyl-violet solution after adding HCl will disappear on pouring in a definite proportionate amount of a solution of albumen, albumose, peptone, etc.; or the color change may not occur at all if these substances have been added to the HCl before using it. I say, "in proper proportion," and thereby I also explain the entire phenomenon from whose varying distinctness with different reagents false deductions have been drawn as to their greater or less usefulness. Under the above conditions it was only necessary for the substances in question to combine with the acid to form unstable compounds with it or to absorb part of it; hence it can no longer react as a free acid. Therefore, in making comparative tests with solutions of acids which exceed the sensitiveness of a reagent, the more delicate the reagent the greater is the amount of the above-named substances [albumen, etc.] which may be added without preventing the reaction; the opposite result will be observed if we are working with solutions which still contain even a trace of acid to act upon the reagent.

This enables us to understand the statement made, for example, by Seeman,* that a combination of equal parts of a ½-per-cent peptone solution and a 0·2-per-cent HCl mixture will just give the methyl-violet reaction; while Krukenberg† claims that the phloroglucin reagent (see p. 29) will do the same when one part of a 4-per-cent peptone solution is added to two parts of the identical HCl mixture. It simply means that methyl-violet is about four times less sensitive than phloroglucin-vanillin.

The other dyes act just like methyl-violet; some—e. g., tropæolin—are more markedly affected by salts, while others, like smaragd-green and Congo-red, by albumens. When we are using impure acids, or especially stomach-contents, which always have a slight tinge of color, this behavior of the dyes may give rise to serious errors, and is certainly the cause of many of the controversies which have arisen in discussing these results. As early as 1880 I called attention to this,‡ and showed, especially concerning the methyl-violet reaction, that "it was delayed by the presence of even small quantities of blood, and that it was markedly enfeebled or even prevented by solutions of hydrochlorate of leucin and tyrosin as well as by albumen and peptone." I shall demonstrate to you on this somewhat turbid sample of stomach-contents (obtained from a different patient) that a distinct bluish color will be given by methyl-violet, which is nevertheless not due to free acid; for, if I test for the latter with tropæolin, although a darkening or, rather, a clouding of the reagent occurs, yet there is no true brown color. Free acid is therefore absent in spite of the change of color produced by the methyl-violet. The organic acids which have been alluded to above as affecting the color solutions include lactic acid, acetic acid, and butyric acid; yet, in order to simulate the changes produced by HCl, much stronger solutions are requisite than are found in the stomach-contents. Where HCl and the above organic acids occur together, the delicacy of the HCl reaction is not affected

* Seeman. Ueber das Vorhandensein freier Salzsäure im Magen. Zeitschr. für klin. Med., Bd. v, 1882.

† Krukenberg. Ueber die diagnostiche Bedeutung des Salzsäurenachweises bei Magenkrebs. Inaug. Dissert. Heidelberg, 1888.

‡ Ewald. Ueber das angebliche Fehlen freier Salzsäure im Magensaft. Zeitschr. für klin. Med., Bd. i, S. 622.

by the latter. Concerning this I have constructed a table which will be found at the end of this lecture.

This behavior of the aniline dyes showed the desirability of other tests in which these sources of error would not arise. The test proposed by Mohr depends on the change which occurs in a solution of sulphocyanide of potassium and acetate of iron on the addition of HCl; this is due to the formation of sulphocyanide of iron, which varies in color from a peach-red to a brownish red. Two c. c. [f ʒ ss.] of a 10-per-cent solution of sulphocyanide of potassium are added to 0·5 c. c. [ɱ viij] of a neutral solution of ferric acetate (the liquor ferri acetici, Pharm. Germanic., which contains between 4 and 5 per cent of iron); this is diluted with water to 20 c. c. [f ʒ vjss.], so that the fluid assumes a light mahogany color. A little of this is poured into a test-tube and some dilute hydrochloric acid is added; the color of the solution then changes to a dark brown-red. This method is not so distinct as when tried with a thin layer in a porcelain dish. A few drops of the reagent are placed in a small porcelain dish and spread into a thin layer by rocking the dish to and fro, and pouring off the excess. A little hydrochloric acid is allowed to trickle slowly from the edge of the dish; at the point of contact of the two fluids a beautiful peach-red color forms at first, but on adding more acid it assumes a brownish tinge. This peach-red color is very characteristic and enables us to detect very small traces of hydrochloric acid, although it is not as delicate as the aniline dyes. It possesses these advantages, that it is disturbed only by larger quantities of albuminates, and not at all by salts. Instead of always preparing the solution fresh, strips of filter-paper may be dipped into it and dried, and the reaction may be obtained with them. But these papers after a time become less sensitive as a result of contact with the air.

I have no personal experience of the value of ultramarine and zinc sulphide proposed by Kahler,* because I considered it superfluous to search for new methods after the announcement of Günzburg's reagent.† This test, which surpasses all of those thus far mentioned,

* Kahler. Ueber die neuen Methoden zur Untersuchung des kranken Magens. Prager med. Wochenschr., 1887, No. 32; and Kraus, ibid., 1887, No. 52.

† Günzburg. Centralblatt für klinische Medicin, 1887, No. 40.

is so sharp and at the same time so simple and positive that a control test with other reagents is necessary in only very few cases indeed. According to my extensive experience thus far, using it daily and comparing it with other tests, I do not hesitate to pronounce Günzburg's reagent very valuable; my original recommendation of it* has in the mean time been corroborated by many other writers. The principle of the reaction is that a pine-needle which has been dipped into a solution of phloroglucin will assume a bright red color when it is brought in contact with hydrochloric acid. Max Singer has shown that this color-change is due to the presence of vanillin. The solution is made as follows:

Phloroglucin	2·0 [gr. xxx]
Vanillin	1·0 [gr. xv]
Absolute alcohol	30·0 [f ℥ j]

The solution is pale yellow in color, and has a pronounced odor of vanilla or fresh pine-wood; on exposure to light it in time assumes a dark golden-yellow color, and it must therefore be kept in black bottles. If a drop of the reagent is put into a small porcelain dish and some concentrated hydrochloric acid is added, a bright red color and the formation of small red crystals will be at once observed. If the acid is weaker, as, for example, only 0·05 per cent or less, or with stomach-contents, no change will be observed at first; but if the dish is carefully heated over a flame, so that the fluid does not boil, but simply evaporates slowly, at the edge of the drop a bright red tinge or very delicate red stripes will be observed. These are absolute proofs of the presence of free hydrochloric acid. Blowing on the dish will cause the beautiful red stripes to appear at once. Filtration of the gastric contents is unnecessary; one or two drops in a small dish or on a strip of filter-paper with an equal quantity of the reagent will suffice. The reaction has this great advantage over all others, that it is not simulated by the albuminates which may be present; neither is it interfered with by salts, provided they are within the usual proportion; nor is it affected by organic acids; but of this I shall speak again later on. Its delicacy

* Ewald. Verhandlungen des Vereins für innere Medicin zu Berlin. Deutsch. med. Wochenschr., 1887, No. 46.

far surpasses every other reagent. Tropæolin papers fail when hydrochloric acid is below 0·3 per mille [1 in 3,300]; but I am convinced that Günzburg's reagent may be used when it is as low as 0·05 per mille [1 in 20,000].

The color obtained is always a bright red, but where the amounts are very small it may be a pale rose-red, yet it is never brown nor brownish yellow nor brownish red. The presence of such shades indicates overheating and the combustion of organic substances. Characteristic is the appearance of red stripes or of a uniform reddish tinge at the *edge* of the drop after *gentle* heating or slow evaporation to dryness. Strong heating and evaporation of any albuminous substance will produce a marked *central* red coloration, yet this is scarcely to be confounded with hydrochloric-acid reaction. If dilute hydrochloric acid is added to solutions of albumen or peptone, then the above-mentioned reaction of these substances will only occur after their affinity for the acid has been completely satisfied.

The behavior of the reaction will afford a fairly good quantitative estimation of the amount of free hydrochloric acid; an easy and reliable method for this has thus far been lacking. By successively diluting the stomach-contents which react to Günzburg's reagent to $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{10}$, etc., till the reaction is no longer obtained, we can approximately estimate the quantity of actually free hydrochloric acid, since we know that the limit of the reaction lies at $\frac{1}{20}$ per mille [1 : 20,000]. For example, the red color is just visible with the twentieth dilution; then the gastric juice contains 1 per mille—i. e., 0·1 per cent of free hydrochloric acid. However, we can also get a rough idea of the larger or smaller amount of free acid by the more or less intense red color while making the test.

Boas* discovered that *resorcin* was a substance with a very similar action. The reagent consists of:

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* Boas. Ein neues Reagens für den Nachweis freier Salzsäure im Magensaft. Centralblatt für klin. Med., 1888, No. 45. [Also, Boas. Diagnostik, etc., 2te Auflage 1891, S. 134. This test may also be applied by means of strips of filter-paper which are dipped into the stomach-contents; add one to two drops of reagent and heat gradually. It is slower than Günzburg's reagent, and requires greater delicacy in using it.—Tr.]

Resorcin resublimat.....	5·0 [gr. lxxv]
Sacchar, alb.....	3·0 [gr. xlv]
Spiritus dilut.....	100·0 [f ℥ iijss.]

Three to five drops of the reagent are poured into a porcelain dish and an equal quantity of stomach-contents is added; it is now heated slowly, when a purple-red color appears at the edge of the drop, as in Günzburg's test, even in the presence of only 0·05 per mille of free HCl. This reaction is also produced only by hydrochloric acid, and is never caused by organic acids.

Having thus spoken of all the more important means for detecting free hydrochloric acid, we conclude that for simplicity and distinctness the reagents of Günzburg and Boas and tropæolin are to be considered the best. We must next consider the other acids which are found in the stomach-contents—how they are to be detected, and what are their relations to and reciprocal action upon hydrochloric acid. At all events, the discussion of the color-tests for free hydrochloric acid is by far the most important, but it may be dismissed for the present, since many comparative examinations have been made by various observers—Reischauer, Kraus, Haas, Krukenberg, and others; their conclusions as to the relative value of the different tests agree fairly well. In a recent dissertation Kuhn* arranges these substances according to their increased sensitiveness towards pure hydrochloric acid; yet it by no means follows that the same order is true when applied to stomach-contents. He tabulates them thus: Ultramarine-blue, tropæolin paper, Congo paper, emerald-green, methyl-violet, tropæolin, phloroglucin-vanillin, Congo solution.

I shall now consider the **Determination of the Organic Acids**—i. e., lactic acid, acetic acid, and the true fatty acids, especially butyric acid. After it had been positively settled that the true and only acid produced by the gastric glands was hydrochloric acid, the opinion for a long time prevailed that the occurrence of organic acids, especially lactic acid, was always pathological. The recent investigations of Dr. Boas and myself, which were conducted on

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* Kuhn. Ueber den Werth der Farbstoffreagentien, etc. Inaug. Dissert. Giessen, 1887.

living subjects with healthy stomachs, definitely proved that an organic acid also exists normally in the *early* stages of digestion. If organic acids are found in the *later* stages in such quantities that they can be detected with the ordinary reagents, then they always have a pathological significance. These organic acids are the results of a normal fermentation of some of the substances acted on by the gastric juice—starch, sugar, and albuminous bodies. As far as we know at present, sarcolactic acid is to be regarded as a constant constituent of meat, from which it is dissolved.

Lactic Acid.—There are two kinds of lactic acid, *fermentation lactic acid* and *sarcolactic acid*. They are distinguished not so much by differences in chemical character as by their source. The former is of more importance to us than the latter, yet the tests to be described presently apply to both kinds. The method used by chemists to determine the presence of lactic acid is a very elaborate one, and is too complicated for general use. A very simple and rapid test for medical practice has been proposed by Uffelmann. Diluted solutions of neutral ferric chloride turn canary-yellow in the presence of lactic acid. If I take some ferric chloride and dilute it till it is almost colorless, and then add a trace of lactic acid, you will see this canary-yellow color at once appear. Nevertheless, the reaction is somewhat uncertain, or rather difficult of recognition, because we must merely distinguish the intensity of otherwise similar shades of color. Hence the test was modified as follows: a few drops of a diluted neutral ferric chloride solution are mixed with one or two drops of pure carbolic acid, or about 10 c. c. [ʒ ijss.] of a 2 to 5 per cent solution of carbolic acid—the exact proportions are not essential—and water added till the solution assumes a beautiful amethyst-blue color. A few drops of even a 0·05 per thousand solution of lactic acid [1 in 20,000] will suffice to change this blue to the characteristic yellow color. The delicacy of the reaction is such that 2 c. c. [ʒ ss.] of this Uffelmann's reagent will give a distinct result on adding 0·8 c. c. [12 minims] of a lactic acid solution of 0·01 per cent; with 0·6 c. c. [9 minims] of the same solution the color is pale yellow; but no yellow color is recognizable on adding only 0·3 c. c. [4½ minims]. Unfortunately, this test is not entirely free from sources of error, since lactates as well as free lactic

acid produce the yellow color. This, however, does not make much difference, for it is immaterial to us whether free lactic acid or lactates are present; we simply wish to ascertain the presence of lactic acid in the stomach. But the reaction can also be caused by alcohol, sugar, and certain salts, especially phosphates, which are frequently found in the contents of the stomach. If I add to Uffelmann's reagent some phosphate, as for example a little phosphate of soda in solution, you will notice a change to a canary-yellow color, which is, however, different from the characteristic tinge; but if the stomach-contents have a yellowish hue of their own, then the resemblance may be very close. Under such circumstances we are compelled to resort to a modification of the method used by chemists—i. e., we must make an ethereal extract of the fluid to be examined, then evaporate it and apply the reaction on the residue left after evaporation. This method is very simple, as I shall now show you. I have here a gastric juice with an acid reaction, which gives a marked yellow color with Uffelmann's reagent, but which shows no reaction for free acid with tropæolin; we must ascertain whether the yellow color is due to traces of free lactic acid or lactates or acid salts. Lactic acid may easily be extracted with ether from solutions of 0·75 to 0·5 per thousand; hence, if free lactic acid be present, the aqueous solution of the residue left after evaporating the ethereal extract ought to react acid. First, we extract with ether. We may do this by using a so-called "separatory funnel" (*Scheidetrichter*), or more simply by thoroughly shaking about 2 to 5 c. c. [℥ss. to ℥jss.] of the stomach-contents with ether; let the ether separate, which usually occurs very rapidly, and pour it off into a small glass beaker. This is repeated with fresh portions of ether till we have used, all told, about 30 c. c. [f ℥ j] of ether. The ether is then evaporated without an open flame by placing the glass beaker in a vessel of hot water. Add a few drops of water to the residue, and with this try Uffelmann's reaction by carefully letting one or two drops of the reagent flow from a pipette. The reagent and the substance to be tested must always bear a definite relation to each other. If we add too much, the reaction might be concealed. Thus, this might have been the reason why Cahn, of Strassburg,

could not at first corroborate my statements of the occurrence of lactic acid in the digestion of meat. The residue left in our test is acid, and gives a distinct Uffelmann reaction. The fact that there is no reaction for free acids with tropæolin shows how much more delicate Uffelmann's test is than tropæolin. Whereas no free acid could be detected with tropæolin because it was concealed by acid salts, and, even then, the quantity of free acid was very small, yet it was absolutely demonstrated with Uffelmann's reagent.*

The **fatty acids,** and especially **butyric acid,** change Uffelmann's reagent to a tawny yellow color with a reddish tinge; but this occurs only when they are present in over 0·5 per thousand [1 in 2,000]. Fat in the stomach-contents may be easily recognized by the small oily particles which are to be found in the aqueous solution of the residue left after evaporating the ethereal extract. The butyric acid, which is present in this same aqueous solution, may be separated in the form of oily drops by adding some small pieces of calcium chloride.

The best practical test for **acetic acid** is the nose. If present in considerable quantity, its odor is unmistakable. It may be detected by neutralizing the watery residue of the ethereal extract with carbonate of soda and then adding neutral ferric chloride solution. A beautiful blood-red color is struck, which can only be obtained by one other substance, formic acid, but this does not occur in the contents of the stomach.

Finally, one other substance—**alcohol**—is to be mentioned; it is to be found only in the rare cases of marked yeast fermentation in the stomach. It may be detected with the so-called Lieben iodoform reaction in the distillate of the stomach-contents; but we must

* [Leo also gives a not too complicated method for testing lactic acid and lactates. All the volatile acids are removed by boiling the stomach-contents till litmus-paper held over the vessel is no longer reddened. Replace the water lost by evaporation. After cooling, pour an equal quantity of ether and the specimen into a test-tube, close the opening of the tube, and shake thoroughly. After letting the tube stand vertically for a few minutes till the layers have separated, suck up the ether-layer with a pipette and put it into a watch-glass. Evaporate the ether; dissolve the residue in water. If lactic acid is present, it will give acid reaction with litmus or Congo-red, or show Uffelmann's reaction.—Leo. Diagnostik der Krankheiten der Verdauungsorgane. Berlin, 1890, S. 106.—Tr.]

be certain that the patient has not taken alcohol for some time, either in beverages or medicines (tinctures, fluid extracts, etc.).

I have constructed the following table to show the delicacy of the various reagents and the mutual relations and disturbing effects on the reactions of the acids, peptone, and salts. Detailed explanations are unnecessary, since I have already given all the necessary data in the early part of this lecture.

	Reaction Positive in the Presence of		
	Hydrochloric acid, per thousand.	Lactic acid, per thousand.	Butyric acid, per thousand.
Methyl-violet	0·24	4	5 to 6
Tropæolin	0·3	Over 10	Over 10
Smaragd-green	0·4	10	Over 10
Congo-red *	0·1	0·2	0·4
Günzburg's reagent	0·05	....	....
Boas's reagent	0·05	....	....
Mohr's reagent	1·0	....	....
Uffelmann's reagent	....	0·1	0·5

All the above reagents give qualitative but not quantitative results. To obtain the latter, which are not essential in daily practice, we are compelled to resort to complicated processes.

At the outset the questions must be answered: first, whether the amount of *free hydrochloric acid* is to be estimated; secondly, whether that of the *loosely combined hydrochloric acid* (see above, page 28)—i. e., that portion of HCl which, although secreted by the gastric glands, has entered into combinations with bases or organic substances; and, finally, whether the total quantity of HCl is to be ascertained. As has already been repeatedly stated, under normal conditions every time food is introduced into the stomach there is so abundant a secretion of hydrochloric acid that not alone are all of the above-mentioned affinities satisfied, but there is even an excess (the free HCl). Under pathological conditions free HCl is not infrequently absent; it must then be determined whether any of it has been produced in the stomach at all, or whether it has only been insufficient in amount. Thus the quantity of free hydro-

* Hösslin (*loc. cit.*) gives 0·02 as the lowest limit, but I agree with Boas (Deutsch. med. Wochenschr., 1887, No. 39) that a distinct blue color of the Congo paper first occurs when the proportion is as above.

chloric acid may vary under different conditions; hence the necessity of ascertaining its amount.

Estimation of Free Hydrochloric Acid.—This may be done approximately in the absence of other acids (especially lactic and fatty acids) by converting the acidity found by titration into that of HCl (see page 23). Mintz's method * is more exact; deci-normal soda solution is added [from a burette] to 10 c. c. of the filtered stomach-contents till Günzburg's reaction *no longer occurs;* here the quantity of alkali corresponds to the amount of free hydrochloric acid which is present. Mintz has estimated the limits of the Günzburg reaction to be 0·036 per mille HCl (i. e., 1 c. c. deci-normal soda solution to 100); he has also demonstrated by special experiments that even in mixtures of albuminous substances and hydrochloric acid the alkali combines *first* with the free HCl. For example, if the Günzburg reaction no longer occurs after adding 1·3 c. c. deci-normal soda solution to 10 c. c. stomach-contents, and is still positive when only 1·2 c. c. of the soda solution have been added, then the amount of free HCl, as calculated for 100 c. c. stomach-contents, equals 13 c. c. deci-normal soda solution (i. e., 12 + 1); this represents 0·047 per cent HCl. †

Estimation of Loosely Combined Hydrochloric Acid.—It is evident that in this way by reversing the process we can ascertain the amount of loosely combined hydrochloric acid in stomach-contents *containing no free hydrochloric acid.* A deci-normal hydrochloric-acid solution is added to this kind of stomach-contents till Günzburg's reaction is positive. Now, since the limit of this reaction is 0·036 HCl = 1 c. c. $\frac{1}{10}$ normal soda solution, then the difference between this and the amount of $\frac{1}{10}$ normal HCl solution represents the quantity of combined hydrochloric acid which was present. For example, if Günzburg's reaction was positive after adding 0·7 c. c. $\frac{1}{10}$ normal HCl solution to 100 c. c. stomach-contents, then 1 — 0·7 = 0·3 c. c. is the amount of acid which was already present.

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* S. Mintz. Eine einfache Methode zur quantitativen Bestimmung der freien Salzsäure im Mageninhalt. Wiener klin. Wochenschrift, 1889, No. 20; and 1891, No. 9.

† [13 × 0·003646 (1 c. c. $\frac{1}{10}$ normal soda solution = 0·003646 HCl) = 0·047398 per cent HCl.—Tr.]

Boas* and Mörner have somewhat modified this method; the stomach-contents are extracted with ether, and the limits of the reaction are then determined with Congo-red, either in solution or as test-paper [10 c. c. of stomach-contents are extracted with 100 c. c. ether]. If the former is used, 5 c. c. of a watery solution are added to an equal quantity of the filtrate of the stomach-contents; the mixture is titrated with $\frac{1}{10}$ normal soda solution till the blue fluid assumes a red color. The number of cubic centimetres of the soda solution added at once indicates the quantity of free hydrochloric acid which is present.

Another method is that suggested by Leo;† this is based upon the fact that calcium carbonate is not decomposed by acid phosphates, but with free hydrochloric acid it forms a neutral solution of calcium chloride.

The Estimation of Free and Loosely Combined Hydrochloric Acid.—The best practical method is that of Sjöqvist,‡ as modified by Salkowski.# If a mixture of organic acids and free or loosely combined hydrochloric acid be treated with barium carbonate, evaporated to dryness, and then reduced to ash, all the Cl combines as barium chloride, which is soluble in hot water. The organic acids are decomposed and form barium carbonate, which is insoluble in water. From this solution, which may also contain inorganic chlorine compounds, the barium chloride is precipitated as barium car-

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* Boas. Centralblatt für klin. Med., 1891, No. 2. [Also Boas's Diagnostik, etc., p. 134.—Tr.]

† Leo. Eine neue Methode für Salzsäurebestimmung im Mageninhalt. Centralblatt für die med. Wissenschaft., 1889, No. 26.

[This method is carried out as follows: Moisten a strip of blue litmus-paper with gastric contents and keep this as a standard. A few drops of stomach-contents are put in a watch-glass, and a small amount of powdered, *chemically pure* calcium carbonate added; stir up with a glass rod and test the reaction with blue litmus-paper. Compare this with the standard. If the litmus-paper no longer reddens, then the acidity was entirely due to free acid, and not to acid salts; if it is less red, then both were present; if there is no change, then there are only acid salts, while free acids are absent. If the stomach-contents have previously been extracted with ether to remove lactic and fatty acids, then, if free acid is found, it is hydrochloric acid.—Tr.]

‡ Sjöqvist. Eine neue Methode freie Salzsäure im Mageninhalte quantitativ zu bestimmen. Zeitschrift für physiologische Chemie, 1888, Bd. xiii, S. 1.

Fawizky. Ueber den Nachweis und die quantitative Bestimmung der Salzsäure im Magensaft. Virchow's Archiv, Bd. cxxiii, S. 292.

bonate by adding soda; it is collected on a filter and is once more converted into $BaCl_2$ by adding hydrochloric acid. The excess of hydrochloric acid is removed by evaporation to dryness; the dry residue, which has a neutral reaction, is dissolved in water, and the $BaCl_2$ is titrated with silver nitrate with the addition of potassium bichromate. One c. c. of the silver solution represents 0·001 sodium chloride, and the quantity of hydrochloric acid may be calculated according to the formula, $x : t = 36{\cdot}5 : 58{\cdot}5$, in which t = number of cubic centimetres of the silver solution used.

Accordingly, the examination is carried out in the following way: Ten c. c. of the filtered stomach-contents are mixed with about 0·5 gramme barium carbonate in a platinum capsule; the fluid is then evaporated to dryness and reduced to ash. After cooling the residue is dissolved by adding 50 to 75 c. c. boiling water and filtered. Several drops of a concentrated soda solution are added to the filtrate [until the entire $BaCl_2$ is converted into $BaCO_3$, which is thrown down as a flocculent precipitate]. Again filtration; the precipitate on the filter is collected and washed, and then dissolved in HCl and evaporated to dryness. The residue is dissolved in water and titrated with the silver nitrate solution as stated above.

The various manipulations in this test require a considerable length of time, yet the actual labor is not great; it is not as complicated as the modification proposed by von Jaksch,* in which the barium chloride is converted into barium sulphate and weighed as such.

Unfortunately, recent investigations by von Pfungen† and Leo‡ have shown that Sjöqvist's method is not free from sources of error, since the presence of large quantities of phosphates or sodium chloride may interfere with the accuracy of its results. However, if the quantity of these substances in the test-meal be restricted as far as possible, in spite of this disadvantage it is never-

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* Von Jaksch. Sitzungsbericht der Akademie der Wissenschaften in Wien, Bd. xcviii. [Also von Jaksch. Klinische Diagnostik. Translated by Cagney, p. 101.]

† Von Pfungen. Ueber den quantitativen Nachweis freier Salzsäure im Magensafte nach der Methode von Sjöqvist. Zeitschrift für klin. Med., Bd. xix, Supplementheft, S. 224.

‡ Leo. Beobachtungen zur Säurebestimmung im Mageninhalt. Deutsch. med. Wochenschrift, 1891, No. 41.

theless the best and most reliable method for estimating the quantity of hydrochloric acid combined with organic substances and that in a free condition.

A process which is even more complicated is that proposed by Hayem and Winter.* In a measured quantity of stomach-contents these investigators estimate:

a. The total chlorine.

b. The total chlorine minus that portion which is volatilized after prolonged heating at 100° C.

c. The fixed chlorides combined with mineral bases.

From these it follows that—

$a - b$ = free hydrochloric acid.

$b - c$ = hydrochloric acid combined with organic bases and ammonia.

$a - c = (a - b) + (b - c)$.

Hence each trial of this method requires three determinations of the amount of chlorine; in other words, many hours would be needed for the examination of a specimen of stomach-contents. The question arises whether the practical value of the result will repay one for the labor expended. In my opinion, this is not the case, because it is of no importance to know the quantity of chlorine combined with mineral bases, or the *absolute amount* of hydrochloric acid in combination with organic bases. It will be sufficiently accurate to know these values as ascertained with the combination of the methods of Sjöqvist and Mintz or Boas.

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* Hayem et Winter. Du Chimisme Stomacale. Paris, 1891. [See Amer. Journal Med. Sciences, September, 1891, p. 282.—Tr.]

LECTURE II.

METHODS OF EXAMINATION (*continued*).—DETERMINATION OF THE DIGESTION OF ALBUMEN AND STARCH.—ABSORPTION AND MOTILITY.—THE TECHNIQUE OF THE EXAMINATION OF THE STOMACH.

GENTLEMEN: The action of the digestive ferment pepsin on albumen is manifested by a series of characteristic derivatives—the albuminates—concerning which I shall now speak. In passing I wish to call your attention to the various well-known forms in which pepsin is artificially prepared by different manufacturers. I show you here a fine, dust-like powder, scales or lamellæ, and also so-called granules. Each of these preparations bears a label indicating its digestive powers—i. e., the amount of albumen which is dissolved by one part of pepsin. I shall, however, refrain from passing judgment upon the relative value of these preparations, since it always varies according to the care in the manufacture. First one factory, then another, heads the list; yet, taken all in all, the activity of these preparations does not vary much. Some years ago I examined and compared all of the various preparations,* but I do not know whether these results are valid to-day.†

The essence of the **digestion of albumen** consists in the well-known transformation of the various kinds of this substance, of which I shall only mention the more important varieties—egg-, serum-, and plant-albumen, fibrin, and casein—into a soluble and easily diffusible form, peptone. In another place‡ I have already

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* Ewald. Zeitschr. für klin. Med., Bd. i, S. 236.

† [Recently an excellent preparation has been put upon the market in the form of Fairchild's glycerin of pepsin; it is essentially a glycerin extract. It may be administered with dilute hydrochloric acid, and thus constitute an artificial gastric juice. It is also free from the disagreeable odor of many of the old pepsin products, and keeps indefinitely. The dose is from 5 to 30 drops.—TRANSLATOR.]

‡ Ewald. Klinik der Verdauungskrankheiten, I. Theil, 3te Auflage, S. 92, etc.

given an exact description of this change, and to-day I shall restrict myself to the practical deductions from the facts known to us. You know that between albumen at the beginning and peptone at the end of the process of albuminous digestion there exist certain intermediate bodies which are collectively known as the albumoses. Of these we are concerned only with syntonin, the product of neutralization, and propeptone or hemialbumose. Now the question arises, What significance have these bodies in the processes of digestion, and by what tests may they be recognized?

1. *Temperature.*—Fluid albumen and syntonin coagulate on warming—i. e., heating to about 70° C. [158° F.]. Propeptone and peptone are not coagulated by heat. If propeptone is precipitated from its solutions in the cold and is then heated, the precipitate redissolves, but is again deposited on cooling. Temperature has absolutely no influence on peptone.

2. *Biuret Reaction.*—If cupric sulphate is added to propeptone and peptone in an alkaline solution in the cold, an intense purple-red color is observed, the so-called biuret reaction. If caustic potash and dilute cupric sulphate are added to ordinary albumen and syntonin without warming, a more or less marked bluish-violet color is struck, which at all events may often be confounded with the biuret reaction. I have here a solution of peptone; I add some caustic potash, and then a little dilute cupric sulphate; you will observe a deep purple-red color, which is distinctly different from this bluish-violet color obtained in a similar way with a solution of pure albumen. The same is true of propeptone, as I can show you with this solution of Kemmerisch's meat peptone.

3. *Precipitation.*—Albumen and syntonin are precipitated by saturated solutions of sulphate of soda or common salt in an acetic-acid solution, hot or cold. Syntonin is precipitated from acid solutions as soon as it is neutralized. Propeptone in neutral solution is precipitated in the cold by a saturated solution of common salt or rock salt on adding strong acetic acid; it is soluble when heated. However, a portion remains in solution, and can only be precipitated by the addition of ammonium sulphate in substance or in concentrated solution. Peptones are not precipitated by the above nor by the following reagents which throw down albumen, syntonin,

and propeptone: cold or warm nitric acid, acetate of lead, acetic acid with ferrocyanide of potash, metaphosphoric acid, ammonium sulphate.

The behavior of the above-mentioned substances may be seen at a glance in the following tables:

- Coagulated by heat; no biuret reaction.
  - Albumen.
  - Syntonin.
  - → Precipitated by saturated solution of sulphate of soda or common salt and acetic acid, cold or warm.
- Not coagulated by heat; biuret reaction.
  - Propeptone.
    - → Precipitated cold by saturated solution of common salt and strong acetic acid.
  - Peptone.
- Precipitate albumen, syntonin, and propeptone.
  - Nitric acid, acetic acid.
  - Acetic acid and ferrocyanide of potash.
  - Acetate of lead.
  - Metaphosphoric acid.
  - Ammonium sulphate.
  - Mercuric chloride.
  - Phosphotungstic acid.
  - Phosphomolybdic acid.
  - Tannin.
  - Mercuric iodide.
  - → Precipitate peptone.

Now, what are the practical deductions from these results?

If gastric juice containing pepsin and hydrochloric acid be allowed to act on albumen, after a certain time the specimen ought to contain the various modifications of albumen, and, according to the nature and strength of the gastric juice, some or all of them ought to be present. The results of such an examination will give us an indication of the intensity of the digestive processes in the stomach. Accordingly, we first test whether the stomach-contents are coagulable by heat. If they are, albumen or syntonin, or both, may be present; if not, we may find propeptone or peptone. If the reaction is acid, and coagulation occurs on heating, we must neutralize. Should a precipitate be thrown down, it is syntonin. If this is filtered out and an equal quantity of concentrated common-salt solution is added to the filtrate, and then acidulated with acetic acid, any precipitate thrown down which is redissolved on heating is due to propeptone, and the biuret action must be positive. The latter precipitate is also removed by filtration; the filtrate is treated with acetic acid and ferrocyanide of potash; if no precipitate is obtained, and if the biuret test is positive, and if, furthermore, precipitates

are thrown down by tannin or the salts of the heavy metals, or by phosphotungstic acid, etc., then peptone is present.

Such would be the method of conducting an examination. But the question naturally arises, What is the practical value of such a demonstration of the various transformation-products of the digestion of albumen, and what conclusions can be drawn in regard to the pathology of the cases in question?

It is a peculiar fact that as soon as the digestion of albumen has begun as the result of the action of pepsin and hydrochloric acid, the biuret reaction may be obtained in a very short time. This may be due either to propeptone or peptone. Let us, therefore, briefly consider the *relations of propeptone to digestion.*

Is it absorbed as such, or is it simply a necessary preliminary stage of peptone? Concerning the former we know nothing; of the latter we can at least say that propeptone seems to be a very frequent but by no means a constant transformation-product in the digestion of albumen by pepsin and hydrochloric acid. On the other hand, by the simple action of hydrochloric acid upon albumen at the temperature of the body, syntonin as well as propeptone may be obtained. Since propeptone will give the biuret reaction as well as peptone, the simple application of this test, as has been done heretofore, will give no positive proof of the presence of peptone. The best way is to precipitate the propeptone.

As the result of investigations conducted in my laboratory, Dr. Boas* has shown that propeptone is absent in the digestion of meat, but is present in the digestion of plant albuminates and pure egg-albumen. Hence it is by no means an essential transformation-product of albumen. Nevertheless, its demonstration is important, since it is always present in the ordinary mixed diet, and the amount of it bears some relation to the energy of digestion. But, after all, our main object is to ascertain the rapidity of the peptone formation; this could be most readily accomplished by making a quantitative estimation of the amount of peptone formed during digestion. Unfortunately, up to the present time we possess no simple

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* I. Boas. Beiträge zur Eiweissveidauung. Zeitschr. für klin. Med., Bd. 12, Heft 3.

and reliable method for this;* and even if we did, it is questionable whether pathologically we would derive any benefit from it, since the formation of peptone rapidly reaches its maximum and then appears to be kept steadily at that point by special means. Yet this is by no means proved. According to our present knowledge, it is of considerable value to determine and estimate quantitatively not alone the final but also the intermediate products at any given stage of the digestion of albumen. The demonstration of propeptone is valuable for this purpose. The more marked the propeptone reactions are, the less the peptone which has been formed and eventually removed from the stomach.

Now we have found that in an ordinary diet, containing an abundance of plant albuminates, and after the test-breakfast, the digestion of albumen has progressed so far within an hour that propeptone is present only in traces, or usually is not to be detected at all; whereas in abnormally slow digestion it is still abundant at that period. We may also approximately estimate the amount of peptone by the intensity of the biuret reaction, provided we always use the same quantities of stomach-contents, caustic potash, and cupric sulphate, and compare it with the reaction given with a peptone solution of known strength. But it has been observed that the biuret reaction is equally intense where at the same time there is either no propeptone or where the amount of the latter is very variable. In other words, just as Cahn† found in the digestion of meat in dogs, the formation of peptone remains at a certain percentage, or is kept at that figure by the removal of the peptones over that amount; in such cases the only guide to the rapidity and amount of the transformation of the albumen is the amount of propeptone formed or still remaining. Naturally there are also cases in which the peptone formation does not reach the normal height, being thus entirely insufficient; for this reason it is advisable to make the test for propeptone even where the amount of peptone is apparently normal. However, according to recent

* [See Boas. Diagnostik, etc. 2. Aufl., p. 24.—Tr.]

† A. Cahn. Die Verdauung des Fleisches im normalen Magen. Zeitschr. für klin. Med., Bd. 12, Hefte 1 und 2.

investigations made by Dr. Gumlich and myself,* the formation of true peptone in the human stomach is only slight, and for the most part the transformation of albumen does not go beyond the albumoses. At all events, after the test-breakfast, as well as after larger meals, albumoses predominate in the stomach-contents, and these having been precipitated by ammonium sulphate, the biuret reaction is feeble and much less marked than this reaction was before the albumoses had been removed.

Let me give you a practical example of the use and value of the above:

I have here the filtrate of the stomach-contents of a ship-chandler from H., who has been under my observation for two years. There is a very strong suspicion of carcinoma of the stomach, yet no tumor can be demonstrated; and although the patient apparently digests his food well, neither has disturbance of appetite nor complains about his digestion, yet he has emaciated progressively. Repeated examinations failed to show free hydrochloric acid in the gastric contents. In this filtrate, also, there is no free hydrochloric acid, although the reaction is acid and the biuret reaction is well marked. Let us now see whether the latter is due to peptone or propeptone. I neutralize carefully, add an equal quantity of concentrated common-salt solution, and then a little pure acetic acid. There is not the slightest trace of a turbidity; hence no propeptone can be present. On the other hand, heating causes a slight coagulation of albumen. Thus this specimen has absolutely no free hydrochloric acid, nor have repeated examinations in the past few years at any time revealed its presence; and yet this gastric juice can form peptone, and, as it seems, in a fair quantity. You will remember that the production of peptone may occur in the presence of other acids, especially lactic acid;† with Uffelmann's reagent I can show you large quantities of lactic acid in this specimen. Hence this case proves that pepsin may be secreted or formed by the gastric glands independently of hydrochloric acid, as I have already shown in another patient, and as Cahn has demonstrated in dogs which have been deprived of chlorides in their food.‡

The most striking feature of the pepsin and hydrochloric acid digestion is the liquefaction of the solid albumen (*proteolysis*). The intensity of this process may be estimated approximately by noting how quickly coagulated albumen is liquefied. We may do this by adding small pieces of coagulated albumen or fibrin to the filtered

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* Ewald and Gumlich. Berl. klin. Wochenschr., 1890, No. 44.

† Ewald. Klinik der Verdauungskrankheiten. I. Theil, 3. Auflage, S. 110.

‡ Ewald. Ein Fall von Atrophie der Magenschleimhaut. Berliner klin. Wochenschr, 1886, No. 32. — Cahn. Die Magenverdauung im Chlorhunger. Zeitschrift für physiolog. Chemie, 1886, Bd. x.

contents of the stomach, and observing the rapidity of their liquefaction at the temperature of the body.

Coagulated white of egg is cut into thin lamellæ with a double section knife [Valentine's knife], and uniform disks are cut out with a cork-borer or some similar instrument with a round, hollow cutting edge. [A short piece of glass tubing will do.] By preserving these disks of albumen in glycerin they are ready for use at any time. In order to determine in a given specimen of stomach-contents whether the pepsin or hydrochloric acid is present in too great or too small amount, an equal quantity of the filtered specimen is placed in four small test-tubes and one or two disks of albumen put into each. To the first nothing else is added; to the second, enough hydrochloric acid to make a solution of about 0·3 to 0·5 per cent; this is accomplished by adding two drops of hydrochloric acid (Ph. Germ.)* to 5 c. c. [f ʒ j¼] of stomach-contents. To the third we add a definite quantity of pepsin, about 0·2 to 0·5 gramme [gr.iij to gr. vijss.]; to the fourth add both hydrochloric acid and pepsin. The test-tubes are placed in an incubator kept at about 100° Fahr.; from time to time we look to see how far the liquefaction of the disks of albumen has proceeded. The rapidity of this liquefaction will at once inform us whether digestion would have occurred without having added anything, or whether acid or pepsin or both were necessary. Furthermore, it will also inform us if by adding more hydrochloric acid to the filtered gastric juice we have made the acidity too strong. In this way we can judge which factor is at fault. But we must not forget that after the amount of peptone has reached a certain percentage its further production is retarded, or even suspended, so that an apparently slow reaction may be really due to a very active gastric juice. In this, as in all laboratory experiments on digestion, we must never forget the great difference between them and the natural processes, and that in our flasks and test-tubes we can never imitate the absorption on the one hand, and the removal to the intestines on the other, by which the stomach strives to maintain a fairly uniform

* [Acidum hydrochloricum of the German Pharmacopœia is somewhat feebler than that of the U. S. Pharm.; the former has 25 per cent pure anhydrous acid, the latter 32 per cent.—Tr.]

degree of concentration of its contents; hence all our tests are fundamentally deviations from Nature, and are thus to a certain degree pathological.

Günzburg* and Sahli† have proposed another method to ascertain the rapidity and intensity of the digestion of albumen and fibrin. A small quantity of potassium iodide, 0·1 to 0·2 gramme [gr. jss. to iij], is inclosed in a gelatin capsule or gelatin-coated pill or in a thin gum packet fastened with a string of fibrin; if the drug is introduced into the stomach in one of these ways, the iodide is liberated, and can be absorbed only after the envelope of fibrin has been digested. The length of time required for the appearance of the potassium iodide in the saliva or urine is said to indicate the thoroughness of gastric digestion. [See p. 52.] Unfortunately, not alone is the absorption of potassium iodide very variable, but also the rapidity of the digestion of the fibrin capsule does not bear any direct relation to the presence of free hydrochloric acid in the stomach; for in some cases this occurs as rapidly in the absence as in the presence of this acid. Therefore, this method also is not adapted to give reliable data concerning the digestive activity of the stomach.

The gastric glands secrete not alone pepsin but also **rennet** (*Labferment*), which causes the coagulation of milk. Its presence may be detected by taking a small quantity, 10 c. c. [f ʒ ijss.], of boiled milk having a neutral reaction, and adding an equal amount of carefully neutralized filtered stomach-contents; the mixture is then placed in an incubator at 100° Fahr., and, after a short time, 10 to 15 minutes on an average, the milk has coagulated and separated into a cake of casein and clear serum. [Leo‡ uses 10 c. c. of *raw* milk, and only 2 to 5 drops of stomach-contents. On account of the relatively small quantity of the latter, neutralization of the mixture is unnecessary. Raw milk is used because it coagulates

* Günzburg. Ein Ersatz der diagnostischen Magenausheberuung. Deutsch. med. Wochenschr., 1889, No. 41.

† Sahli. Ueber eine neue Untersuchungsmethode der Verdauungsorgane und einige Resultate derselben. Correspondenzblatt der schweizer Aerzte, 1889, p. 402, and 1891, p. 126.

‡ [Leo. Diagnostik, etc., 1890, p. 119. For quantitative tests for rennet, and also literature on this subject, see Boas, *loc. cit.*, pp. 26 and 164.—Tr.]

ten times more rapidly than cooked milk. With this modification it occurs from one minute to several hours after being placed in the warm chamber. The coagulation by rennet is the characteristic cake of casein floating in clear serum, and is not to be confounded with the flaky or lumpy coagulation by acids.]

The rennet ferment or enzyme (*Labenzym*) exists also in a preliminary stage as a pro-enzyme or rennet zymogen (*Labzymogen*); this itself has no action upon milk, but by adding acids, especially hydrochloric acid, and also calcium chloride while warm, it is converted into the typical ferment. This will become evident in the filtrate of a gastric juice which either has no spontaneous coagulating action or in which the ferment has been destroyed by adding an alkaline carbonate. If this filtrate be digested with dilute hydrochloric acid, or if a 5-per-cent calcium-chloride solution be added, it will curdle milk. In the stomach, while fasting, and at the beginning of digestion, the zymogen is only found, but later both it and the ferment are present. An acid reaction or the presence of free acid in the original filtrate of the stomach-contents is not absolutely necessary for the curdling action of rennet, since it has been demonstrated when free acid was absent, or even when the reaction was neutral.

Among the various investigations on rennet in human beings I would call especial attention to the works of Raudnitz, Boas, Johnson, Klemperer, and C. Rosenthal.*

Digestion of Starch and Sugar.—You will remember that in the organism starch is converted into grape sugar (dextrose) by the action of the salivary ferment, ptyalin, and that cane sugar, as shown by Leube, is changed into invert-sugar, a mixture of cane and grape sugar. We know that this sugar fer-

* Raudnitz. Ueber das Vorkommen des Labferments im Säuglingsmagen. Prager med. Wochenschr., 1887, No. 24.—Boas. Labferment und Labzymogen im gesunden und kranken Magen. Zeitschr. für klin. Med., Bd. 14, S. 249.—Johnson. Studien über das Vorkommen des Labferments, etc. Ibid., S. 240.—Klemperer. Die diagnostischer Verwerthbarkeit des Labferments. Ibid., S. 280.—C. Rosenthal. Ueber das Labferment nebst Bemerkungen über die Production freier Salzsäure bei Phthisikern. Berl. klin. Wochenschr., 1888, No. 45. [The result of these investigations is that rennet, like pepsin, is a constant constituent of the gastric juice; its absence indicates atrophy of the gastric mucosa; otherwise it has no practical significance. Leo, *loc. cit.*, p. 120.—Tr.]

ment exists not alone in the saliva, but also in small quantities in very many tissues, and probably also in the mucus which is usually sparingly secreted in the stomach. It was formerly supposed that ptyalin acted on the amylaceous substances only in the mouth during mastication. At all events, the transformation of starch into sugar by ptyalin occurs very rapidly indeed; yet this would not suffice to allow the ferment to act thoroughly on the more or less compact masses swallowed. The saliva which is swallowed continues its action on the amylaceous substances even in the stomach, as has been shown by von den Velden.* The only question is, How long does this process continue? We know that pytalin acts best in neutral or feebly alkaline solutions, but is checked in acid fluids. It has been shown that the formation of sugar ceases as soon as the amount of acid (reckoned for hydrochloric acid—a point of vital importance to us) reaches 0·01 per cent or more; but in smaller quantities the action of the ferment is even somewhat accelerated (Chittenden). With lactic acid the acidity must be much higher, namely, 0·1 to 0·2 per cent, and with butyric acid or fatty acids may be even higher than this, up to 0·4 per cent. But, as first shown in pigs and horses by Ellenberger and Hofmeister,† and in human beings by Ewald and Boas, the simple taking of raw starch will cause the secretion of hydrochloric acid, to which is later added the lactic acid produced by fermentation. This naturally occurs also in a mixed diet with amylaceous substances. As normally the acidity of the stomach-contents gradually becomes more marked as more hydrochloric acid is secreted, we will hence observe an initial stage in which starch is still converted into sugar; but gradually the process becomes feebler, and finally ceases entirely. Thus the conversion of starch into sugar is not a simple uniform process, but, like the digestion of albumen, there are intermediate products, the dextrins and maltose.‡

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* R. v. d. Velden. Ueber die Wirksamkeit des Mundspeichels im Magen. Deutsch. Arch. für klin. Med. Bd. 25, S. 105.

† Ellenberger und Hofmeister. Arch. für wissensch. und prakt. Thierheilkunde, viii, S. 395, and xii, S. 126.—Pflüger's Archiv, Bd. 44, S. 484.

‡ See Ewald. Klinik, etc., 1. Theil, 3 te Auflage, S. 55 *et seq.* Also a detailed account in Ewald: Ueber die Zuckerbildung im Magen und Dyspepsia acida. Berl. klin. Wochenschr., 1886, No. 48.

The two important varieties of dextrin are erythrodextrin and achroodextrin. Maltose is to a certain extent an intermediate body between starch and dextrin on the one hand, and grape sugar on the other.

Starch is recognized by the familiar deep-blue color struck with iodine or a mixture of iodine and potassium iodide—i. e., Lugol's solution :

Iodi.....	0·1 [gr. jss.]
Potass. iodidi.....	0·2 [gr. iij]
Aq. destillat.....	200·0 [f ʒ vj ʒ vj]

This reaction becomes less marked in proportion to the amount of starch converted into dextrin and sugar. A solution of erythrodextrin, as its name indicates, no longer gives a blue color, but purple ; solutions of achroodextrin, maltose, or dextrose assume no other color than the yellow of the iodine solution. The latter substances have a closer relation to iodine than dextrin, and the latter again more than starch ; hence, in a mixture of these bodies, the first drops of iodine solution added cause either no color at all or only a transitory one, and it is only after adding more iodine that the purple of erythrodextrin or the blue tinge of starch is observed.

As was shown by von Mering in laboratory experiments, and by myself on human beings, in the transformation of starch into sugar by ptyalin, the smaller portion only is converted into dextrose, the greater into maltose. The latter passes on into the intestines, where it is changed into dextrose (Brown and Heron).

The practical result of these conditions is the following : If the amylaceous transformation proceeds normally in the mouth and stomach, after a time, within an hour at least, so much starch has been changed into achroodextrin, maltose, or dextrose that the addition of small quantities of Lugol's solution to the filtered stomach-contents no longer produces any changes of color. The occurrence of a purple (erythrodextrin) or a blue color (starch) shows that the sugar transformation has been incomplete. This may be due either to a deficiency of ptyalin or to a too rapidly increasing acidity or an original hyperacidity of the stomach.

If, then, we should be unable to titrate the gastric contents—

supposing, for example, that we had only a very small quantity—such a result would of itself indicate a hyperacidity of the gastric juice. But under such circumstances we might also suspect a deficiency of ptyalin in the saliva, and hence a normal acidity of the stomach. Yet this does not appear to be the case. For a long time I have tested the fermentative power of saliva in patients with dental caries, inflammatory lesions in the mouth, angina, diphtheria, carcinoma of the tongue, and similar conditions, but never have I found a saliva which could not convert starch into sugar; yet I must not fail to add that no quantitative examinations were made. It appears that saliva does not lose any of its ferment, but pepsin seems now and then, although very rarely, to be absent from the gastric juice. Sugar may always be found in the stomach-contents after the test-breakfast, since a certain amount is contained in it.

There are still two factors to be discussed—*the absorptive power of the stomach and its motor functions*—two points which have recently been underestimated because they have been overshadowed by purely chemical examinations.

Absorption by the gastric mucous membrane is tested with potassium iodide. Penzoldt* recommends giving it in small doses of 0·1 gramme [gr. jss.] in capsules which have been carefully wiped off, so that none of the drug adheres to the outside of the capsule. A capsule is taken, and the moment iodine appears in the saliva is determined by means of the well-known reaction with starch paste. Filter-paper is moistened with starch paste and dried; after the capsule is taken, from time to time, say every five minutes, a little of the patient's saliva is placed upon the dried filter-paper. Then by adding some fuming nitric acid (one or two drops) the appearance of a blue color will indicate exactly when the iodine appears in the saliva. Normally this occurs in ten to fifteen minutes; but in processes where absorption by the stomach is slow or fails entirely, this reaction occurs much later, being delayed a half to a whole hour or even longer. At my request, Dr. Boas investigated this

* Penzoldt und Faber. Resorptionfähigkeit des menschlichen Magens. Berl. klin. Wochenschr., 1882, No. 21.

subject; his results, as well as those of many others and myself, agree in confirming them, and I must therefore contradict the statements of J. Wolff, and regard periods of absorption of one to one and a half hours as decidedly pathological. Consequently, this procedure offers us a simple means of determining the absorptive powers of the stomach. [See also p. 48.]

Another question is, How can we test the **motility or motor function of the stomach?** The determination of the normal peristalsis and proper movement of the ingesta in and expulsion out of the stomach is very important; for a number of observations which have recently accumulated indicate more and more that a stomach whose chemical functions are more or less altered may nevertheless—I will not say completely, but almost so—fulfill its digestive duties, so that this deficiency in the chemical processes may be compensated by the motor function, and hence may effect the expulsion of the chyme from the stomach at the proper time.

I have had under my observation for three years a foreign gentleman whose stomach-contents I have examined several times yearly, and yet have never been able to detect free hydrochloric acid and pepsin. He goes to Kissingen every summer, feels tolerably well, eats large dinners, pursues his occupation; and yet I must confess that without exception hydrochloric acid and pepsin have been absent in every test made at various intervals after eating different kinds of food, both the test-breakfast as well as larger meals. Dr. L. Wolff and myself * have published analogous cases, and recently I have had a similar experience in a female patient upon whom gastrotomy was performed for carcinoma of the œsophagus. From this we may infer that under certain circumstances the secretory function of the stomach is not essential to maintain life, providing that the lesion in the stomach does not of itself imperil life by a general intoxication, but that under these conditions the intestinal digestion seems to vicariously assume the entire burden. This is plausible, since the chemical processes of digestion are doubly provided for: two secretions digest starch—i. e., saliva and

* L. Wolff und Ewald. Ueber das Fehlen der freien Salzsäure im Mageninhalt. Berl. klin. Wochenschr., 1887, No. 30; and Ewald, ibid., 1887, No. 49, Verhandlungen des Vereins für innere Medicin.

the pancreatic juice; albumen may be peptonized at two places, the stomach and intestines; and fats may be emulsified by the pancreatic juice and bile. The intestine is thus capable of acting vicariously for the stomach, if necessary. Similar conclusions have been reached by other writers. But Jaworski has gone to extremes in maintaining that the chemical functions of the stomach play a subordinate part, and that the stomach is nothing more than a store-room and warming-place where the food may enter and be admitted to the intestine as through a sluice. This is a wild speculation, which brings us back to the old Hippocratic doctrine of the *coctio ciborum*, the cooking of the food by the animal heat.

Salol Test.—Up to recent times we had no suitable method for determining the motor function of the stomach. Leube's proposition to estimate the duration of digestion—i. e., to determine after a definite average time of six to seven hours after a large meal, or two to two and a half hours after Ewald's test-breakfast, whether solid contents were still to be found in the stomach—is subject to too many physiological variations to permit any reliable deductions. And the great practical objection is that it requires the use of the stomach-tube. Absorption as well as motion is involved. For the separate determination of the latter I have proposed the use of salol.* Salol is a compound of phenol and salicylic acid—a phenol ether of salicylic acid which, according to Nencki, is not changed by acids but is converted by the action of the pancreas into salicylic acid and phenol. Supposing this to be true, salol would be a splendid means of determining not alone how rapidly substances pass from the stomach into the intestine, but also whether the action of the pancreas is normal—a subject which is still enveloped in darkness. With these premises, Dr. Sievers, of Helsingfors, and myself undertook a series of observations which showed that salol is decomposed by relatively feeble alkaline fluids, but that it is not decomposed when introduced into the stomach or when mixed outside of this viscus with acid stomach-contents or artificial digestive mixtures with pepsin and hydrochloric acid. The splitting up of salol into

* Sievers und Ewald. Zur Pathologie und Therapie der Magenectasien. Therapeutische Monatshefte, August, 1887.

salicylic acid and phenol, and the appearance in the urine of salicyluric acid, the product of the decomposition of salicylic acid, will indicate that the salol has actually passed out of the stomach.

Normally, salicyluric acid will appear in the urine, 40 to 60, at most 75 minutes after taking one gramme [gr. xv] of salol, which has been given preferably during the course of digestion. Hence delay in its appearance will indicate a retardation in the passage of food into the intestines. Salol is a white, tasteless powder which is easily administered; it is given in capsules; gelatin-coated pills might also be used, but these sometimes pass unchanged through the intestines, and pills may easily remain an abnormally long time, or at least for varying periods, in the folds of the gastric mucous membrane. The great advantage of salol resides in the fact that it is thoroughly mingled with the stomach-contents and certainly participates in their movements. Salicyluric acid is easily recognized in the urine by the violet color produced on the addition of neutral ferric chloride solution. To detect the earliest trace of it, acidulate the urine with hydrochloric acid and extract with ether; the salicyluric acid combines with the ether, and may be easily detected in the ethereal extract. A simple method is to place a drop of urine on a piece of filter-paper, and then let a drop of a 10-per-cent ferric-chloride solution fall upon the moistened spot on the filter-paper. The edge of the drop will assume a violet color in the presence of even the smallest trace of salicyluric acid. These papers may be dried and preserved, and in this way one may easily compare the reaction in the same patient at various times.

Unfortunately, in this method the time of the decomposition of the salol depends on the occurrence of the neutral or alkaline reaction of the intestine; even under normal conditions this may vary, since it depends on the changeable reaction of the chyme and the quantity of bile and pancreatic juice which reaches the intestines. We (Sievers and Ewald) thought that we could exclude this source of error by having empirically calculated the above average length of time; and, in fact, *in the great majority* of our experiments this period, 60 to 75 minutes after taking the salol to the beginning of this reaction in the urine, proved to be constant. But this constancy has been questioned by other observers. For this reason

Huber* has estimated the time which elapses from the taking of the salol to the complete disappearance of the reaction in the urine. In healthy persons this excretion lasts 24 hours; in patients with enfeeblement of the motor functions of the stomach it lasted 48 hours, or even longer. Yet even here it is impossible to definitely ascertain how much of this time is due to tardy movements of the stomach, and how much to delayed intestinal absorption. However, Silberstein,† unlike Pal and Decker,‡ has obtained favorable results with this method; in 26 cases of gastric dilatation and in 12 cases of atony of the muscular fibers of the stomach the excretion of salicyluric acid lasted till the second day—i. e., 30 hours or more. The condition of the bowels, diarrhœa or constipation, appeared to exert no influence, although *a priori* this would seem to be very improbable; for in diarrhœa the intestinal contents are certainly evacuated more rapidly; hence the salol passes through the intestines much more rapidly than under normal conditions. To carry out Huber's test, one gramme [gr. xv] of salol is given, and the urine is examined 24 to 30 hours later. If salicyluric acid is still present at the latter period, or even later, we may with tolerable certainty infer a disturbance of the muscular activity of the stomach.#

An objection was raised that although the salol might not have been decomposed in the stomach, yet it could have been absorbed as such, enter the blood, and be altered there and then be excreted. This argument has been disproved by the following experiment: We took a dog, placed double ligatures about the pylorus, and then gave the animal some salol; three hours later the dog was killed, and up to that time not a trace of salicylic or salicyluric acid could be detected in the urine. This is an absolute proof that salol is not absorbed by the stomach.

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* A. Huber. Zur Bestimmung der motorischen Thätigkeit des Magens. Münch. med. Wochenschr., 1887, No. 19.

† Silberstein. Deutsch. med. Wochenschrift, 1891. No. 9.

‡ Pal. Ueber die Verwerthung der Salolspaltung zu diagnostischen Zwecken. Wiener klin. Wochenschr., 1889, No. 48.—Decker. Zur Frage des diagnostischen Werthes des Salols bei motorischen Insufficienz des Magens. Berl. klin. Wochenschrift, 1889, No. 45.

[Recently a death has been reported from the use of this method. See London Lancet, May 23, 1891. Such an accident must be regarded as a very rare event.—Tr.]

Oil Test.—Klemperer* has proposed another method for determining the motor activity of the stomach. He pours a definite quantity, 100 c. c. [f ℥ iij ʒ ij], of pure olive oil into the empty stomach which has previously been washed out, if necessary; two hours later the stomach is aspirated, and whatever oil is left is removed as thoroughly as possible, till only an insignificant trace remains. The difference between the original quantity of oil and that aspirated is used by him as an indication of the motor function of the stomach. However, even Klemperer himself admits that this method can not be always used in general practice, because it is complicated and objectionable to patients. He simply proposes to use it to discover certain typical forms of motor insufficiency which are of themselves so characteristic that, having once demonstrated them by the oil method, its further use would be unnecessary. The future will show how far this object will have been accomplished; at all events, his results thus far concerning the influence of certain drugs upon the movements of the stomach agree very well with the conclusions arrived at with the salol method.

Finally, I must state that **bile** may be detected in the contents of the stomach by the greenish tinge it imparts, or by Gmelin's test. It is also characteristic of biliary pigment that the bright yellow *débris* left upon the filter upon filtering the stomach-contents after the test-breakfast, and especially that portion at the edge of the filter, assumes a greenish tinge by oxidation after prolonged exposure to the air.

This concludes the various chemical methods of examination of the diseased stomach. Their significance in the diagnosis and treatment of the diseases of the stomach will be distinctly stated on all occasions in the following discussions. As far as I am free from an overestimation of these methods, as you have already observed in my opening remarks, so sure, nevertheless, am I that in the future we may confidently expect many valuable additions to our stock of knowledge from the field of investigation just inaugurated.

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* Klemperer. Ueber die motorische Thätigkeit des menschlichen Magens. Deutsche med. Wochenschr., 1887, No. 47.

The physical methods of examination, the second great group of our diagnostic aids, I can only speak of here in so far as they have a direct bearing upon the examination of the stomach, or are connected with it in some peculiar manner. Moreover, in the description of the various diseases, I shall have many opportunities to speak of percussion, auscultation, inspection, etc., so that I shall now restrict myself to the following technical factors or aids. [See pages 172 *et seq.*]

1. **Palpation.**—Of all the various means of examining the abdominal organs this is undoubtedly the most important. Whoever can palpate well, and has a delicate sense of touch, possesses an advantage in diagnosis which is not to be overestimated. Naturally there must always be a combination of the tactile impression and the mental process which will enable the observer at that particular moment to draw upon the whole range of his experience and to use it upon the case in question; or, to use a figure of speech, which will enable him to look through the abdominal walls and direct his fingers. For example, the great clinician von Frerichs, who possessed a marvelous certainty and skillfulness in palpation, was certainly greatly aided by this. But a proper technique is very important here, and, as I so often see errors committed and examinations rendered difficult and uncertain, I shall be pardoned if I call attention to several very well known points: Never palpate with the hand held perpendicularly or obliquely to the abdominal wall; gradually and carefully go deeper by small rotatory movements in a horizontal plane. Place your hands flat upon the abdomen, and only press down gradually and with very gentle pressure by bending the end phalanges. In this way we not alone prevent the contraction of the abdominal muscles whose edges have caused errors and uncertainty in even very experienced clinicians, but we also obtain a much better perception of the site, size, and form of any peculiar conditions beneath the abdominal wall; and, finally, last but not least, we cause a minimum of discomfort and pain to the patient. Here the same considerations are true as in percussion. As is well known, differences of tone which are perceptible with gentle percussion are overlooked when it is forcible. It is hardly necessary to state that under certain circumstances firmer

pressure may be needed in palpation, and a stronger stroke may be required in percussion, yet such cases always have peculiar features which distinguish them from the ordinary ones. Sometimes it may be of great advantage to supplement the palpation in the dorsal and lateral posture by examining the patient in the knee-elbow position. Movable tumors will then sink against the anterior abdominal wall, and may be recognized as such.

2. **Distention of the Stomach and Intestines with Air.** — The method of distending the stomach with carbonic-acid gas generated *in loco* was introduced by von Frerichs, and since then has been in general use. Von Ziemssen,* following the American method, applied it also to the intestines by administering per rectum bicarbonate of soda and some organic acid; we may also employ carbonic-acid gas already generated outside of the body—for example, from an inverted siphon of mineral water (Schnetter).† These methods suffer from the disadvantages that we have no control over the amount of gas produced after the salts have been introduced into the stomach or intestines, that disagreeable accompanying symptoms frequently arise from the irritation of the carbonic-acid gas upon the walls of the stomach or intestines, and that, even though varying quantities of gas are needed for different persons, the degree of tension produced can not be regulated at will nor increased at a given moment. For these reasons it is better to use the method recently recommended by Runeberg,‡ which has long been used by Oser# and myself, and which consists in introducing a stomach or rectal tube, and then insufflating air with the double bulbs of a spray apparatus. Frequently there are also other good reasons for introducing the tube in a given case, and this does away with any objections against a special passage of the tube with its accompanying inconveniences, although the latter are really too insignificant to have any weight. Runeberg says cor-

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* V. Ziemssen. Die künstliche Gasaufblähung des Dickdarms zu diagnostischen und therapeutischen Zwecken. Deutsch. Arch. für klin. Med., Bd. 33, S. 235.

† Schnetter. Zur Behandlung der Darmverschliessungen. Deutsch. Arch. für klin. Med. Bd.. 34, S. 638.

‡ W. Runeberg. Ueber künstliche Aufblähung des Magens und des Dickdarms durch Einpumpen von Luft. Deutsch. Arch. für klin. Med., Bd. 34, S. 460.

Oser. Die Neurosen des Magens. Wien, 1885, S. 10.

rectly: "In endeavoring, for example, to estimate exactly the size and situation of a markedly dilated stomach it is by no means an easy task to obtain a suitable degree of distention by generating carbonic-acid gas. On the other hand, this may be very conveniently and easily accomplished by this method of pumping in air." The same is true of the intestines, especially of the transverse colon. Any excess of air pumped in escapes alongside of the tube, or is easily expelled by a reactive contraction of the stomach as soon as the patient experiences a marked tension of that viscus. In using carbonic-acid gas the reverse usually occurs, since the irritation of the gas causes a spasmodic contraction of the cardia, so that the patient must exert himself more vigorously to expel it; furthermore, the pylorus may relax more readily than the cardia, and the gas may then pass on into the small intestines. I have never observed the condition described by Ebstein as insufficiency of the pylorus, in which the gas generated in the stomach passes rapidly into the duodenum; I believe that conditions in which the pylorus is not relaxed at first, but only during the generation of the carbonic-acid gas, are due to the causes above mentioned. It is true Schütz* has had just the reverse experience of observing the air pumped in escape rapidly into the intestine, but it seems to me that this was an exceptional case, which does not agree with the experiences of Oser† and of myself. Insufflation of the stomach and intestines may be combined. Recently Behrens‡ called attention to the value of the latter method for detecting tumors which might be present in the abdominal cavity. According to my own experience, the quantity of air to be pumped in through the rectum is very variable, and the same is true of the distinctness with which the distended coils of intestines may be seen. I have always been struck by the amount of air which could be pumped in through the anus without again escaping, providing, of course, that there is no marked accumulation of fæces. Where the latter exists, and in strictures

* E. Schütz. Wanderniere und Magenerweiterung. Prag. med. Wochenschr., January 14, 1885.

† Oser. Die Ursachen der Magenerweiterung. Wiener med. Klinik, 1881, S. 4.

‡ O. Behrens. Ueber den Werth der künstlichen Auftreibung des Dickdarms mit Gasen und mit Flüssigkeiten. Göttingener Inaugural Dissertation. Helmstädt, 1886.

and stenoses of the lower portion of the intestine, the air is soon expelled, together with foul-smelling gases. This feature was strikingly illustrated in a recent case of compression of the descending colon by a neoplasm.

3. **Distention of the Stomach with Water.**—A somewhat similar but less convenient idea was embodied in the plan proposed by Piorry, but made especially well known by Penzoldt* to determine the site of the lower border of the stomach by filling that viscus with water. As water sinks to the lowest part of the stomach, in a sitting or standing posture, a large quantity of fluid introduced into the organ will indicate the course of the greater curvature by a curved line of dullness with the convexity downward—providing that the transverse colon contains air; and by pouring in and siphoning out larger quantities, about one litre [quart], we will prevent mistaking it for neighboring organs, tumors, etc., having a dull percussion note. Further details concerning this method, and also a modification proposed by Dehio, will be discussed while speaking of dilatation of the stomach.

4. **The Deglutition-murmurs** (*Schluckgeräusche*), as diagnostic aids. At another place† I have spoken of the nature and character

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* Penzoldt. Die Magenerweiterung. Erlangen, 1877.

† Ewald. Klinik der Verdauungskrankheiten, I. Theil, 3te Auflage, S. 67 to 70. [As these murmurs are quite frequently referred to in the following pages, this brief extract of the author's views as to their nature and origin has been added. At the beginning of swallowing a murmur is propagated from the pharynx into the œsophagus; this sound has no significance whatsoever. The true murmurs are the *Durchspritzgeräusch* and the *Durchpressgeräusch*. Ewald thinks it much better to call them simply the first and second murmurs respectively. The *first murmur* (*Spritzgeräusch*) occurs almost immediately after the beginning of deglutition, and is a hissing sound as if the fluid were being directly squirted into the stethoscope Some time after, usually six to seven seconds, the *second sound* (*Pressgeräusch*) is heard; this is a series of tones rapidly following one another, either gurgling, clucking, sprinkling, or splashing. These murmurs are heard only near the cardia; the best site is just below the xiphoid cartilage; this at once distinguishes them from the sounds transmitted from the pharynx, which may be heard all along the œsophagus. The first sound is only heard rarely: its occurrence is said to denote a relaxation of the cardia, and the direct passage of the food into the stomach; the second is quite constant, and is absent only when the first is heard. Its nature is not so evident: some (Kronecker) claim that it is due to the audible vibrations of the cardia which are caused by the passage of the food over it; others (Zencker, Quincke, Ewald, Dirksen) assert that it is simply a result of the pressing through of the air which has been swallowed with the food.

of these murmurs, and shall simply say here that they give no positive indications in the diagnosis of gastric diseases. Meltzer* claimed that the so-called *Schluckgeräusch* was due to a relaxation of the cardia, and occurred as a specific symptom of old syphilis, phthisis accompanied by mild vomiting, neuroses of the cardia, etc. The inconstancy of the phenomenon was shown by Dirksen † and myself. I have never observed any constant and characteristic change in the intensity or quality of these murmurs, either in paralytic spinal lesions or dilatation of the stomach, or in any other condition which at first sight might seem to include this phenomenon. On the other hand, *typical and of diagnostic value* is the *absence* of the deglutition-murmurs in complete or almost complete closure of the cardia, whether the obstruction be above or below the cardia. Yet this negative proof must be determined positively by repeated examinations, since the murmur is now and then absent in healthy persons.

5. Another method of examination requiring a few words is that inaugurated chiefly through the labors of Mikulicz—**gastroscopy,** or the direct visual examination of the mucous membrane of the stomach with a specially adapted instrument, the *gastroscope.* Unfortunately, the simple mention of this author's name almost exhausts the literature of the subject, for the instrument, as constructed by Leiter (of Vienna), is so expensive and at the same time so difficult to manipulate, unless both patient and physician have been well trained, that its use has been very limited. The results which Mikulicz ‡ obtained in carcinoma of the pylorus are of diagnostic interest. In the normal stomach the pylorus appears as a long slit or a triangular, oval, and often a circular opening, surrounded by a ring of bright-red folds and projections of mucous membrane, which are in active motion and show an infinite number of changes

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These sounds were first mentioned in 1864 by Natanson, and were carefully studied by Zencker and also by Meltzer. The literature of the subject may be found in Ewald, *loc. cit.*, p. 92.—Tr.]

* Meltzer. Schluckgeräusche im Scorbiculus cordis und ihre physiologische Bedeutung. Centralbl. f. d. med. Wissensch., 1883, No. 1.

† H. Dirksen. Beitrag zur Lehre von den Schluckgeräuschen. Inaug. Dissert., Berlin, 1885.

‡ Wiener med. Wochenschrift, 33te Jahrgang, S. 748.

of form. But in neoplasms at the pylorus this region is smooth, pale, without the above-described folds and projections, and absolutely motionless. This would thus be a valuable aid in diagnosis, had not Pribram* reported a case of pyloric carcinoma — at all events, without gastroscopic examination, in which there were active movements of the tumor, i. e., a change in its size synchronous with active contractions of the whole stomach.

The use of the *gastrodiaphane* has been suggested by Einhorn.† This instrument consists of a small electric light, which is introduced into the stomach; the contours of this organ are outlined by the light shining through the gastric wall and the abdominal parietes. Whether this procedure will be of any practical value must be determined by experience. Similar experiments were made on animals as long ago as 1867 by Milliot.

The Technique of the Treatment of Stomach Diseases.—Of the numerous methods from time to time proposed for *washing out the stomach* or *irrigating its mucous membrane*, the best is the simple siphon method, concerning which we may speak as of the expression method, *simplex veri sigillum*. A glass funnel is attached to the free end of the stomach-tube by means of a piece of rubber tubing about one metre [one yard] ‡ long, and by alternately raising and lowering the funnel the stomach may be filled or emptied. The simple siphon action is all that is needed, since, with very few exceptions, we can undertake the operation at a time, or after such meals, when there is no danger of having the openings of the tube plugged; and even if small pieces of meat and similar substances are aspirated into the eyelets, they can easily be dislodged by holding the funnel high up. I consider it entirely irrelevant whether we use a continuous stream with a double-current tube or

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* Pribram. Zur Semiotik des Pyloruscarcinoms. Prager med. Wochenschr., 1884, S. 53.

† M. Einhorn. Die Gastrodiaphanie. New-Yorker med. Monatschrift, November, 1889. [The instrument is condemned by Boas, *loc. cit.*, S. 100.—Tr.]

‡ [A small piece of glass tubing, the caliber of which is somewhat smaller than that of the stomach-tube, is very convenient for connecting the latter with the tubing attached to the funnel; through it we may also see the nature of the fluid raised from the stomach, and can also readily determine when it comes up perfectly clear.—Tr.]

whether we fill and empty the stomach alternately; if anything, I prefer the latter, since the rapid raising and depressing of the funnel agitates the fluid in the stomach more forcibly, and mucus and other solid substances caught in the folds of the mucosa may be more easily removed mechanically. I prefer to use a large glass funnel of about two litres [two quarts] capacity, with a diameter of 20 centimetres [8 inches]; this is attached to a rubber tube of suitable length, which is joined to the upper end of the stomach-tube [by a small piece of glass tubing]. The funnel rests in a wooden frame (Fig. 4) on the floor [or table], and is here filled with the requisite amount of water or other fluid used, and is then raised to a height suitable to obtain the amount of pressure desired.

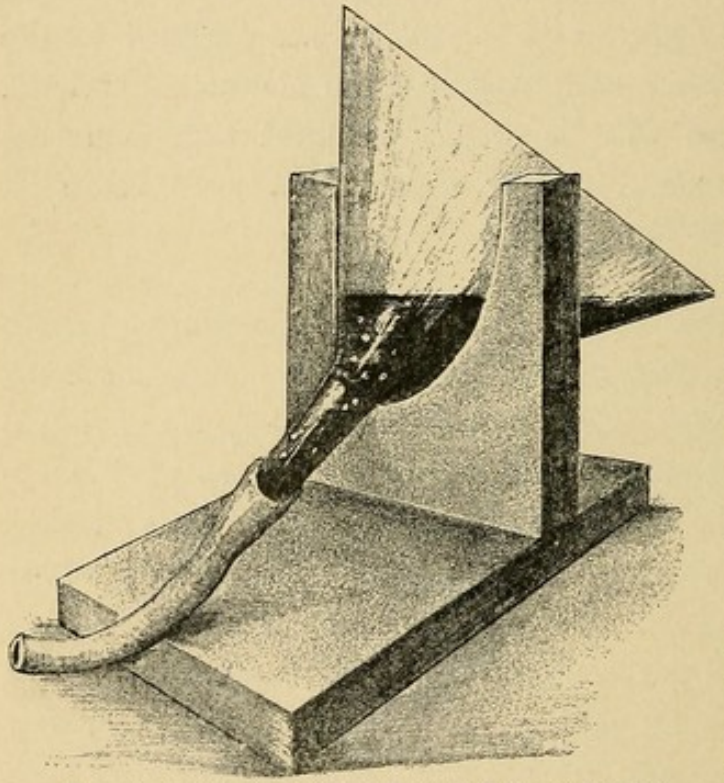


Fig. 4.—Stand for holding funnel of stomach-tube.

The water escapes from the various openings in the tube, as from a sprinkler, so that, by gradually withdrawing the tube a little, the various portions of the stomach may be successively irrigated. To siphon the water out of the stomach, the funnel is again placed in the wooden frame, and thus any foreign substances that may be present may rise in it, and can be obtained for examination if desired. If one is alone, this technique is much more convenient than to work with a small funnel. For consultation practice out of the office, I use a small hard-rubber funnel of about 300 c. c. [f ℥ x] capacity.

Siphonage of the stomach by elevating and depressing a funnel can not be done by the patient alone. Yet, in many cases, it is essential that the patient should wash out his own stomach; the

first requisite is, of course, to learn to introduce the tube himself, a manipulation which most patients acquire very readily. Here, too, the simplest method will suffice. For siphonage, the following will be found to be convenient: One extremity of the horizontal portion of a glass T-tube [*c*, Fig. 5] is connected with the stomach-tube [*a*], the other extremity is joined to an irrigator by means of a soft-rubber tube [*d*], a hard-rubber stop-cock * intervening; to the free end of the vertical portion is attached a rubber tube [*e*] about one metre [one yard] long. The patient sits near the irrigator, which has previously been filled and placed at a suitable height; the tube is introduced into the stomach while the stop-cock is kept closed, and the open end of the rubber tube [*e*] from the vertical piece of the T-tube is compressed with the fingers of one hand. With the other hand he then opens the stop-cock after the tube is in the stomach, and then allows a sufficient quantity of fluid to pass into the stomach. As soon as he feels the distention the stop-cock is closed, and the fingers are taken off the vertical tube; this allows the fluid to be siphoned from the stomach. By repeating this the stomach may be filled and emptied as often as desired. Many patients become very skillful, and often do not know when to stop, so that finally they may even abuse it. Numbers of such cases can be found reported, especially in French literature.

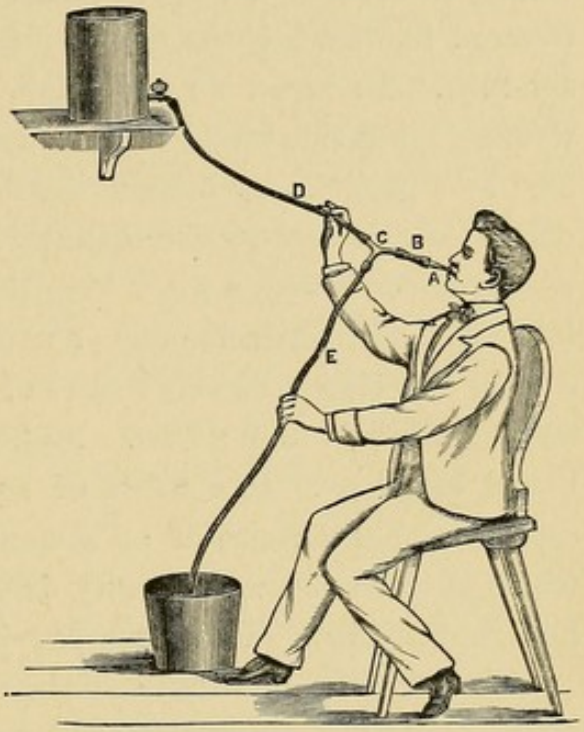


Fig. 5.—From Pepper's System of Medicine (after Leube)—Tr.

Electricity may be applied to the stomach, either by placing

* [This is not essential; it may be replaced by a pinch-cock placed on the tubing (*d*); it will also be found convenient to have one upon *e*.—Tr.]

both electrodes on the anterior abdominal wall or by introducing one of them into the stomach and closing the current by means of another electrode upon the abdominal wall, the latter electrode, according to well-known physical laws,* having as large a cross-section as possible. The electrode which passes into the stomach usually consists of a copper wire whose lower end bears a leather-covered knob, while the wire itself has been passed through a stomach-tube. To screw on the knob, the wire must possess a certain thickness, but this renders it stiff and unpliable. This may be obviated by a preliminary hammering of the wire in the fire, which renders it so soft and supple that it will assume any curve desired. I usually cover it with a piece of ordinary rubber tubing of small caliber. The patient drinks one or two glassfuls of water before introducing the electrode, or, in cases of marked dilatation, the stomach may be filled through a tube. Einhorn† has recently devised a very useful electrode. It consists of an ovoid perforated hard-rubber capsule about the size of an almond; within is a button electrode which is connected with a very delicate wire covered with a very fine rubber tube. The accompanying drawing (Fig. 6) represents

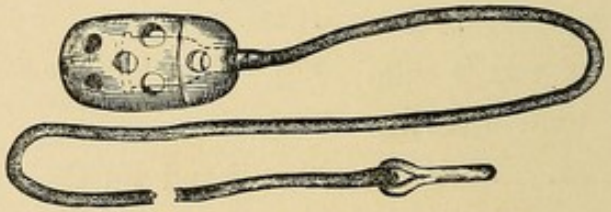


Fig. 6.—Deglutable stomach-electrode.

the instrument in its natural size. The method is as follows: "The patient drinks, best while fasting, one or two glasses of water; after opening the mouth widely the capsule is placed far back on the

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* Vide C. Rieger. Grundriss der medicinischen Electricitätslehre. Jena, 1887.

† Einhorn. New Method for Direct Electrization of the Stomach. New York Medical Record, May 9, 1891, p. 530. [Also Therapeutic Results of Direct Electrization of the Stomach. New York Medical Record, January 30 and February 6, 1892.—Stockton. A New Gastric Electrode, ibid., November 9, 1889; Clinical Results of Gastric Faradization, Amer. Jour. Med. Sciences, July, 1890. Both faradaic and galvanic currents may be employed; the latter being especially indicated for the relief of gastralgia and nervous vomiting, the positive pole being in the stomach.—Tr.]

root of the tongue, and the patient is told to swallow. He again drinks some water, and the electrode finds its way into the stomach without further assistance." The circuit is closed by means of a flat electrode placed upon the abdomen. But, since many persons can not swallow the capsule, or, if swallowed, it frequently stays in the œsophagus, I have drawn the wire through a somewhat larger rubber tube, something like a Nélaton catheter, number 13. This small instrument can be readily introduced in the same way as a stomach-tube, and yet is delicate enough to be readily tolerated for some time in the mouth or stomach. I am very well satisfied with this method of using the electrode, and have obtained very satisfactory results which I shall discuss later on. Von Ziemssen* considers this intraventricular method of electrization inadequate because the electrode always reaches only the left part of the greater curvature, since the direction of the axis of the œsophagus to the left deviates it into this direction—i. e., to the left iliac region—and hence a uniform action upon the entire organ is impossible; and, further, even disregarding this, the procedure is very tiring and exhausting for feeble patients. But it is known that, by filling the stomach with water, the current is distributed in all directions, and acts upon the walls of the viscus so far as they are under water; and as to the possible feebleness of the patients, the method may nevertheless be used, and is used on robust persons as a rule. Von Ziemssen's experience in this field must date from a time when the entire local treatment of the stomach had not reached its present perfection, and consequently all these procedures must have been more tedious and exhausting than they are to-day.

The entire digestive tract may be electrized by having one electrode in the stomach and the other in the rectum, the electrode being introduced after having cleansed the intestines with an enema. Schillbach† tried this method on rabbits without observing any effect, but, as it appears, neglected the preliminary cleansing of the intestines. In several cases of atony of the bowels, combined

* Von Ziemssen. Ueber die physikalische Behandlung chronischer Magen- und Darmkrankheiten. Klinische Vorträge. xii. Leipzig, 1888.

† E. Schillbach. Studien über den Einfluss der Electricität auf den Darm. Virchow's Archiv, Bd. 109, S. 284.

with a moderate dilatation of the stomach, I have obtained surprising results, but in others none whatsoever.

A series of investigations has already been made to show the possibility of influencing the stomach with the electric current; for example, von Ziemssen and Caragiosiadis,* Bocci,† and others. According to these observations, the external application of the electrodes causes only moderate contractions, which are of very doubtful therapeutic value; the constant current produces nothing more than a localized contraction. The induced current, especially when it is applied directly to the mucous membrane, is more powerful, and may cause the secretion of gastric juice or mucus, as Bocci has shown on a dog with a gastric fistula. Von Ziemssen ‡ says that in dogs the direct passage of a powerful current of both kinds increases the secretion of gastric juice. Regnard and Loye # observed the same thing in an executed criminal whose vagi were stimulated by an electric current forty-five minutes after his death. The experiments conducted by Sievers and myself ‖ showed positively that faradization of the abdominal wall with a strong current and broad, flat electrodes has a decided effect on the stomach. In many persons on whom the salol test (see page 54) was tried for this purpose, it was found that the reaction in the urine occurred earlier than usual, and hence the salol must have been carried on into the intestines more rapidly as the result of more powerful contractions [of the stomach].

There is a good deal of clinical evidence of the beneficial effects of the constant, but more especially of the induced, current. Many reliable writers agree on this point, as Kussmaul, Leube, Fürstner, Burkart, and others. Even Ziemssen claims good results from the percutaneous electrization of the stomach with large electrodes of about 500 to 600 square centimetres [about 80 to 100 square inches] area, and strong currents combined with a brief faradic brushing of the skin of the abdomen, chest, and back for two to three minutes.

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* Caragiosiadis. Die locale Behandlung der Gastro-ectasie mit dem elektrischen Strom. Inaug. Dissert., Munich, 1878.

† Bocci. Elettricita nello stomaco dell' animale e dell' uomo. Lo sperimentale, 1881, p. 561.

‡ Von Ziemssen, *loc. cit.*, p. 7.

\# Quoted by von Ziemssen, ibid., p. 7.

‖ *Loc. cit.*

As the result of this there is a feeling of warmth and invigoration, marked improvement of the appetite, and decidedly increased digestive activity. I can corroborate all this; for example, patients with nervous anorexia frequently eat their food with relish and digest it fairly well immediately after the application of electricity. It must, unfortunately, be admitted that all such therapeutic procedures which may be complicated by other factors do not of themselves prove much until we have the ocular proof of actually seeing the stomach contract under the influence of the electric current, especially as Pepper,* in a case of pyloric cancer with dilatation and visible peristalsis, could not increase the latter either with a faradic or a constant current, but could only cause a contraction of the abdominal muscles. Surely, by using Einhorn's stomach-electrode, or my modification of it, contractions of the muscular fibers of the stomach themselves must be obtained, and, as I have already stated, and as I shall discuss later on, excellent results have been obtained, especially in gastric dilatation. Baradui † has also obtained very satisfactory effects in stomach disorders from *électrisation intra-stomacale* and *galvanisation du grand sympathique au cou.*

At this place I might also speak of the gymnastics of the abdominal organs, especially of *massage and the hydrotherapeutic procedures of the stomach;* but, disregarding the simplest measures, like rubbing with cold or gradually cooled water, compresses, and half baths and wet packs, with or without douches, the household remedies of hydrotherapy, as it were, the methodical treatment, especially when combined with electric baths, requires the direction of a specialist and apparatus which is only to be found and properly used in hydrotherapeutic establishments. I would also recommend the same in regard to massage, and, whenever it is possible, it ought only to be done by properly trained persons.

Finally, these chapters on technique would be incomplete if I failed to state that the credit of having been the first to use the aniline colors for detecting free acids, especially hydrochloric acid, and to call attention to the clinical value of these reactions, belongs

* Pepper. A Case of Scirrhus of the Pylorus, with Remarks on the Electrical Excitation of the Stomach. Philadelphia Medical Times, May, 1871.

† Baradui. Journal de la Soc. scient., 1891, No. 10, p. 97.

to two Frenchmen—MM. Laborde and Dusart—who as long ago as 1874 published a paper on the *Nouvelles recherches sur l'acide libre du suc gastrique.* They first used aniline sulphate and lead peroxide, and later (1877) methyl-violet. This, having been acknowledged by von den Velden * in 1879 and having never been contradicted, at once establishes the claims for priority recently put forth by Laborde.†

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* Deutsch. Arch. für klin. Med., Bd. 23, S. 374.

† Laborde. Les colorants appliqués, etc. Bulletin général du Thérap., 1887, 30 janv.

LECTURE III.

STENOSES AND STRICTURES OF THE CARDIA.

GENTLEMEN: Disregarding the obstructions situated higher up in the mouth, throat, and œsophagus, and the accidental swallowing of foreign bodies (bones, etc.) which become impacted at the cardia, and relegating them to the hands of the surgeon, we find that the entrance to the stomach—the *mouth* or *cardia*—may be obstructed in two ways, and the swallowed food thus more or less impeded in entering the stomach. These are (1) *spastic contraction* and (2) *cicatricial tissue, more especially new growths* at the site referred to. The latter are never exclusively limited to the ring of the cardia, but extend above into the œsophagus or below into the stomach.

The **symptoms** to which these conditions give rise possess a great deal in common in spite of the most manifold causes which may produce them. The fundamental feature is the inability to convey the food which has been swallowed into the stomach, and from this obstruction to the introduction of food the other complicating phenomena are developed.

In most cases the passage through the cardia is gradually occluded. In the beginning there are times when absolutely no obstruction to swallowing seems to exist; while at others the patients distinctly feel that the food is retarded above the stomach, "that it lies like lead above the stomach," but that by repeated movements of swallowing, by waiting, and drinking, it may be forced past the narrowed spot into the viscus. At this time fluids and very soft foods do not usually cause any difficulty, but the obstruction is more marked the more consistent the food and the larger the morsels that are eaten; for instance, if too large a piece of meat or the like be accidentally or hurriedly swallowed, it can readily cause a

transient complete closure which will not even permit fluids to pass. Later on the intervals grow progressively shorter and finally disappear entirely, while the necessity of taking food in a fluid form becomes continually greater, the choice of food continually more limited. Then a new symptom appears in the form of regurgitation of the food, which is brought up unchanged except for the admixture of mucus or saliva; for in the same degree that the obstruction at the cardia becomes greater and more marked, the masses which are swallowed must gather more and more above the opening, so that they can readily return, should the lower sections of the œsophagus be the seat of peristaltic contractions, or should they be compressed from without by coughing, etc. A further result is seen in the *consecutive dilatation* of the œsophagus, which may appear the more readily since a slight congenital expansion is occasionally found in it close to the entrance into the stomach, forming what Luschka calls the "ante-stomach" (*Vormagen*).

Yet von Ziemssen and Zenker* rightly remark that this dilatation is by far not so frequently found as one would infer from the statements in the text-books. Of course, a great deal depends on what is understood by "dilatation"; and if these authors speak of a case of ectasis of the œsophagus with a diameter of 5 centimetres [2 inches] in the widest part of the dilated portion, I can oppose thereto what I found in two out of three autopsies in cases of stricture of the cardia, in which the widest part of the œsophagus, situated 5 centimetres [2 inches] above the cardia, measured 6·2 or possibly 6 centimetres [2½ to 2⅔ inches], while higher up the diameter was only 3 centimetres [1⅛ inches]. Neither of the cases impressed one in any way as important ectases of the œsophagus from the mere inspection of the anatomical preparations.

Thus, as far as the space will permit, the ingesta collect in the œsophagus above the cardia till they irritate its walls to such an extent that they are reflexly expelled by the pressure due to the strong efforts at coughing. These efforts at expulsion and vomiting, following at first only after eating, may finally also appear between

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* Von Ziemssen und Zenker. Oesophaguskrankheiten, in Handbuch der Krankheiten des chylopoetischen Apparates, i, p. 33.

meals without food having been taken immediately before. At first the regurgitation of food is mostly incomplete, since the œsophageal contents are forced up but a short distance and then sink down again after that portion which has in the mean time become fluidified passes by the stricture. Later on this takes place in a more marked degree, and, as Brinton * says, it may be easily understood that since the œsophageal contents are compressed by the normal peristalsis which runs from above downward, a central core must escape above, just as this occurs under similar circumstances in the centrally perforated piston of a pump or syringe.

The expelled masses consist of the unchanged ingesta mixed with mucus and saliva, in which chemical examination completely fails to show the products of gastric digestion. At times the specific constituents of a neoplasm may be recognized under the microscope. Unless specially colored fluids (red wine, fruit-juices, strongly colored medicines, etc.) have been taken, the vomited matter usually has a grayish-white or yellowish-gray color, without a trace of bile. I wish to call particular attention to this last point, for the absence of biliary coloring matters may be of the utmost importance in deciding whether we have to deal with œsophageal or gastric contents, a decision which at times may be very difficult. Exceptionally food which has been eaten at a previous meal is brought up, while none of that taken last, so far as it possesses characteristic constituents, is to be found. Since this is not a rare occurrence in diverticula of the œsophagus, and one which under the then existing circumstances can be readily explained, it might in such a case cause the diagnosis of diverticulum to be established or its presence to be suspected. In this connection I can refer to the autopsies made by me in two cases of stenosis of the cardia with dilatation, but without the formation of any diverticula, in which the condition described had been repeatedly observed, and consequently the question of the presence of a diverticulum was frequently debated during life, but in which, as I have said, the œsophagus was entirely free from any such formation. Thus this condition can not be regarded as a positive diagnostic factor indicating an existing

* W. Brinton. Lectures on the Diseases of the Stomach. London, 1864, p. 10.

diverticulum. It could only come into play in case of partial perviousness of the stricture, in which certain articles of food could pass through more rapidly, while others would be detained there for a longer time.

Another result of the obstruction to the passage of nourishment, and growing *pari passu* with the increasing constriction of the cardiac orifice, is the disturbance and impairment of the nutrition of the patient, which finally leads to a marked degree of emaciation and weakness. We see groove-like hollowing of the abdomen, the epigastric and hypochondriac regions being specially retracted, and the pulsation of the aorta can be very plainly felt through the walls; the muscles and fat waste away more or less; the skin becomes pale, waxy, or, especially in the face, assumes the specific yellowish-green color of the cancerous cachexia. The eyes are sunken, the lips thin, the nose and cheek-bones become pointed and prominent. The tongue usually has a thick white coat, and, despite careful cleansing of the mouth, a fetid odor emanates from it. The stools are small and tardy, and the fæces are hard, dry, and scybalous; the urine is scanty, with few solid constituents—in one case I was scarcely able to find a trace of the chlorides—and toward the end of life now and then contains albumen. Puffiness over the malleoli, and also slight œdema of the legs, usually appear toward the end of the disease.

To be sure, the picture just drawn is very essentially influenced by the causative factor of the disease and by the constitution of the patient, especially in cases of spastic contraction, in which, although the resulting symptoms may be really severe and very marked, they do not as a rule lead to the most extreme consequences; but even in organic stenosis of the cardia you will find that the patency of this orifice and the general bodily condition do not always correspond. I have repeatedly seen cases in which the stricture was very well marked, but in which the appearance and general strength were relatively favorable, even though the patients complained of having fallen off from their former condition. On the other hand, the cancerous cachexia caused by carcinoma of the cardia, which is to be regarded as the result of constitutional intoxication, may reach a high degree without the presence of a correspondingly great narrowing of the cardia. It is a peculiarity of cancer of the cardia

that the reaction upon the general system, so far as it is expressed by metastases, adenopathies, etc., is comparatively slight.

Among the least frequent of the common symptoms appearing in the course of the disease are local or more diffuse pains. True cardialgia—i. e., marked cramp-like pain, with a definite localization in the epigastric region—does not occur; and thus, too, the severe radiating pains which so often accompany carcinomatous or ulcerative processes of the stomach are almost always absent. Should they be present, they occasion the suspicion that the process is not limited to the cardia. Most frequently the patients complain of a slight burning or boring pain, or only of a feeling of pressure in the region of the ensiform cartilage. At times, and rather in the minority of cases, this may be increased by pressure from without on the ensiform cartilage. As a rule, swallowing causes either no special increase of the pain or none at all. In one of my cases in which the carcinomatous neoplasm had invaded the retro-peritoneal tissues the patient complained of pain in the lumbar region. In many cases pain is entirely absent.

I shall now present a case of stenosis of the cardia, and annex the discussion of diagnosis and therapy thereto:

Mr. P., restaurateur, forty-eight years old, is a man of large and marked bony build. At a glance it is evident that he must lately, and in a comparatively short time, have lost considerable flesh. Not that his face has emaciated so much, but that his clothes undoubtedly were cut for a much stouter man. Indeed, he tells us that he has fallen off markedly only for the past ten weeks, because he has suffered from "stomach trouble," with constantly increasing severity. Without any warning a sensation was developed as if the food after eating were held fast in the region of the stomach "as if by a cork"; this feeling disappeared only after he had emptied his stomach by vomiting. As I have said, in the beginning this took place only after a meal, but lately he has had to vomit even when he had not eaten anything. The stomach is more apt to retain fluids and very soft articles of food, but he is forced to vomit a portion even of these. The vomited masses have always been only slightly changed, and mixed with large quantities of tough mucus. No pain or belching. Appetite good. Bowels somewhat constipated, but easily regulated by cathartics. Lately a marked feeling of weakness has developed, and the patient spends the greater part of the day lying down.

No family history of cancer. Father died of paralysis; mother is still living. Physical examination of the gastric region in the patient is entirely negative; the abdominal walls are slightly retracted; percussion shows that neither the stomach nor the neighboring organs, liver, spleen,

and intestines, are of abnormal size. Palpation is also negative regarding a tumor or any other abnormity in the abdominal cavity. The greater curvature apparently crosses the mid-line 2 centimetres [$\frac{4}{5}$ inch] above the umbilicus. At the same time distention of the colon from the rectum, by means of the double bulb of a spray apparatus, shows that the transverse colon immediately appears as a swelling under the free border of the ribs; therefore, at any rate, no enlargement of the stomach can exist. The œsophageal sound passes with ease through the entrance of the œsophagus, and through its entire length; but after it is introduced 44 centimetres [$17\frac{3}{5}$ inches] it impinges upon a firm obstruction, just as if its point had struck against the bottom of a sack. This makes the patient force up a large quantity of a white, mucous fluid, mingled with single lumps of tough, glassy mucus. It produces no pain, occasioning rather severe choking by reflex irritation. All efforts to pass the sound further are fruitless, in spite of our using sounds of different calibers down to that of a goose-quill. No change is produced by varying the posture of the patient to the right or left side or to the knee-elbow position. While in the latter position I again palpated the abdomen, but was still unable to detect any abnormities.

Examination of the fluid brought up, amounting to about 100 c. c. [f $\frac{3}{3}$ iij], gives the following result: Reaction with blue and red litmus-paper is neutral; it gives a light burgundy-red color with iodine, contains sugar, and has a slight diastatic action; salts of lactic acid present in minute quantities; peptone and pepsin entirely absent. Even after acidulating the fluid, mixing it with albumen and heating, it possesses no digestive action. I here show you the test in question, in which the unchanged disk of albumen lies at the bottom of the test-tube, and with which the biuret reaction gives a negative result.

Under the microscope, in addition to numerous starch granules which have been colored blue by the iodine, we find a few muscular fibers entirely intact, and numbers of fat-cells of various sizes. Rod-shaped bacilli are present in small numbers. On the other hand, we do not find any yeast-cells or sarcinæ, or any cellular elements which might originate from a possible tumor. The patient tells us that about three hours ago he took some milk, and that some time before he had a small quantity of scraped meat. On auscultating in the infrasternal depression we can not hear any deglutition-murmurs, neither a first nor a second sound being present; but by listening at the neck, after swallowing, we can distinctly hear the fluid passing down without being able to appreciate the so-called "stenosis-murmur," which sounds as though the fluid were being forced through a narrow spot.

Consequently there can be no doubt that we have to deal with a case of *stenosis of the cardia, and a consecutive dilatation of the œsophagus above this.* This is proved not only by the examination with the sound and the negative results of all exploratory procedures directed toward the stomach, but also by the results of the chemical examination.

The distance to the cardia from the incisor teeth naturally varies with the height of the individual. The average figure is estimated to be 40 centimetres [16 inches], of which 15 centimetres [6 inches] include the distance from the incisors to the commencement of the œsophagus, 5 centimetres [2 inches] belong to its cervical, 17 centimetres [6⅘ inches] to its thoracic, and 3 centimetres [1⅕ inches] to its abdominal portion. I have repeatedly found much greater measurements, as high as 46 centimetres [18⅖ inches] *in toto*. According to this, the 44 centimetres [17⅗ inches], for which distance we introduced the sound from the incisors, would just represent the length of the œsophagus, *plus* the mouth and throat, in a large man like our patient, and its point would be arrested just above the cardia.

At this place I shall introduce a few practical points about *the sounding of the œsophagus.*

For sounding the œsophagus we must use either the œsophageal sponge-probang, rigid sounds, or the tube. The first consists of a small sponge, about the size of a hazel-nut, fastened to a straight or slightly curved piece of whalebone. With this, if it be long enough—although, as a rule, the instrument-makers make them much too short—the œsophagus is swept out, as it were, the presence of any obstruction established, and possibly shreds of tissue caught in the meshes of the sponge and brought up for examination. The objection to the instrument is that in patients who have a narrow entrance to the œsophagus, or in whom there is marked irritability of the constrictors, considerable force is needed both to introduce and to remove it from the œsophagus, for at times it is caught so tightly immediately at the entrance (or, in the other sense, the exit) of the œsophagus, or at a certain spot behind the larynx,* that an inexperienced person could be led thereby to assume an abnormal obstruction. It stands to reason that the sponge is not to be dry, but that it must be moistened and always thoroughly cleansed and disinfected before it is used. I have already

* Waldeyer. Beiträge zur normalen und vergleichenden Anatomie des Pharynx mit besonderer Beziehung auf den Schlingweg. Sitzungsb. d. Akad. d. Wissensch. zu Berlin, Physik.-math. Klasse, 1886, 25 Febr.

given you the necessary information concerning the technique of this manipulation on page 8 of the first lecture.

The best œsophageal sounds are made of prepared catgut. They must be flexible, and are either bluntly pointed or provided with a tapering knobbed extremity. As advantageous as the latter seems to be in order to work its way through a stenosed or constricted spot, just so undesirable do these sounds prove, for the thinned portion above the knob is soon bent on repeated use. I never employ sounds which contain a wire or which consist only of whalebone, because they are too hard, or in the physical sense too elastic, and on account of the danger of perforation. We must have the various sizes of sounds at hand, preferably Nos. 13 to 30 of Charrière's scale, so that if necessary we can employ progressively smaller sounds. It is to be regretted that the thinner the instrument is, the more do we lose the necessary feeling of resistance; and when the sounds have only the diameter of a quill it is impossible to decide whether in a given case we are pushing the instrument on, or whether it has been bent or twisted like a corkscrew. For this reason alone the œsophageal or stomach tubes are preferable to the sounds, from which they differ by being hollow and having an eyelet on either side of the tube above its blunt extremity. While they serve the same purpose for sounding, we can readily tell by pouring in fluid whether we have passed the constriction or are still above it, and this even with the smallest tubes. But they also possess the advantage that after we have succeeded in passing one through the œsophagus (no matter what the disease may be), we can immediately thereafter pour nourishing fluids into the stomach. This is an advantage which is not to be underestimated, for it is often a matter of accident whether the tube glides into the stomach or not. For this reason, in sounding the œsophagus I invariably employ the so-called feeding-tube, with a funnel-shaped enlargement at the upper end, so that if necessary I can at once introduce fluid.

Finally, the fenestrated tubes have another advantage in that the edges of the openings not infrequently shave off particles of tissue which would not have been caught in the sponge. As a matter of course, the soft-rubber tubes are not applicable for sounding the œsophagus or possibly for overcoming strictures, since a certain

amount of rigidity is requisite for that purpose. Yet the soft tube, open at the lower end, has several times proved itself of advantage to me in cases of cancerous stricture, since particles of the neoplasm were forced into it by the patient's gagging or coughing when the tube was introduced as deeply as possible, and the point consequently either impinged upon the tumor or insinuated itself into the funnel-like constriction. Such particles had not become adherent at previous attempts either to the sponge or to the rigid fenestrated sound.

After this digression let us return to the further consideration of the results of the examination of our patient. Aside from the negative result of the physical examination, I consider the chemical examination of the masses brought up of the greater importance because its results may have enough weight to turn the scale in a doubtful case. The following case may serve as a proof of this:

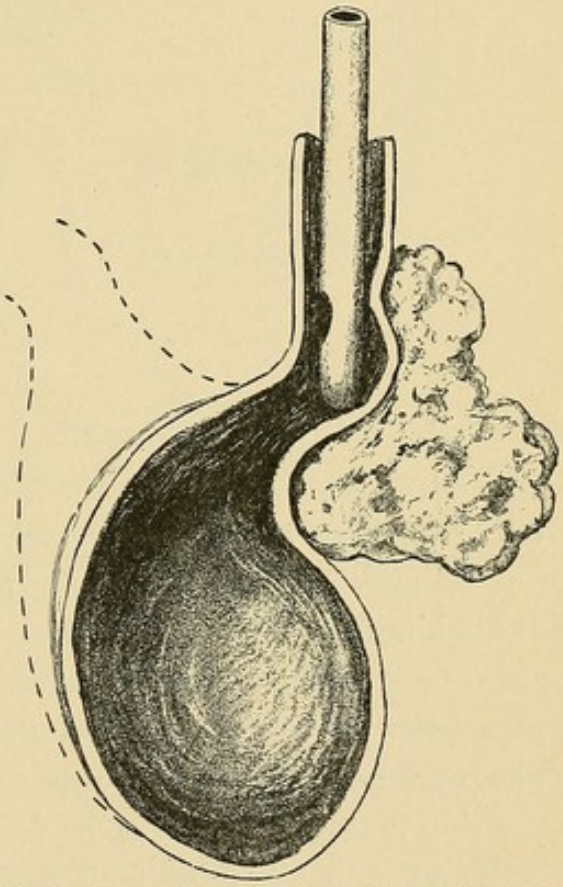


Fig. 7.—Stomach of Mrs. S., died June 30, 1887. Side view, to show the cardia and *cul-de-sac* surrounded by the new growth.

Mrs. S., sixty-two years old, suffered with carcinoma of the stomach and liver. On passing the sound, she showed great similarity to the case we are considering in regard to the resistance met by the instrument. Here, too, the sound struck an impassable barrier at the level of the ensiform process. Immediately above this I had the unmistakable impression of having passed a constricted spot, and after this was overcome there followed the hissing sound of air escaping from the stomach. The cause of this resistance offered to the sound remained doubtful during life.

The autopsy showed that a very large tumor growing up from the retroperitonæum had encircled the cardia and had lifted the fundus of the stomach horizontally upward, so that to a certain extent two divisions of the stomach were formed, one horizontal and one vertical. The sound impinged upon the bottom of the former. In order that the condition may be more thoroughly comprehended, the accompanying illustrations (Figs. 7 and 8), made by me at the autopsy, are here inserted.

Similar conditions might also be present in our case, or, as Quincke * has shown, a kind of valve may be formed by an ulcer of the œsophagus, which would prevent the introduction of the sound.

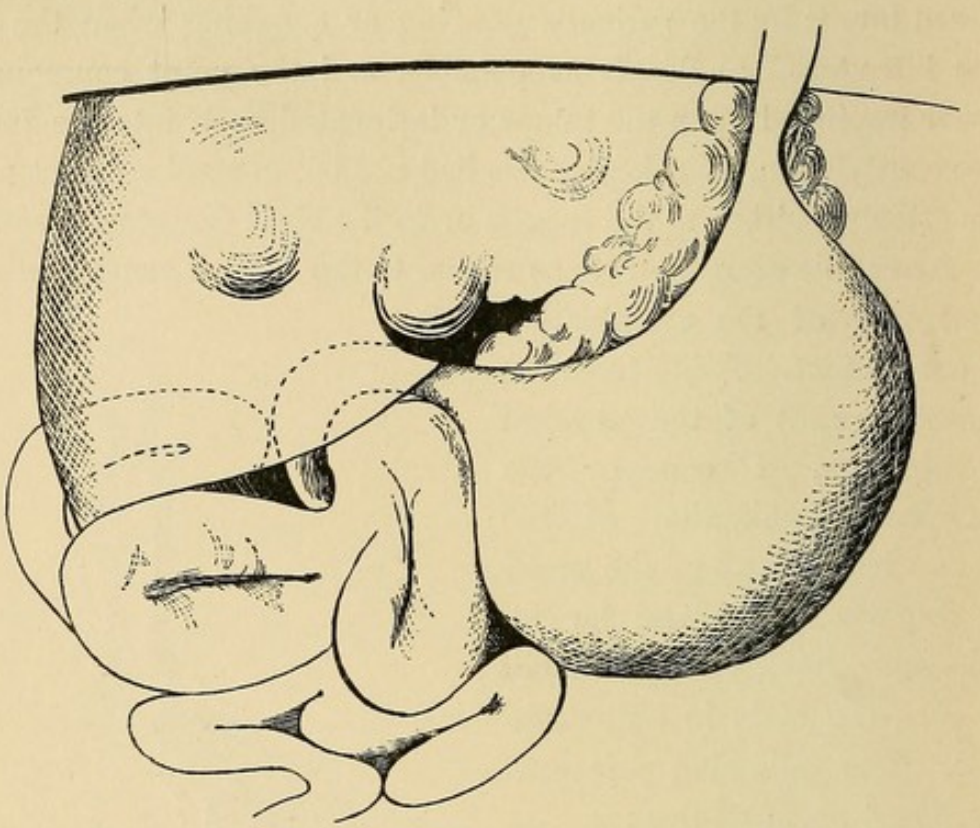


Fig. 8.—Stomach of Mrs. S. Front view, showing cancerous nodules on the anterior surface of the liver, the head of the pancreas, the cardia, and the retroperitoneal tissues.

But while in that case the masses which came up through the tube always contained pepsin and several times also peptone, while they repeatedly showed a yellowish-green color due to admixture with bile, our case is absolutely negative in this regard. This is proof positive that they do not come from the cavity of the stomach.

If according to these facts there can be no doubt about the existence of stricture of the cardia, its nature and cause are not less positively to be established.

As I have already said at the commencement of this lecture, closure of the cardia may be caused in two ways: (1) *By spastic contraction*, and (2) *by cicatricial tissue or neoplasm situated either within or without the cardia.* The former, *the* **spastic contractions,** which are always the result of a neurosis or of a reflex, consequently

* Quincke. Klappenbildung an der Cardia. Deutsch. Arch. für klin. Med., 1882, Bd. 31, S. 408.

of a purely functional nature, can in general be easily distinguished from the firm closure of the cardia by the following points: The contractions are frequently intermittent, sometimes being entirely absent, and at other times appearing only feebly—i. e., with complete integrity of the power of deglutition. They occur in paroxysms due to mental disturbances, exhausting attacks,* neuralgias,† palpitation of the heart, etc. Direct or more remote irritating factors, such as œsophagitis and gastritis, even gastric carcinoma, metritis, pregnancy, and irritation due to worms, can also produce spasm of the œsophagus. It occurs in neuropathic persons suffering with nervousness, neurasthenia, and hysteria, and on observation they can be recognized as specially well-marked features of a general nervous disease. Furthermore, such obstructions can be overcome by a *thick* sound, either immediately or after it has been kept in the œsophagus for a short time. This procedure will also succeed under chloroform. Naturally, this could not be done where the stricture is organic. The larger the caliber of the sound, the more readily can spasmodic contractions be overcome.

It is well known that spastic strictures may appear throughout the whole length of the œsophagus, and at times may become so marked as to simulate the symptoms of hydrophobia.‡ They may exist for months and even years without specially influencing the nutrition of the patient; thus we meet with well-fed ladies who say that they "are unable to force down a morsel." Yet such spasms may lead to the most severe disturbances of nutrition and may even result in death.# The seat of the spasm is shown by the distance to

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* Carron. Observation sur une suspension de la déglutition pendant plus de deux jours produit par un émétique violent chez un homme atteint d'une dyspepsie rhumatique. J. génér. de méd., chirurg. et pharm. Paris, 1811, pp. 58–62. A remarkable case, entitled Spasmodic Inability of Deglutition caused by Mercurial Unction, is reported in the Med. Obs. Soc. Phys., London, 1784, which I was unable to procure.

† Coin reports A Case of Spasm of the Œsophagus and Air-passages from Dorso-intercostal Neuralgia. This was mistaken for an organic stricture. Charleston Med. J. Rev., 1851, pp. 199–205.

‡ J. Barnes. A Singular Case of Spasmodic Disease, simulating Hydrophobia. Amer. Med. Record, 1822, pp. 650–652.

H. Power. On a Case of Spasmodic Stricture of the Œsophagus terminating fatally. The Lancet, 1866, i, No. 10. The patient, refusing an operation, died of inanition. Nothing found at the autopsy.

which the sound can be introduced until it reaches the constricted spot, unless, as I saw in one case, the sound invariably passes into the stomach with ease, and the spasm appears only on eating—i. e., swallowing solid or fluid foods, and then not at once, but only later. The patients are frequently able to overcome the spasm by various manipulations, as can be seen in the following history of such a case : *

Miss M., from New York, August 15, 1885. Age thirty-three. Well nourished ; appetite good ; bowels regular. Asserts that, on swallowing, the food, both liquid and solid, lies above the stomach. She is able to take a small plate of soup and a corresponding quantity of other nourishment, but then she must make extra exertions to force the mass down into the stomach.

Stomach in the normal position, somewhat distended. Normal on percussion and palpation. Patient eats two cakes and drinks a glass of water, but the murmurs of deglutition could not be heard. After repeated deep inspirations and simultaneous efforts at swallowing she forces air into the gullet, and then at the same time we can hear a very pronounced and loud sound as if something were being squirted through (*Durchspritzgeräusch*). The stomach tube is arrested at the cardia ; the English sound enters the stomach after overcoming a certain mild resistance.

In this case, consequently, in which there were no manifest hysterical or neuropathic factors to account for the spasm, it could be overcome, and the general nutrition of the patient was correspondingly but slightly influenced. Nevertheless, her condition was extremely painful and unpleasant, for at her meals she was forced to leave the table as soon as she had taken a couple of morsels, in order to perform her "swallowing gymnastics," and she was thus naturally debarred from all kinds of society except that of her most intimate friends. In this case there was evidently spasm of the cardia, due to its hypersensibility, a condition of which I shall speak again under the neuroses of the stomach.

Organic Strictures.—*Strictures of the cardia or of the lowest portion of the œsophagus, due to cicatricial tissue*, are the usual results of the action upon these parts of caustic or corrosive substances such as lyes and acids. Virchow has called attention to the fact that there is here a point of predilection for the action of these sub-

* This case has since been reported in detail in the Berliner klin. Wochenschr., 1888, No. 3, by Dr. Meltzer, of New York.

stances, and this is easily understood, since the investigations of Kronecker and Meltzer have shown that the swallowed mass remains immediately above the cardia after having been hurried through the œsophagus. Rare causes of cicatricial stricture, in fact, uncommon occurrences, are syphilitic and tubercular ulcers and *ulcus rotundum œsophagi*. According to Quincke,* the latter can also lead to narrowing of the gullet, and is usually situated just above the cardia.

I have a drawing of such an ulcer from the portfolio of the late Prof. von Frerichs, which was situated just above the cardia, and which resulted in a marked cicatricial contraction and consecutive dilatation of the œsophagus.

The cicatricial tissue is firm, does not ulcerate, and has a marked contractile tendency, so that such constrictions, if left to themselves, rapidly reach a high degree, and may even lead to cord-like fibrous obliteration of the œsophagus. As a rule, it is easy to overcome the stricture with a sound of the proper size, because pockets and projections in which the point of the sound might be caught are in general not to be found in the smooth cicatricial tissue (*vide* the case of Quincke cited above). The history, and the negative result of the examination for cancer, are of diagnostic import.

The neoplasms which lead to constriction of the cardia resolve themselves into those which exert pressure from without, and those which are situated in the tissues of the digestive tract, and which grow from its wall into the lumen.

Among the former class we find tumors, abscesses, and firm swellings of a carcinomatous, sarcomatous, or fibrous nature, which develop in the tissues of the mediastinum or retroperitonæum; or they may be glands which have undergone carcinomatous or scrofulous degeneration. There is normally a little group of glands close above the foramen œsophageum of the diaphragm.† Or they may be osseous or periosteal tumors growing from the vertebral column; or, finally, aneurisms of the large arteries. Such conditions,

* H. Quincke. Ulcus œsophagi ex digestione. Deutsch. Arch. für klin. Med., Bd. 24, S. 72.

† *Vide* Thaddeus. Dysphagie durch Schwellung der Bronchialdrüsen. Berl. klin. Wochenschr., 1889, No. 36.

as a rule, are readily recognized by a careful study of the history and all the accompanying symptoms. It would lead me too far to take up the particulars of the differential diagnosis here, but I will not omit cautioning you particularly against the use of rigid sounds or tubes in the examination of such cases. Under such circumstances, even with careful manipulation, the danger of a possible perforation is never to be entirely excluded, and is always to be avoided, especially since soft tubes will often serve our purpose if we wish to discover whether the passage into the stomach is patent, and since the obstruction caused by these processes is never, as a rule, very marked. Abercrombie reported such a perforation. As a warning, Von Frerichs in his lectures always cited a case in which an unrecognized aneurism of the thoracic aorta was the cause of obstruction to deglutition. A rigid sound was introduced, and the point perforated the wall of the œsophagus adjacent to the aneurism, which had been thinned by it, and also the aneurismal sac, thus producing fatal hæmorrhage. I myself saw the following case :

A gentleman, forty-five years of age, had suffered for some time with lancinating pains coming on in attacks and located in the mediastinal region back of the ensiform cartilage. At the acme of the attack the pain was so unendurable that it could only be allayed by large injections of morphine. He acquired the morphine habit and had subjected himself to treatment for this. For a time the paroxysms were less severe, but they then reappeared as intense as before. Inasmuch as there was no objective reason for these pains, the cause was suspected to be a psychical one, hysteria; syphilis was also thought of, although syphilitic new-growths usually cause very little or no pain, and antisyphilitic treatment was without result. Then later on there appeared difficulties connected with eating, the food seeming to remain above the stomach; his appetite, which had been capricious for a long time, now disappeared entirely, and he lost considerable strength. Fever was never present. At times he expectorated muco-pus containing no elastic fibers—this was before the era of bacilli. Sounding the œsophagus was suggested. Percussion showed the heart dullness to be abnormally increased, extending on the right to the right margin of the sternum, above and on the left to the lower border of the third rib; no murmurs; radial pulse regular, equal on both sides; the back showed no dullness or sound of any kind, except signs of a slight catarrh. In view of this, and of the attacks of pain, and the remaining general conditions, I suspected a mediastinal tumor, perhaps an aneurism, and therefore advised against the introduction of the sound.

Two nights afterward the patient had a terrific hæmorrhage, consisting

of pure blood, not frothy, which "seemed as though it gushed from the mouth," and he died in a few moments. Although an autopsy was not allowed, there can be no doubt that a large blood-vessel had perforated into the œsophagus, and it is equally certain that the blame would rightly or wrongly have been ascribed to a previous sounding had it been undertaken.

A similar case was reported by me at the meeting of the Berlin Medical Society on June 18, 1890.* A man who was suspected of having a cancer of the stomach presented himself to have the stomach-tube introduced in order to obtain some of the gastric contents for examination. No tumor could be felt, yet he was emaciated and cachectic. Heart and heart-sounds normal. While the patient was introducing the tube himself, which he did without any exertion, he suddenly fell back, became pale and cyanotic, and died within a few minutes. There was no hæmatemesis, nor was there any blood on the tube. During the last few moments of life a rapid increase in the area of cardiac dullness and a loud friction-sound over the heart could be made out. The diagnosis made was hæmatopericardium, resulting from rupture or perforation of an aneurism. The autopsy revealed the presence of a dissecting aneurism at the beginning of the ascending aorta just above the aortic valves and still within the pericardium, just where the latter is reflected. At this spot the wall of the aneurism was torn, and it was here that the blood had entered the pericardial cavity. The stomach and œsophagus were absolutely intact and were free from any neoplasm. It must remain an open question whether this was merely a coincidence, or whether the introduction of the tube and the consequent increase in the intrathoracic pressure had caused the rupture of the aneurism. However, the latter supposition is very improbable, for the reason that, according to physiological laws, the *blood-pressure* (an increase of the pressure on the internal wall of the aneurism or aorta which alone could cause the rupture) is not increased by the introduction of the stomach-tube.

Just such cases warn us to be cautious under all circumstances in making an examination with the sound, and you ought not to think that I take unnecessary trouble in *always* assuring myself in the most careful manner of the condition of the heart and its adnexa before I explore the œsophagus or stomach with the sound.

Constricting neoplasms of the cardia are always of a carcinomatous nature, and are very rarely indeed limited exclusively to the orifice of the stomach. As a rule, they spread from above—the lower section of the œsophagus; or from below—the cardiac portion of the stomach.

Rokitanski† states that a special characteristic of cancer of the

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* Ewald. Ein Fall von Aneursyma dissecans. Berl. klin. Wochenschr., 1890, p. 694.

† Rokitanski. Handbuch der speciellen pathologischen Anatomie. Bd. ii, S. 205.

cardia is that it always has the tendency to involve the œsophagus, thus contrasting with cancer of the pylorus. As opposed to this assertion, Brinton* cites two cases of sharply localized cancer of the cardia, and in consideration of the rarer appearance, on the whole, of malignant growths in the region of the cardia, he believes that both cancers of the pylorus and of the cardia appear localized with about equal frequency—that is, one case to fifteen in which it spreads. Disregarding my own relatively small personal experience, which, by the way, agrees entirely with Rokitanski's views, I can find but few recorded cases of isolated cancer of the cardia—two cases of epithelial cancer of the size of an egg, described by Hanot,† which were limited exactly to the cardia—and also through the kindness of Prof. Virchow, I saw only one more case in the splendid collection of our [Berlin] pathological institute, of which I append a drawing made by myself (Fig. 9). Should we wish to regard the neoplasms which strictly involve only the circular muscular ring of the cardia as localized cancers, we can easily see that the tendency for them to spread has already been provided for in the anatomical arrangement; for the muscular layer, as is well known, is made up of semicircular and crossing fibers which spread from the cardiac to the fundal zone of the stomach.

As a rule, the cause of these tumors is not to be discovered, and the hereditary factor is far oftener absent than present. I shall again treat of this subject—heredity—in the general discussion of carcinoma of the stomach. I must not forget to mention that two of my patients positively ascribed their trouble to traumatisms. One of them, a lawyer, traced it to a fall in which he hurt his chest; and the other, a farmer, while at work in the field, suddenly experienced a sharp pain within his chest, and since then he claims that the disease developed. In both there was cancer of the cardia. I scarcely need say that such statements can only be accepted with the greatest caution. The well-known necessity of man, especially a sick man, of finding a cause, frequently leads him to confound the

* Brinton. Lectures on the Diseases of the Stomach. Second edition, London, 1864, p. 227.

† Hanot. Arch. génér. de Méd., October, 1881.

post hoc or the *simul cum* with the *propter hoc*. But since it has been proved that traumatisms may give rise to carcinomata, it appears to me that this, to which as far as I know no attention has been paid, is worth mentioning.

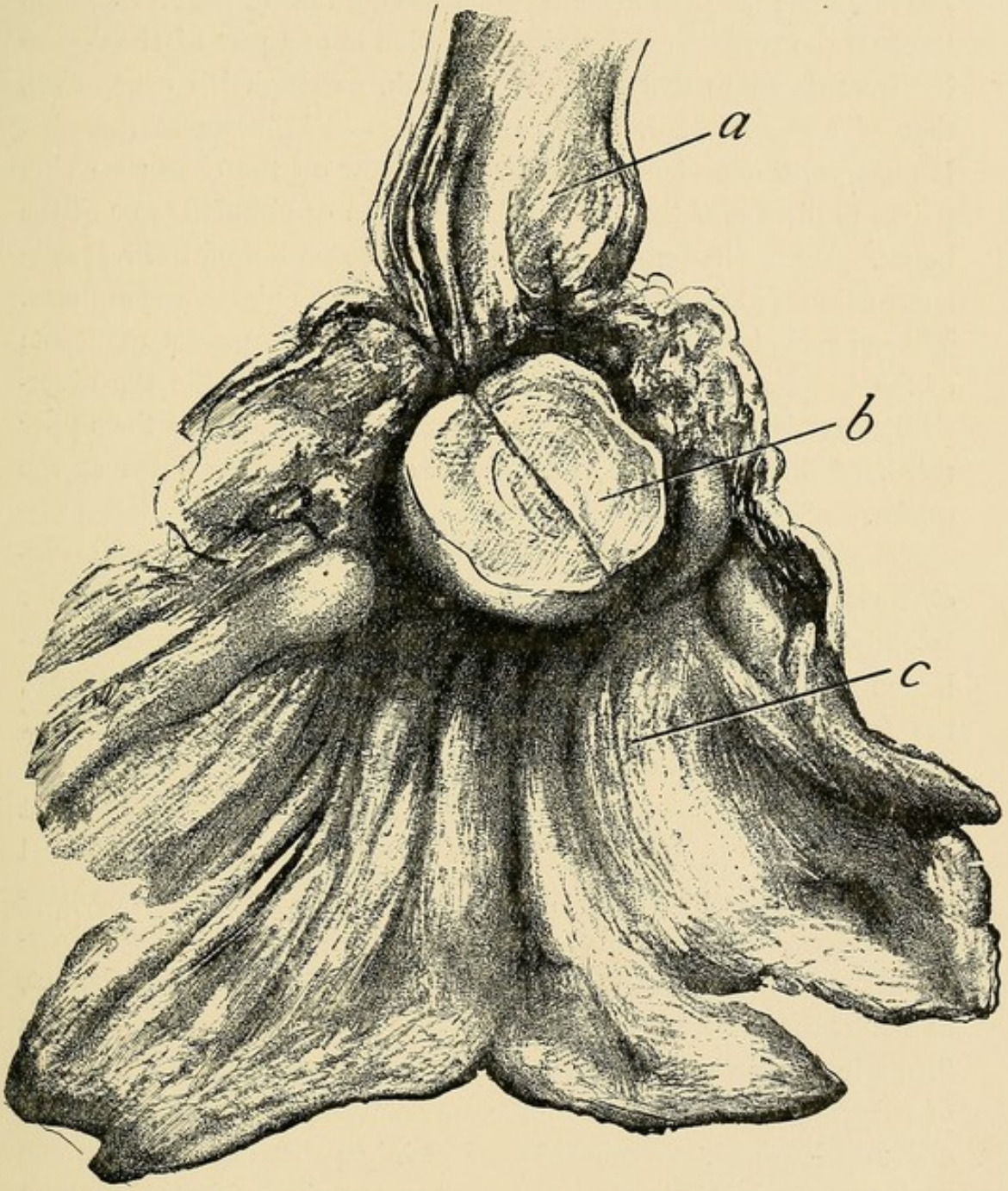


FIG. 9.—Localized cancer of cardiac orifice of stomach. (From Berlin Pathological Institute.) *a*, œsophagus; *b*, localized cancer of cardia; *c*, cavity of stomach.

I shall consider the nature of carcinomatous tumors of the stomach and their diagnosis in a later lecture (*vide* Lecture V).

Let us now return to our case of to-day.

Among the many causes which we must consider as producing the stenosis in our patient, one may be at once excluded, and that is cicatricial stricture of the œsophagus. He has never swallowed corrosive fluids; he does not remember having taken food hot enough to cause the well-known burning sensation at any part of the digestive tract down to and into the stomach, although his occupation, that of a restaurateur, would offer a certain inducement therefor. He has never experienced pressure or a blow on the chest; no sign points to disease of the organs of respiration or circulation or of the bones. He has had no fever. There can be no thought of a spastic contraction, judging from the history and the objective symptoms. We can exclude a diverticulum—i. e., a saccular, partial dilatation of the œsophageal wall without any narrowing—because the diverticula are always situated in the upper portion, chiefly the upper third, of the œsophagus, and never extend as low down as the cardia.

Thus by exclusion we would arrive at the assumption of a carcinomatous stricture of the cardia. It is true that positive evidence is entirely lacking; yet its absence, above all the absence of enlarged glands, the deficient proof of carcinomatous tissue-elements, the freedom from all pain, and the relatively moderate loss of muscular tissue and of strength, do not oppose it.

Only a short time ago I saw a case, almost the exact counterpart of the present one, differing from it only in that loss of flesh and strength had advanced much further. Here, too, there was no positive evidence of cancer, either from the history or on physical examination. At times the stricture would admit small sounds, but, as a rule, they could not be passed. We made an artificial gastric fistula in this patient, and at the operation we had the opportunity of palpating the stomach and the surrounding viscera through the abdominal wound. We could very plainly palpate a tumor in the region of the cardia beneath the diaphragm, which felt to be about as wide as a finger, somewhat flattened, and inclosing the cardiac opening like a ring. Several weeks after the operation the patient died while absent from Berlin, and, although it is to be regretted that an autopsy was not held, yet the diagnosis of cancer in this case

is as firmly established as though it had been made by ocular inspection.

Thus also in our patient, as so frequently occurs in making a diagnosis, the proper estimation of negative data is nearly as important as the positive results of examination, and we are justified in making a diagnosis of *carcinomatous stricture of the cardia.* Whether it lies within or without the lumen is a question which we must leave unsettled.

There still remains a condition to be discussed which is nearly always a result of stricture of the œsophagus or the cardia of long duration, and that is **dilatation of the œsophagus** above the constricted spot. But since a prolonged reaction of the narrowed portion upon the parts above is necessary for their formation, we can easily understand the rare occurrence of such secondary dilatations in cases of carcinomatous stricture, which, as a rule, cause death too rapidly.

Saccular dilatations of the gullet have always been subdivided into the *pressure and the traction diverticula* and *simple ectasis.*

The first two are partial dilatations of the periphery of the œsophageal wall, which appear as blind appendices attached to the otherwise normally sized tube, and which when moderately well developed and in a filled condition may appear on the surface of the body as circumscribed projections. They have no place in the present discussion, since, as has already been mentioned, they occur in the upper two thirds of the œsophagus; in fact, the former are situated chiefly at the boundary between the throat and the œsophagus. Thus I will only consider the last form. Dilatations situated above a constricted spot, as a rule, tend to involve the whole circumference of the gullet, and, after existing for some time, to cause complete atrophy of the mucous membrane, while the muscularis is thinned and its fibers separated into wide meshes. By this I do not mean to say that the dilatation may not develop more in a certain direction and in this way gradually lead to the formation of a true pocket. For this purpose there is needed only a somewhat greater yielding of the œsophageal muscle-fibers to the pressure of masses of food. Such a case was observed by Nicoladoni * in a four-year-old girl,

* Nicoladoni. Wiener med. Wochenschr., 1877, No. 25.

who had a stricture of the œsophagus due to corrosion. The stricture was 8 centimetres [3⅓ inches] long, and above it the œsophagus was irregularly bellied out for a distance of 2½ centimetres [1 inch], chiefly on the anterior wall and to the left, so that there existed a saccular dilatation which was sharply shut off from the stricture, and in which one could easily introduce the entire last phalanx of the forefinger. Under such conditions — that is, when the stricture is not immediately above the cardia, but is situated higher up in the gullet—partial dilatations may give the first impetus to the formation of a diverticulum, for which there is no room immediately above the diaphragm. However, the dilatation existing in our case must have reached a considerable size, otherwise it would not be conceivable how it could hold 100 c. c. [f ℥ iij ʒ ij] and over. Naturally this can only take place at the expense of the neighboring viscera by compressing or displacing them.

Wheatley Hart * describes the case of a woman, fifty-eight years old, who had for twenty years suffered with dysphagia, connected with frequent vomiting, and who gradually died of marasmus. The autopsy showed the following: The stomach, the mucous membrane of which showed no abnormalities, was small and its mouth so narrow that the little finger could only be introduced with difficulty; but there was neither thickening nor hardening of the tissue at this place. Above this the œsophagus was enormously dilated, so that on the right side of the spine it lay in the hollow of the ribs, where it was fairly bent at a right angle and directed toward the foramen diaphragmaticum. On its removal it looked like a second stomach, and could hold 750 grammes [℥ xxv] of fluid. The muscularis was greatly hypertrophied. Hart believes that it was originally attached to the lungs and pericardium, but that it was afterward separated by a retracting pleuritis and mediastinitis, since both processes were found markedly developed.

Spasmodic contractions of the œsophagus of long standing may also cause dilatation of the portion of the gullet lying above them.

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* Wheatley Hart. Autopsy on a Case of Prolonged Vomiting. Lancet, 1883 ii, p. 456.

Leichtenstern * has reported a well-marked example of this in a patient who had suffered for seven years from obstinate hysterical vomiting.

A case which I have reported elsewhere † was remarkable for the fact that the dilatation existed *not above*, but *below* the site of the carcinomatous stricture; the latter was located at nearly the middle of the œsophagus. It was evident that this was due to a fatty degeneration and an accompanying atrophy of the muscular fibers in the lower section of the gullet; consequently this portion of the tube lost its contractile power and became dilated by the swallowed masses, which, as shown by the experiments of Kronecker and Meltzer, normally accumulate above the cardia and are forced through the latter by the contractions of the œsophagus.

One of my patients, in whom there was a condition entirely analogous to that existing in the case under discussion, complained of severe dyspnœa as soon as he made any extra demands upon his respiratory organs, even in walking from one room to another a little faster than usual or on going up-stairs. The patient whom you see to-day was so short of breath the first time he visited me that at the first glance I took him to be suffering with pulmonary or cardiac disease. This condition may be primarily ascribed to the general weakness of the patient, but it can in part be referred to purely mechanical causes—to compression of the lungs, and possible displacement of the heart.

The treatment of our case is clearly indicated. Inasmuch as the stricture is entirely or practically impassable, and since internal medication, even if we possessed specific remedies, would thus be of no avail, and since mechanical dilatation is impossible, there remain only rectal alimentation and the production of a gastric fistula. Although rectal alimentation is very valuable for a short while, it is not effective for long periods of time, and therefore if the entrance to the stomach is closed to all kinds of food or nourishing materials it is to be combined with gastrostomy. We shall perform this oper-

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* Leichtenstern. Enorme sackartige Erweiterung des Oesophagus ohne mechanische Stenose desselben in einem Falle von siebenjährigem hysterischen Erbrechen. Deutsch. med. Wochenschr., 1891, No. 4.

† Ewald. Berl. klin. Wochenschr., 1889, No. 22.

ation in our case, and, if possible, we shall attempt bloodless dilatation of the constricted portion, working from within the stomach.

The patient presented to you on the 3d of this month, on whom gastrostomy was to be performed because of our diagnosis of cancerous stricture of the cardia, was operated on in my presence by Prof. Sonnenburg five days later. Reserving the remarks concerning the operation kindly placed at my disposal by Prof. Sonnenburg for the end of this lecture, I wish now to tell you that we palpated the stomach after the abdominal cavity was opened, but were unable to recognize any abnormity.

Two days later, when the fistula had been established, it was seen that with the exception of some mucus the stomach was empty. This mucus had a neutral reaction on strips of litmus-paper which were introduced.

For the first three days after the formation of the fistula the condition of the patient was excellent. He complained only of a feeling of pressure, but retained the nutrient enemata given to him and the soup poured in through the fistula. On the fourth day he began to cough a little and to bring up slightly fluid, greenish-yellow sputum, which contained small, whitish particles about the size of a grain of sand or the head of a pin. The cough increased in frequency and severity, chiefly at night, and could not be relieved by subcutaneous injections of morphine. A penetrating odor from the mouth became noticeable, and the evening temperature rose to 39·2° C. [102·5° F.]. Examination of the sputum revealed numerous pus-cells, free nuclei, bacteria, and masses of cocci, but no tubercle bacilli and no elastic fibers. The minute particles mentioned above consisted of large numbers of short, rod-shaped bacilli, so that they almost represented a pure culture. An ineffectual attempt was made to check the putrid decomposition by giving the patient capsules of salicylic acid to swallow and by washing out the œsophagus with a solution of the same drug. Dullness and bronchial breathing appeared over the lower portions of both lungs posteriorly. Elastic fibers were now found in the sputum, and a diagnosis of double pleuro-pneumonia due to perforation or swallowing was made. The fever continued, the patient's strength rapidly failed, and he died on the eighth day after the operation in a mildly somnolent state.

The autopsy which I made revealed the following:

Fundus of the stomach lies in the hollow of the diaphragm. It measures 12 centimetres [4⅘ inches] in its widest portion, and 30 centimetres [12 inches] from the pylorus to the cardia. The organ when cut open has a transverse diameter of 19 centimetres [7⅘ inches]. The opening of the fistula is 6 centimetres [2⅖ inches] above and to the right of the ring of the

pylorus. Its edges are puffed up, so that the mucous membrane lies quite smoothly over the muscularis toward the outer side. From without the pylorus feels swollen and thickened. On cutting open the viscus we see that this is caused by a trabecular thickening of the submucous connective tissue, while the muscularis and serosa are not involved.

Even from without we can see that the œsophagus above the cardia is converted by a dilatation measuring 6 to 7 centimetres [$2\frac{3}{5}$ to $2\frac{4}{5}$ inches] into a hard, sausage-like mass. On introducing a thin glass rod it either enters a pocket, in which it is arrested, or it passes through a narrow canal into the stomach. Water poured in from above slowly flows into the stomach after first having rapidly filled the œsophagus. The latter is widened above the tumor, so that at a distance of 5 centimetres [2 inches] from the upper margin it has a diameter of 6 centimetres [$2\frac{3}{5}$ inches]; then it gradually becomes narrower, and, 13 centimetres [$5\frac{1}{5}$ inches] higher up, is only 3 centimetres [$1\frac{1}{5}$ inches] wide. Opening the œsophagus, we see that the growth commences exactly at the cardia and that the incision has separated it into a larger (right) and smaller (left) ovoid portion with only a very narrow canal—admitting a thin pencil—between them, which is further marked by warty polypoid excrescences. The growth is so friable that the right side tears apart lengthwise, thus opening an empty cavity or cleft lined with a greenish-gray, fairly firm membrane (Fig. 10). Under the surface of the mucous membrane of the œsophagus are single small punctate nodules, appearing faintly white through the mucous membrane, the epithelium of which is desquamated in shreds as though it had been corroded. The same condition exists immediately below the tumor, where it passes on to the mucous membrane of the stomach. The latter membrane is smooth at the fundus and of a pretty pink color. In the remaining portions it is thrown into very many folds and is more of a slate color. No punctate hæmorrhages or suggillations. The left side of the œsophagus corresponding to the expansion of the tumor is attached to the mediastinum and the pulmonic pleura by a recent adhesive inflammation. A lymphatic gland, situated above and to the left of the diaphragm, is slightly tumefied, and on section shows commencing punctate suppuration.

The lower lobes of both lungs are swollen, of a marked reddish-brown color, and are absolutely non aërated. The upper lobes and the middle one of the right lung are aërated, and the pleura covering the two lower lobes shows a recent slight fibrinous deposit. We further find sharply circumscribed round spots of a light greenish-yellow color like pus, chiefly at the base of the right lung. They are less numerous on the posterior surface of the lower lobes of the right and left lungs. Their size varies from that of a lentil to that of a pea. On cutting into them we discover that they correspond to little hollows with a membranous lining and filled with a smeary, greenish-yellow mass having a penetrating and most offensive odor. A bronchus or bronchiole can be traced to each hollow. The mucous membrane of the bronchi is dark bluish red in color, like satin, swollen, and filled with quantities of frothy, blood-streaked pus.

All the other organs are normal.

The small intestines are unusually firmly contracted, so that they are scarcely the size of a finger.

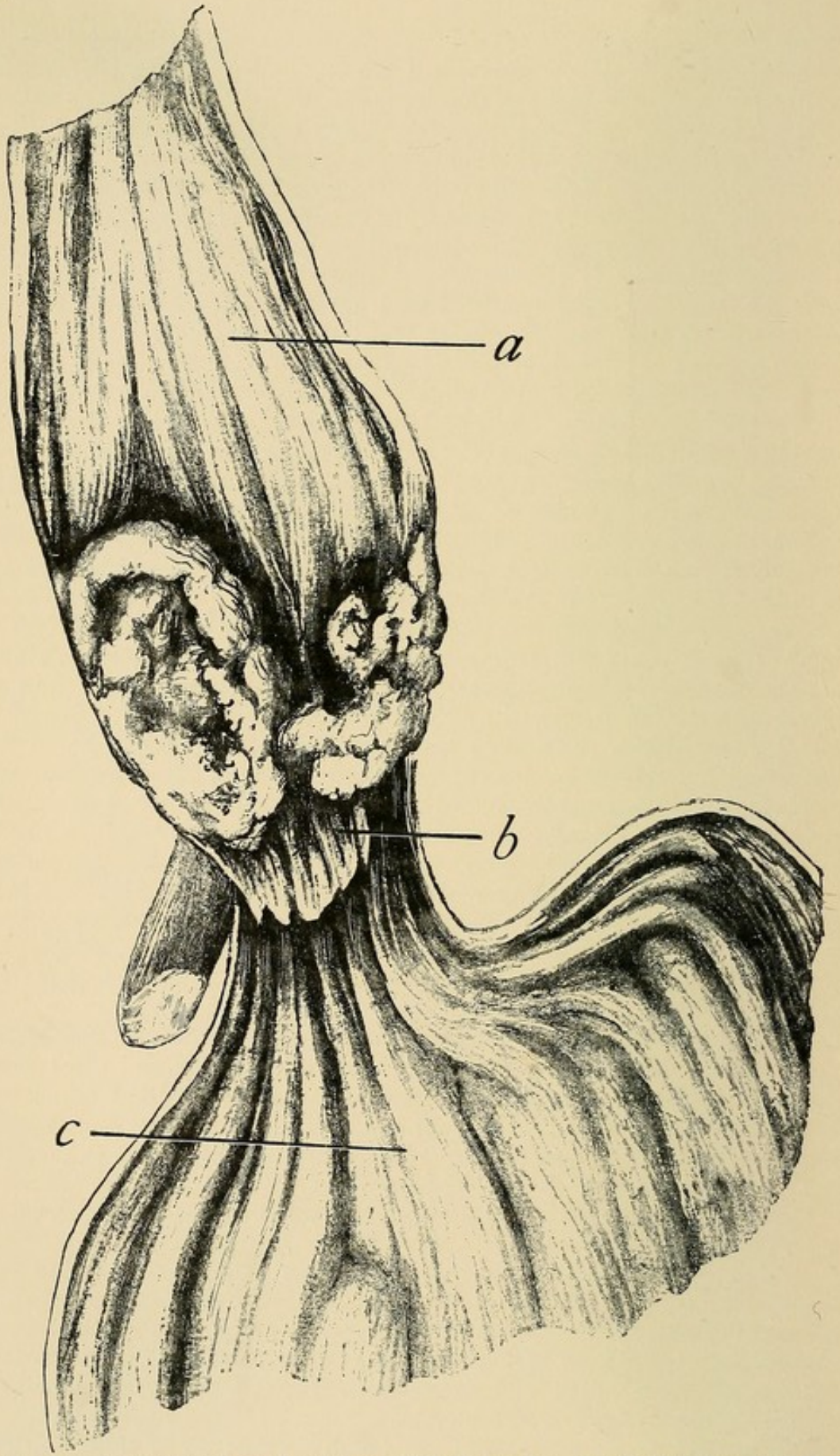


Fig. 10.—Carcinoma of œsophagus just above the cardia. Mr. P. died Aug. 3, 1887. *a*, œsophagus, *b*, cardia, *c*, cavity of stomach.

A fresh particle of the tumor scraped from its surface shows the most varied forms of cylindrical and pavement epithelium, round cells with large nuclei, and masses of cocci. Microscopic examination of the hardened tumor reveals an epithelioma extending down to the serosa, with portions of its elements undergoing degeneration.

In this record of the autopsy the patency of the stricture established post mortem does not seem to correspond to the complete closure existing during life. If we consider, though, that the tissues, losing their turgescence, shrink after death, we can easily explain how during life the narrow canal was completely displaced and occluded between the masses of the growth. At any rate, the operation was not only fully indicated, but it would have offered the best chances for the patient had not the gangrenous aspiration pneumonia [*Schluckpneumonie*] intercurred. This is an accident, prevention of which lies beyond our power. A lady with carcinoma of the œsophagus, on whom gastrostomy was performed also by Prof. Sonnenburg, was in as good condition five months after the operation as the circumstances could possibly permit, in spite of the fact that five years previously her right breast had been amputated and the right arm disarticulated subsequently on account of cancer of the breast. She died finally of a fresh metastasis which developed in the right pleura.

Let us finish the history of our case with a discussion of the

Treatment of Strictures of the Cardia.—In all organic strictures of the œsophagus situated at the cardia we can only expect help from operative procedures. Nobody can believe that we can obtain any results with internal medication, the so-called resolvent or alterative drugs of a therapy which is not so very ancient, mercurials or iodine, or even with the highly praised condurango. We can only attempt the bloodless dilatation of the stricture by means of sounds, and where this is impossible we must perform gastrostomy. Dilatation of the stenosis with bougies necessarily presupposes at least a partial penetration of the instrument into the constricted portion. As a rule, this will succeed at first if the stricture be a simple incomplete one without secondary dilatation of the parts higher up. For this we should always use the largest sounds possible—at least, we should always attempt to introduce the larger ones. The thinner

the sound, the greater the danger that its fine point will be caught in the inequalities of the constricted spot or in pockets due to secondary dilatation, even when these pockets are so small that a heavier sound would glide past them. In this, as always occurs under such circumstances, accident may play an important *rôle;* at one time we may succeed in passing the sound, and at another it bends at its point. I have frequently found it to be advantageous to allow the patients to force down the sounds themselves to a certain extent by ordering them to make repeated efforts at swallowing. It may then glide into the proper path, and can be pushed on by slight pressure from above.

The introduction of sounds too frequently or too rapidly repeated is to be guarded against. I have seen a sound (No. 20, Charrière) pass through a stricture with comparative ease, but it would not do so on the fourth or fifth day, since a marked swelling or a rapid growth of the affected parts had undoubtedly been caused by the irritation of the sound. Mackenzie * has also called attention to the same fact. We allow the sound to remain *in situ* for from three to five minutes, and pass from the smaller to the larger numbers. It is disagreeable to a great many patients who permit the sound to pass easily to retain it for this length of time, principally on account of the copious secretion of saliva. In such cases I usually first give a subcutaneous injection of 3 milligrammes [$\frac{1}{20}$ grain] of atropine with 5 milligrammes [$\frac{1}{12}$ grain] of morphine. The salivation then ceases entirely or does not appear at all, while the morphine increases the tolerance of the patient. Instead of the English sounds we can use a staff of whalebone with olive-shaped ivory points, which can be unscrewed and changed to larger or smaller sizes as the occasion may demand.

Thin English sounds with pyriform extremities are also made. At Frerichs' clinic we used long, smooth instruments of whalebone of various sizes. If the stricture is not too marked, we can also use a soft-rubber œsophageal tube of the proper caliber, which is introduced into the stomach and allowed to remain there for a while.

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* Morell Mackenzie. Die Krankheiten des Halses und der Nase. Uebersetzung von F. Semon. Berlin, 1884, S. 130 u. 185.

The patients tolerate this better than keeping a stiff sound in place, because they can close their mouths, and they do not have the troublesome flow of saliva; moreover, it also seems to create less irritation at the affected spot.

Finally, as early as 1843, Switzer in Copenhagen proposed the use of a permanent canula, which was used later on by Krishaber, Mackenzie, Symonds, and recently by Leyden and Renvers,* in the form of a kind of *catheter à démeure*. A slightly conical tube, oval on section, made of hard rubber, or a caoutchouc catheter, to which two strong silk cords are attached, is introduced into the constricted part by means of a whalebone guide supplied with a proper obturator and left there after the withdrawal of the guide. The cords hang from the mouth and are wound around the ear, or they may be carried through the nose. If the tube does not become clogged, it is allowed to remain in place as long as fourteen days. It is then removed and a new one substituted. This procedure naturally presupposes a certain size of the stricture, since canulas smaller than a large pencil can not be introduced well unless, like Mackenzie,† we care to forcibly thrust the catheter through the stricture, which, granting that it be possible, is by no means advisable. Leyden and Renvers, in two cases in which they diagnosticated œsophageal cancer, had the good fortune to obtain excellent results by means of a permanent canula—i. e., increase in the patient's weight for a considerable time. In three or four cases in which the existence of carcinoma of the œsophagus was proved by autopsy, I found that the patients could tolerate the canula only for a comparatively short time, but that I could produce a decided transient relief by it. Sonnenburg‡ properly says that but few cases are fit for this procedure, which can easily lead to rapid growth of the cancer, the occurrence of sudden hæmorrhages, necrosis, perforations, etc. When the stricture is situated at the spot which interests us at present—the

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* E. Leyden and Renvers. Ueber die Behandlung carcinomatoser Oesophagusstrictur. Deutsch. med. Wochenschr., 1887, No. 50. [Also, Renvers. Die Behandlung der Oesophagusstricturen mittelst Dauerkanülen. Zeitschrift f. klin. Med., Bd. xiii, S. 499.—Tr.]

† *Loc. cit.*

‡ E. Sonnenburg. Beiträge zur Gastrostomie. Berl. klin. Wochenschrift, 1888, No. 1.

deepest portion of the œsophagus—the tube must reach into the stomach. It is doubtful whether this is possible without causing persistent irritation. At any rate, it has not yet been attempted. The same may be said of Gersung's new and complicated "permanent sound for the œsophagus." *

The difficulties of introducing the instrument grow proportionately with the increase in the consecutive dilatation of the gullet or of the possible excrescences and pockets of the constricting growth. At times it would appear that in cases in which a diverticulum had also formed it might be possible to pass the sound beyond the pocket and into the stomach by giving it a certain direction; thus several authors give rules for this purpose. In my opinion, if the obstruction is just above the cardia, this is entirely illusory. None of the sounds which we are able to introduce into the œsophagus possesses rigidity enough to enable us to give its point a definite direction after it has reached the level of the lower portion of the œsophagus. You can easily convince yourselves of this on a corpse or a suitably suspended preparation in which the stomach and œsophagus are preserved entire and in continuity. Neither have I been able to discover any particular advantage in a special position of the patient according to the supposed site of the dilatation. We must admit that in an actual case it is a matter of luck whether the introduction of the sound is successful or not. However, that the posture of the patient may come into consideration during the passage of the masses swallowed is shown by the following very excellent example :

On the 19th of July I was consulted by B., a farmer from Stendal. He had been examined by several physicians because of a group of symptoms which pointed to a diverticulum of the œsophagus. By some his condition was said to be a diverticulum, while others considered it a nervous spasm of the gullet. The patient's nutrition and general condition appeared little changed. He could attend to his business as well as ever, but he felt a slight loss of strength, and as he had read about the pernicious results of œsophageal diverticula, he was in doubt whether or not to give up his property, retire, make all arrangements in conformity therewith, and await the threatening *finale*. The difficulties in swallowing had lately increased very slowly; subjectively they manifested themselves only in occasional regurgitation of the food. In reference to this the patient had

* Wiener med. Wochenschr., 1887, No. 43.

observed that at times portions of "regurgitated" food had been eaten not at the last, but at a previous meal. The sound was caught in a deeply situated sac after being introduced 40 centimetres [16 inches] from the incisors. This made the patient cough, when he brought up unchanged coffee which he had taken three hours before.* It contained no free acid. No deglutition-murmurs could be heard with the patient in the erect posture. On the other hand, however, when he lay down, a second sound could be heard very distinctly twelve seconds after swallowing. This was confirmed by frequent repetition. Thus the entrance of food into the stomach was not entirely prevented, but, as the sound proved, was possible under special conditions. In spite of this, even on a second trial, I was unable to pass a sound into the stomach, whether the patient was erect or recumbent. It was plainly to be seen that in this case conditions were created by the dorsal decubitus which rendered the passage of the swallowed mass a possibility. We can therefore assume that the dilatation—for with this we had to deal, without any doubt—was situated anteriorly, so that when the patient lay on his back it collapsed to a certain extent, and thus did not form a "trap." At any rate, the diverticulum was a small one, for, after the patient had been directed to drink a whole glassful of water, the deglutition-murmur could be heard when he was standing. This proved that the sacculation was now filled, and that it neither caught any further masses which were swallowed nor prevented their entrance into the stomach. Thus a sufficient degree of nutrition was still possible, and in this way only could I explain the relatively good condition of the patient, which had manifestly been the reason why others assumed the presence not of stricture or of a diverticular formation, but of a spastic condition of the œsophagus, especially if, as is very possible, they could occasionally introduce a sound into the stomach without any trouble. It is to be regretted that circumstances did not permit a subsequent examination of the patient; nevertheless, the facts just laid before you were amply sufficient to exclude a spastic contracture and to establish the diagnosis of a diverticulum. As for treatment, I advised the patient to abstain from all sounding for the present, for if the sound took a false direction this might give rise to unpleasant signs of irritation, perhaps to mechanical enlargement of the diverticulum; further, only to permit it when his difficulties had become more marked, especially when the feeling of obstruction on swallowing appeared; and, finally, to assume a recumbent position as much as possible when eating.

Especially good results from the use of the sound are met with in cases of cicatricial strictures if the patience of both patient and physician holds out, and, in case the stricture has become more patent, their use is not discontinued too soon. Even if the constriction seems to be sufficiently dilated the use of the sounds should not be

* In a case of Della Chiaje (cited by Mackenzie) coffee was regurgitated as late as five days after it had been swallowed, without being in the least changed.

stopped for some time, for the contractile tendency of cicatricial tissue is very great and constantly recurring.

For a long time after the campaign of 1870 I treated a young physician who, returning to camp extremely fatigued one day, had received a burn and consecutive stricture of the œsophagus by attempting to drink from a canteen apparently filled with water. The vessel—whether purposely or not, we will leave unsettled—was filled with pure sulphuric acid! He could only spit out a portion of the first hasty swallow, and thus the poor fellow not only received a severe burn of the œsophagus, but also had to suffer from a consecutive stricture. In this patient I could follow the tendency to constantly recurring narrowing of the affected spot for years.

Now that the true poisons are used more frequently for purposes of suicide, we do not have the opportunities which we formerly had to study these cicatricial strictures and their course when it was still the fashion for maid-servants to poison themselves with "oleum" (impure sulphuric acid); for, queer as it may seem, fashion has a decided influence even upon this melancholy procedure! I regret that I do not possess any statistical records of that period, so that I can only say from my general impression, in accordance with the views of other authors, that cicatricial strictures offer a favorable prognosis unless they reach a certain degree of constriction; but as soon as we have to deal with advanced stages, sounding leaves us in the lurch exactly as it does in cancerous constrictions. The latter especially always offer unfavorable prospects. We may indeed succeed in making the canal more patent for a time, but we can not permanently contend with the progressive new growth. Again, we must not be surprised or deceive ourselves with false hopes if, especially toward the end of life, the stricture suddenly seems to become more patent or to have disappeared entirely. This is a result of ulceration, and is always to be regarded as a bad omen.

For most strictures nothing remains but **gastrostomy** (*τὸ στόμα*, the mouth), the establishment of a gastric fistula, first proposed by Egeberg in 1837 and performed by Sédillot in 1849. The tortures which the patients suffer from their disease, the slow starvation which is their lot, are indeed so frightful that we must attempt relief even if we know it will only be transient. It is to be regretted that as yet the operation is performed too late in most cases. The patients are very slow to consent to a procedure about which, even

though very unjustly, there still hangs a nimbus of its being a wonderful operation. They only submit from extreme necessity, and thus the best time, that of a relatively good general condition, passes by. It is true that recently there has been a decided progress in this direction, and consequently the results of the operation have progressively become more favorable. In 1864 Mackenzie collected 67 cases of gastrostomy in carcinoma of the œsophagus, 12 of cicatricial stricture, and 2 of syphilitic stricture, and found that the longest duration of life amounted to from 5½ to 7½ months. Then in 1885 Zesas * collected 129 cases of cancer, 31 of cicatricial stricture, and 2 cases of syphilis, and estimated 16·2 per cent of cures (?) in the first, 55 per cent of cures in the cicatricial strictures, and among the deaths, 17·2 per cent who survived the operation for twelve months. If we select only those operations which have been performed since the inauguration of antisepsis (131), we get 19·5 per cent [cancer] and 68·7 per cent [cicatricial stenosis].

Gastrostomy, to-day, is in itself so free of danger that it is indicated in every case as soon as the diagnosis of a non-dilatable stricture of the cardia, with or without consecutive dilatation, is established. Nothing else can save the patient from the starvation which threatens him. The chances for success naturally depend upon the character of the constriction, and the earlier the operation is undertaken and the less the general condition of the patient is depressed the better are the prospects. That this operation can not save life need scarcely be mentioned. At any rate, if no abnormal intercurrent attacks appear, life is prolonged and death in cases of carcinoma is due to the more or less rapid course of cancerous intoxication and not to starvation. Even the psychical influence of the operation on the patients, the advantages of which you can readily understand, is not to be underestimated, and the reproach made by a patient to Prof. Kocher, that "he had unnecessarily made a hole in his stomach," may well be regarded as exceptional. Among five patients to whom I proposed the operation, only one refused to undergo it, and he was a Russian general, who preferred death in St. Petersburg to an operation in Berlin.

* G. Zesas. Die Gastrostomie und ihre Resultate. Arch. f. klinische Chirurgie, Bd. 32, S. 188.

For the following statement regarding the *technique of the operation* I am indebted to the kindness of my colleague, Prof. Sonnenburg, who has operated upon two of my patients during the past year, and who has lately published his experiences:*

"First of all, in gastrostomy for cancerous stricture it is not easy to determine the position of the stomach, which is markedly shrunken on account of the insufficient supply of food. The best incision is one 5 to 6 centimetres [2 to 2⅓ inches] long, beginning below the xiphoid cartilage and running parallel to and a finger's breadth away from the free border of the ribs on the left side, extending with a slight concavity downward to about the ninth rib. After separation of the skin, fasciæ, and muscles, and the most careful checking of hæmorrhage, the peritonæum is opened and fixed, best by means of two looped cords. On making traction upon the loops the omentum and intestines can be seen in the depths of the wound. If we have chosen an incision nearer the mid-line, we can see the left lobe of the liver; but this is usually only a hindrance in our attempts to find the stomach. The best way to find this viscus is by endeavoring to introduce the hand to the region of the cardia and to pull forward that portion of the intestinal tract lying there. In most cases, especially when the stomach is very much contracted, some difficulty may be experienced in distinguishing between the stomach and the transverse colon; but we can recognize the colon by its muscular bands and the stomach by the sweep of its lower curvature and the vessels which enter there. But in a very atrophic condition, and especially if the viscus is with difficulty drawn forward, these otherwise readily recognizable landmarks may be very poorly marked. There have been cases in which the colon has been fixed in the wound instead of the stomach, and this in spite of great care.—Our attention now in fastening and sewing the stomach is to be directed to getting the opening in the organ as near as possible to the cardia, because then only is the efficient nourishment of the patient possible later on; for the nearer this opening lies to the pylorus the more readily will the food introduced into the stomach on being propelled forward flow out of the fistula, and thus the

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* *Loc. cit.*

nourishment of the patient become impossible. A small portion of the gastric wall, situated as high as possible, is then drawn forward in the shape of a ridge and attached all around to the parietal peritonæum by stitches which only include the serosa; then the peritonæum itself is stitched to the fasciæ and muscles—not to the skin. If it be at all possible, the stomach is left unopened for several days, the wound being tamponed with iodoform gauze until union has taken place. After two or at most three days we may exclude the danger of the occurrence of peritonitis from the entrance of stomach-contents into the abdominal cavity. The best way to open the stomach itself is with a pointed thermo-cautery. The opening need only be very small at first, for it enlarges itself in a short time. The introduction of fluid food is best performed at first by means of a thin œsophageal tube.

"In order to find the stomach more readily, the introduction of a thin sound with an easily distensible bulb attached to the lower end has been recommended. This naturally can only be thought of in case the stricture is not too marked. The introduction of a Seidlitz powder into the stomach to distend the organ by the formation of gas could hardly ever be accomplished in practice.

"Many suggestions and experiments have been made as to the introduction of nourishment. We can get along, however, with very simple methods. As has already been mentioned, we may at first use a thin œsophageal tube for this purpose, the opening of the fistula being closed in the intervals with a rubber or wooden stopper. Later a thin short silver canula may be permanently worn; a rubber tube to which a short funnel is attached is then connected and the food poured in through this. Many patients chew a portion of their food and transfer it to a vessel which is connected with the canula by means of the rubber tube."

However, it is to be regretted that the diverticulum or the dilatation of the œsophagus is not removed by gastrostomy. The introduction of food into the body is naturally no longer prevented, but above the stricture there remains a breeding-place for all kinds of putrefactive germs. The patients are constantly swallowing saliva; although after the formation of the fistula they complain very little or not at all about hunger, they are frequently troubled with severe

thirst. We may permit them to swallow small pieces of ice and even to drink some wine. Later the dilated gullet becomes filled with fluid contents which at once putrefy, a strong fetid odor emanates from the mouth, and either spontaneously or through the stomach-tube the patients force up a fluid with the odor of decaying meat, which on microscopic examination proves to be almost a pure culture of putrefaction cocci. Under such circumstances we must wash out the sacculation as we do a stomach, and for this purpose we may use disinfecting fluids (salicylic acid, thymol, resorcin, borax, etc.), or we may introduce salicylic acid or boric acid in substance. I have also given strong cognac in teaspoonful doses in order to get the disinfecting action of the alcohol.

Finally, a word about **feeding.**

At an early period the patients' own experience teaches them to take gruels and fluid nourishment instead of solid food. Since the functions of the stomach themselves have not suffered, as long as the lesion is not a cancerous growth—about which more hereafter—we must only consider the digestibility of the food in so far that we do not give indigestible articles of diet to persons who are more or less debilitated, but that we must try to give as much nourishment as possible in the most compact form. Besides pure milk, the paps and broths known in every kitchen, raw and soft-boiled eggs, thick gruels of wheat, oatmeal, and barley flour, we may also use the so-called leguminous flours* (containing varying quantities of nitrogen) which are now sold in various forms, as well as beef peptone and peptone chocolate (see p. 348). We can also make a palatable meat broth of an almost sirupy consistency by taking raw beef which has been chopped up very fine and stirring it with an egg and adding some pepper and salt. Kefir is readily taken by some for a long time on account of its acid taste, while it soon becomes repugnant to others. Moreover, in this respect it presents no exceptions to the rest of the artificial food preparations, all of which have the same disadvantage of always sooner or later becoming unpleasant or even disgusting. Nature does not permit herself to be mocked at; and if,

* [*Vide* H. Schlesinger. Aerztliches Hülfsbüchlein. Frankfurt, 1891, 2te Auflage, S. 15.—Tr.]

for instance, she provides albuminoids, in various forms in the common foods and not pure peptones, we can not substitute the latter for the former without being punished in regard to the taste and its results. However much the praises of the excellent flavor of these preparations may be sung, they all have the fault just spoken of, and a substitute for ordinary food with a good taste that is always pleasant and agreeable is still to be found.

The amylaceous flours, such as tapioca, arrowroot, and sago, can not be recommended—first, because they are very poor in nitrogen, in fact in nourishment altogether, and secondly, because the diastatic action of the saliva is needed for their conversion; but this reaches the stomach in a smaller amount than usual, since it is produced in a smaller quantity inasmuch as the stimulus for a more marked secretion of saliva, the mastication of solid food, is practically entirely abolished.

Very soon, however, there arises the necessity of supplementing the deficient nourishment by the mouth by means of the administration of food per rectum. Although *rectal alimentation* dates back to the earliest times in medicine, yet great credit is due to Kussmaul, Leube, Rosenthal, and others for having placed it on a scientific basis. The necessary confidence in this method of feeding was supplied by the proof that we could maintain the nitrogen equilibrium in animals by rectal injections of peptone and peptone-like bodies; but it was an error to suppose that we must use peptonized albumen for this purpose. In a special series of experiments* I proved that the injection of common emulsified white of egg serves the same purpose, and that the mucous membrane of the lower portion of the intestine manifestly possesses the power of absorbing not only peptones but unchanged white of egg as well, and to render it useful in the metabolism of the body. In estimating the values of peptones in rectal feeding, the conditions in alimentation by the intestine and by the stomach have been falsely placed on the same basis, although they differ fundamentally, since in the former case the mucous membrane is healthy and in the latter it is

* C. A. Ewald. Ueber die Ernährung mit Pepton- und Eierklystieren. Zeitschr. f. klin. Med., Bd. xii, Heft 5 u. 6.

diseased and its functions more or less impaired. Hence in the one case the indication is to diminish as much as possible the work of the organ so far as it concerns the chemical changes of the food. In the other, however—i. e., in rectal alimentation—there is a healthy mucous membrane capable of performing its functions, and it is not necessary to do a portion of its work outside of the body. We will never be placed in the position to employ nutrient enemata when the intestinal mucous membrane is unhealthy, because in the vast majority of such cases the stomach is capable of performing its duties. However, should both stomach and rectum be diseased in the same patient—and this is one of the greatest rarities—and should indeed the question of artificial nutrition arise, feeding by the mouth would always offer the better chances.

I therefore believe that peptones may be dispensed with in nutritive enemata. In no case ought it be necessary to use the complicated procedure recommended some time ago by Leube. This consisted of a mixture of chopped meat, fat, and fresh pig's pancreas, which is injected into the intestine, where it is gradually peptonized. For this purpose we may now use the peptone preparations offered for sale, although most of them are only gelatin-peptones; moreover, they only contain a small percentage of true peptones, being rather the earlier products in the formation of the same—i. e., syntonin and propeptone. Nevertheless they represent stages in the transformation of native albumen. As a matter of convenience suppositories have been made of these peptone preparations; but, as has been said, the peptones are entirely superfluous. I order the nutrient enemata to be prepared as follows: A pinch of the best flour is cooked with half a cupful of a 20-per-cent solution of glucose and a wineglassful of claret added. Two or three eggs are beaten up smooth with a tablespoonful of water and slowly stirred in with this after it has cooled sufficiently to prevent the coagulation of the albumen. The entire quantity should not measure more than $\frac{1}{4}$ litre [$\frac{1}{2}$ pint]. In hospital practice or with the poor, three to five eggs, with about 150 c. c. [f $\overline{3}$ v] of a 15 to 20 per cent solution of glucose, may either be injected or allowed to flow in. If necessary to make the mass thicker, we can add starch solution or mucilage; or a few drops of tincture of opium to lessen any possible irritation. Ac-

cording to Huber,* who repeated and confirmed my experiments, the efficacy of the egg-enema may be increased by the addition of some common salt, in the proportion of about one gramme [gr. xv] to each egg. A cleansing enema of 250 c. c. [f ʒ viij] of lukewarm water or of salt solution must always precede the nutrient enema, and we must wait till the passages—often frequent—are over; otherwise it may happen that the nutrient enema will be immediately ejected. Such injections may either be given two or three times a day or the quantity divided into smaller enemata. During such a course the fæces readily assume a ribbon-like form and a light yellow color. This must be borne in mind so that no errors may arise in a given case.

Such enemata may be given for a long time without the intestine reacting and causing their rapid expulsion. We must only use the precaution of allowing the fluid to flow in very slowly through a soft tube introduced as high as possible into the bowel, the best being a large Nélaton catheter or an œsophageal tube with an eye at the lower end and numerous lateral openings. The irrigator is held about two feet above the anal orifice of the patient or the piston of the syringe or the rubber bulb is worked gradually. For some time after, the patient remains either in the dorsal or left lateral position. In case of marked irritability of the intestines a few drops of tincture of opium may be added to the enema at first; but this soon becomes superfluous and is rarely necessary for any length of time. I have never seen more than a transient benefit derived from the rubber tampons (similar to the colpeurynter) devised for keeping back the injected fluid. They are pushed into the bowel beyond the sphincter, and are then dilated with air or water. They can not be passed beyond the third sphincter, and after they have resisted the intestinal peristalsis several times they lose their efficacy; also, owing to the irritation which they produce on the mucous membrane, they render the intestine still more sensitive and intolerant to the injections than would be the case without them.

Finally, the nourishment after the production of a gastric fistula is to be considered. The kind and quantity of food which will be

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* A. Huber. Deutsch. Archiv für klin. Med., Bd. xlvii.

borne under such circumstances will depend primarily upon the nature of the original disease. The celebrated Canadian, Alexis St. Martin, seems to have consumed very nourishing food without any detriment. I have myself seen the boy with the cicatricial œsophageal stricture who was operated on by Trendelenburg enjoy bread and butter, together with meat, potatoes, and vegetables, which he introduced into the fistula.* The patient operated on by Verneuil also had an ample bill of fare from which to choose.† However, these are all cases of a non-cancerous nature with relatively good general condition in which, no doubt, at first a nutrient solution as unirritating and simple as possible was poured into the fistula and a mixed diet given only later on. The digestive functions of the stomach in such cases seem to have suffered very little, although no exact investigations have yet been made on the subject. In cases where gastrostomy is performed for carcinoma of the cardia (whether situated on its œsophageal or gastric side), what are the changes in the secretion of the gastric juice and in the digestive functions of the stomach? It is self-evident that the feeding must vary considerably according to the answer to this question; but it is also clear that, partly at least, this will coincide with the usual changes in the digestive functions in gastric cancer. I shall discuss these relations in their proper connection in Lecture V; but I will anticipate and say that in three cases which were operated upon I have never found any secretion of hydrochloric acid or of pepsin. In two of these, who died a short time after the operation, this might be ascribed to the weakness of the patients; but the third, the previously mentioned case of carcinomatous stricture of the œsophagus, with numerous metastases, is more important. Here the chyme flowing from the fistula was repeatedly examined, the last time four months subsequent to the operation, after the patient had introduced gruel, or gruel with egg and zwieback, one, one and a half, and two hours previously. The mass which flowed out was invariably only slightly changed, containing a little mucus, of neutral reaction, without pep-

* He chewed the food, and then pressed it from his mouth into his stomach through a large rubber tube.

† Cited by Ch. Richet. Du suc gastrique chez l'homme et les animaux. Paris, 1878, p. 88.

tone, and its filtrate had no digestive action either on the addition of hydrochloric acid or of pepsin. The secretion of the glands, therefore, had ceased completely and permanently. I wish to state that in the other cases even before the operation, while it was still possible to introduce a sound into the stomach, I found the chyme to be likewise free from the peptic secretion. The same result—i. e., the absence of hydrochloric acid—was found by Neschaieff * in 105 examinations on four patients with carcinomatous stricture of the œsophagus. Riegel † found a diminished or normal secretion—therefore without characteristic change—in two cases, but the site of the carcinoma is not accurately given and the stricture was undoubtedly still patent.

Under the circumstances which I have described it is evident that we must refrain as far as possible from giving food which in any way demands more of the stomach than that which can be absorbed and passed on into the intestine as quickly as possible. This, therefore, is where the various peptone preparations are indicated. They must be supplemented with carbohydrates and fats. In order to compensate for the absence of the diastatic action of the saliva we give its product, glucose, or we allow the patients to mix the food with saliva by mastication and then to transfer it by means of a tube directly from the mouth to the stomach. In such cases the nutrition depends entirely on the preservation of the absorptive and motor functions of the stomach, and therefore the "diet" of such patients could be made typically simple and restricted to simply a solution of peptone and glucose, together with some fat, were it not that we must take account of their desire to masticate and taste the food and thus satisfy the sensation of hunger as well as their æsthetic sensations. Even our patient chewed meat and zwieback, and forced the masticated morsels into the fistula through a rubber tube in the firm belief of thus "offering something to the stomach." Luckily, it did not accept this, but, as it seems, promptly transferred these morsels into the intestines.

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* Lancet, June 4, 1887. It is not stated where the original paper is to be found, and it remains doubtful whether Neschaieff examined the contents of the œsophagus—or diverticulum—or of the stomach.

† F. Riegel. Beiträge zur Diagnostik der Magenkrankheiten. Zeitschr. f. klin. Med., Bd. xii, S. 434.

LECTURE IV.

STENOSES AND STRICTURES OF THE PYLORUS.—MEGASTRIA AND GASTRECTASIA.—DILATATION OF THE STOMACH.

GENTLEMEN: To-day I shall show you a series of plaster casts of stomachs which were made by filling the viscus with liquefied tallow after it had been removed from the body and tying at both cardia and pylorus. Matrices were then taken from the casts thus formed, and the plaster models made from these.

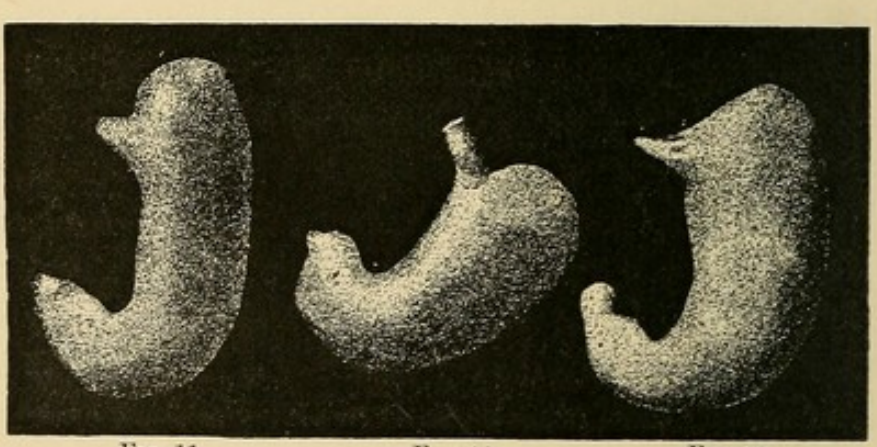


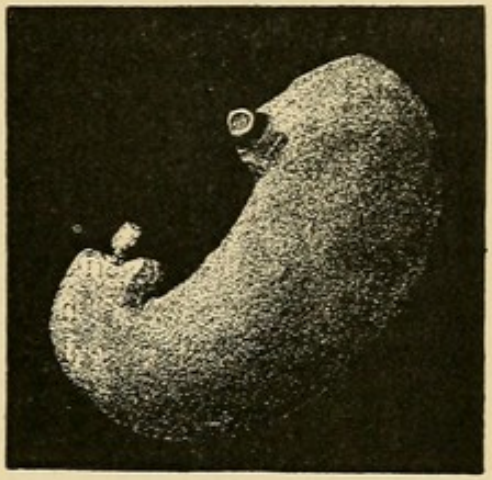
FIG. 11. FIG. 12. FIG. 13.

[FIG. 11.—Cast of cylindriform stomach in vertical position. Female. Ziemssen.
FIG. 12.—Cast of normal stomach. Female. Ziemssen.
FIG. 13.—Cast of dilated stomach in vertical position. Female. Ziemssen.—TR.]

At the request of Prof. von Ziemssen a Munich artist has made papier-maché models of the pathological forms only, and of these I am enabled to show you two specimens of enormous gastric dilatation [see Figs. 11, 12, 13, and 14].* You can most thoroughly

* [Figs. 11, 12, 13, and 14 are from photographs of some of these plaster-of-Paris casts. They were all taken at the same distance from the camera, and were placed in the position which they occupied in the body. The differences in form, position, and size have thus been preserved. Concerning the vertical position of the stomach, see p. 117.—TR.]

convince yourselves of the well-known fact* of the variations in form and size of the stomach by examining these remaining eight or ten specimens, all of which were obtained from persons of about the same size, who had never during life complained of any disturbance of digestion. Besides the simple purse-shaped, we find stomachs which are elongated, almost like a sausage, and others in which —be it remembered, without the action of cicatricial contraction— a marked exaggeration of the so-called *antrum pylori* (i. e., the lower quarter lying in front of the pylorus) has almost caused the viscus to assume the shape of an hour-glass. Just as the form, so varies the capacity of the stomach, which in these preparations was always determined by filling them with water. The largest stomach held 1,680 c. c. [56 fl. oz.], the smallest only 250 c. c. [8 fl. oz.]; between these limits we find all possible variations.



[Fig. 14.—Cast of a markedly dilated stomach tending to assume vertical position. Female. Ziemssen.—Tr.]

From this demonstration you can infer that there is no absolute standard for the size of the normal stomach, at least within the given limits, and that its capacity by no means bears a fixed relation to the size of the body. We may find a very large stomach in a comparatively small individual, and *vice versa*. We can only speak of an absolute dilatation of the stomach when it exceeds the given capacity in round numbers of 1,600 to 1,700 c. c. [53 to 57 fl. oz.]. But the stomach may be actually much smaller and yet be relatively dilated for the individual.

Finally, as Kussmaul and Rosenbach† have already shown, there exist very large stomachs which exert no disturbing influence on

* For example, Von den Velden has laid great stress upon this in his paper, Ueber Vorkommen und Mangel der freien Salzsäure im Magensaft bei Gastrectasie. Deutsch. Archiv f. klin. Med., Bd. 23, S. 369. His results are based upon the clinical lectures of Prof. Kussmaul.

† O. Rosenbach. Der Mechanismus und die Diagnose der Mageninsufficienz. Volkmann's Sammlung klinische Vorträge, No. 153, p. 8.

digestion, so that they are discovered accidentally while making some other examination. I therefore distinguish between *the large stomach*, *megastria*, and the *enlargement of the stomach*, *gastric dilatation or gastrectasia*, which in turn is to be divided into an acute or subacute and a chronic form. Megastria may lead to dilatation, but is not a pathological occurrence. Thus it amounts to an anatomical *condition*, while the nature of dilatation is that of a functional disturbance, combined with a progressive anatomical *process*.

Germain Sée* also distinguishes between simple dilatation, which may exist for a long time, or even permanently, without creating any disturbance and dilatation with dyspepsia—i. e., that condition which we commonly regard as gastric dilatation, by which we do not mean simply a large stomach, but that there is at the same time a morbid disturbance of its function. I understand dilatation of the stomach, or gastrectasia to be that condition of the viscus which is accompanied by the clinical symptoms of disturbed gastric function due to the enlargement of the organ, and megastria to be the acquired or congenital large stomach the abnormal anatomical state of which is functionally compensated. The "large stomach" may become catarrhal, and its owner dyspeptic; but, clinically speaking, such a patient has no gastrectasia, although more disposed thereto than others. Megastria and gastrectasia have frequently been confounded with each other. An entirely different condition, if I may anticipate, is *gastric insufficiency*, which indeed may and frequently does lead to the symptoms of gastrectasia, yet does not have the anatomical basis of the dilated stomach, but is a functional disturbance occurring in the most varied conditions of size of the organ.

We possess the following diagnostic aids for the **recognition of the large or dilated stomach:**

1. *Inspection.*—With relaxed and thin abdominal walls we frequently see the left hypochondriac region and a larger or smaller portion of the right, according to the extent to which the stomach is filled with air or ingesta, bulge out like a hemisphere or balloon,

* Germain Sée. Du régime alimentaire. Paris, 1877, p. 280.

beginning just below the free margin of the ribs. The lower border of this swelling crosses the mid-line on a level with the umbilicus, or below this, between it and the symphysis. At times there is only a lower projection present, with a trough-like depression between it and the free border of the ribs, which is caused, as a rule, by the long axis of the stomach assuming a more or less vertical position; occasionally, however, it may be produced by the region of the lesser curvature becoming collapsed, while the fundal zone is inflated or filled with ingesta. In the former case the lesser curvature runs parallel to the spinal column in the middle line, or even to the left of it, and in highly marked degrees of this condition it only passes to the right on a level with the umbilicus, so that even the pancreas may be felt between the margin of the liver and the stomach, and may be mistaken for a gastric tumor [see Fig. 15]. Peristaltic waves may travel over the stomach from left to right, either in constant succession or as the result of external mechanical irritation; antiperistaltic motions may also be observed (Bamberger,* Cahn,† Glax ‡). If we inject air into the stomach, these conditions become still more marked, and the gradual appearance of the viscus as it becomes distended produces as a rule a very characteristic picture. In advanced dilatation the body is usually, though not always, emaciated, the abdominal walls are relaxed and slightly sunken, and the false ribs on the left side are raised like a wing. The skin is dry, pale, and somewhat tawny.

2. *Percussion.*—Should any suspicion of dilatation exist, it is best before percussing to first distend the stomach with air. (Lecture II, page 59.) Only lately I have had occasion to experience the importance of using the double-bulb apparatus instead of setting carbonic-acid gas free in the stomach. A colleague failed to recognize a marked dilatation, which extended to midway between the umbilicus and the symphysis, in spite of his having given a Seidlitz powder to the patient, because the quantity of gas evolved was actu-

* L. Bamberger. Krankheiten des chylopoëtischen Systems. Erlangen, 1855, S. 325.

† A. Cahn. Antiperistaltische Magenbewegungen. Deutsch Archiv. f. klin. Med., Bd. 35, S. 402.

‡ A. Glax. Ueber peristaltische und antiperistaltische Unruhe des Magens. Pester med. chirurg. Presse, 1884.

ally insufficient for the capacity of the stomach. The percussion note over the inflated stomach is always tympanitic and more or less high according to the contents and the tension of its walls. Should the transverse colon be markedly distended and the curvature of the stomach lie immediately next it, it may at times emit the same note, and thus render it an impossibility to define the boundary between the two organs by means of percussion. In such a case we must either fill the stomach with fluid, and then percuss in order to contrast its dullness with the tympanites of the colon; or we must force more air into the latter from the rectum, thereby producing either a change in position or a higher tympanitic note. Here it is well to remember that the more delicate differences in sound frequently become more distinct by the use of auscultatory percussion when the ordinary method of percussion with the pleximeter leaves us in the lurch, and that therefore this method can also be utilized in doubtful cases. Ferber * has called attention to the fact that the circular, tympanitic "stomach-lung region" (*Magen-Lungenraum*) formed by the stomach under the lower lobe of the left lung gradually disappears behind the axillary line if the organ be normal, while if it be dilated it may be traced to the vertebral column. Yet it is evident, *a priori*, that this must depend essentially upon the quantity of gas and ingesta in the stomach and intestines. These force the organ more or less into the hollow of the diaphragm in such a manner that the resulting tympanitic zone in favorable cases may and indeed does extend as far as the vertebral column even with a stomach of normal size. Judging by my experience thus far, the following method, recommended by Dehio † for determining the boundaries of the stomach in normal and pathological conditions appears to be far more valuable. On an empty stomach the patient drinks a litre [quart] of water interruptedly in four portions of ¼ litre [℥ viij] each. If, now, after every ¼ litre we percuss out the resultant lower crescentic limit of dullness against the tympanitic transverse colon, we find in a healthy person, while erect, that the

* Ferber. Ein Beitrag zur Magenpercussion, etc. Deutsche Zeitschr. f. prakt. Med., 1876, No. 42.

† Dehio. Zur physikalischen Diagnostik der mechanischen Insufficienz des Magens. Verhandl. des vii. Congresses f. innere Medicin, 1888.

stomach moves downward according to the greater amount of fluid it contains, but that it never extends beyond the umbilicus as a rule, coming only to within a few centimetres [an inch] of the same. In the recumbent posture we get a tympanitic note due to the air swallowed with the water, and this prompt change of the percussion note is a strong proof that we are dealing with the stomach and not perchance with the intestine.

At the same time this procedure allows us to recognize the conditions, to be discussed presently, of motor insufficiency or atony of the stomach—i. e., its temporary dilatation and its persistent ectasis—which so often is the immediate result of the former; for it is evident that the more relaxed the gastric walls are, the sooner will the lower boundary of the stomach reach its most dependent position even after the introduction of small quantities of fluid, or in cases of marked dilatation it will be found in an abnormally low position at the very commencement. The conditions which must exist to enable us to use this method of exploration are, of course, that the intestines and especially the transverse colon must contain air; that there is no abnormal configuration of the stomach; and, finally, that the abdominal walls are not so thick as to entirely prevent the transmission of the more delicate differences in sound.

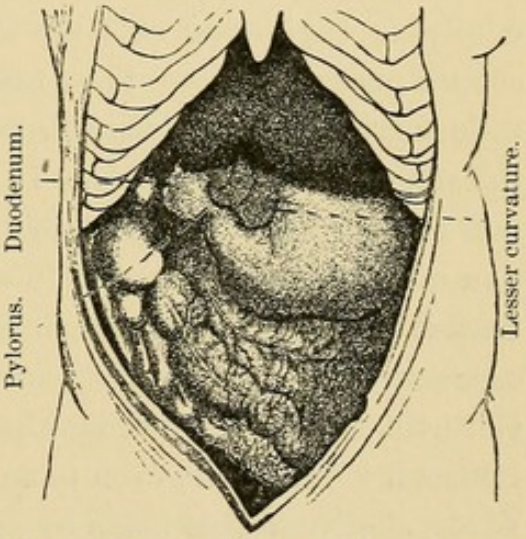
Finally, I quote the results of Pacanowski,* which he obtained by the careful examination of 81 cases—55 males and 26 females—in order to give you some criterion whereon to base your ideas of the normal size of the stomach, or, better, of that part which is projected upon the abdominal walls when the organ is filled with air under medium tension. Agreeing fairly closely with earlier observers (Wagner, for instance), he found that in the left parasternal line the lowest boundary of the stomach in men lies most often 3 to 5 centimetres [$1\frac{1}{5}$ to 2 inches] above the umbilicus, and 4 to 7 centimetres [$1\frac{3}{5}$ to $2\frac{4}{5}$ inches] above in women. The distance between the highest and lowest points of the zone of stomach tympanites was 11 to 14 centimetres [$4\frac{2}{5}$ to $5\frac{3}{5}$ inches] in men and about 10 centimetres [4 inches] in women. The width of this zone amounted to 21 centi-

* H. Pacanowski. Beitrag zur percutorischen Bestimmung der Magengrenzen. Deutsch. Arch. f. klin. Med., Bd. xl, S. 342.

metres [$8\frac{2}{5}$ inches] and 18 centimetres [$7\frac{1}{5}$ inches], respectively. Nevertheless, in accord with our experience, spoken of at the commencement of this lecture, concerning the varying conditions of size of the normal stomach, Pacanowski found fairly marked deviations from these averages. Thus, for instance, he gives 9 centimetres [$3\frac{3}{5}$ inches] and 20 centimetres [8 inches] for the vertical measurement, and 16 centimetres [$6\frac{2}{5}$ inches] and 25 centimetres [10 inches] for the width, and that without being able to infer that pathological conditions existed. From this, therefore, it is also manifest that the absolute conditions of size, as far as we are able to arrive at them by the physical methods of examination, are to be regarded as of only conditional value in the diagnosis of dilatation of the stomach —i. e., only in cases of excessive ectasis—for it may easily happen that an originally small stomach may acquire a pathological dilatation with its resultant clinical features, and that nevertheless its absolute measurement may remain within those bounds which are to be regarded as normal.

3. *Palpation.*—I will simply mention the palpation of tumors of the pylorus in this place, reserving its explicit discussion for later. Leube has recommended "palpation of the tip of the sound" in order to recognize dilatation of the stomach. A stiff sound is introduced into the stomach until it meets with resistance as far as this is feasible without the employment of undue force. If, now, the point of the sound can be palpated below the level of the umbilicus, dilatation of the stomach is proved to exist. This method has been objected to on the ground that it might be dangerous, and that it is frequently impossible to palpate the tip of the sound. Leube has rejected both objections, and, as far as the former is concerned, I fully agree with him. An unusual degree of roughness would be needed to perforate the gastric wall; but feeling the point of the sound through the abdominal walls is an entirely different matter This can very easily be done if we are dealing with an advanced case of dilatation of the stomach in which the abdominal walls are relaxed and sunken; but in such cases we can also arrive at a diagnosis by means of the other methods of examination. However, if the case be that of a comparatively well-nourished person, it is most frequently utterly impossible to feel the sound distinctly, even if we

go over the whole abdomen as carefully as we can, palpating one square inch after another. Further, in experimenting on the dead body it has repeatedly happened to me that the tip of the sound has failed to reach the lowest portion of the stomach. It was much more apt to be caught at some point higher up and to push this before it a little, but it nevertheless remained far above the most dependent portion. Further, we must remember that in men the stomach is not infrequently in a vertical position, and that this is the case much oftener in women, a fact already known to F. Meckel. This may be congenital, or it may be due to pressure, traction, etc. The lesser curvature, then, is almost perpendicular, and the pyloric portion of the fundus may extend to below the umbilicus. This malposition may not infrequently be seen in the dead body unaccompanied by any abnormal increase in the capacity of the stomach [see Figs. 11, 13, 14, and 15].* Thus the stomach of the performer described by H. Virchow in the Berlin Anthropological Society,† who was able to swallow a sword 70 centimetres [28 inches] long, may have been in a similar position. Also, by the cardia becoming depressed to the right with the pylorus fixed so that cardia and pylorus lie close together, we can get a marked depression of the greater curvature on account of the sharp bend in the upper border.



[Fig. 15.—Stomach in vertical position, *in situ*. Female. Ziemssen.—Tr.]

For all these reasons, therefore, palpation with the sound will only give us uncertain results, as Albutt‡ says, "I believe that the palpation of the tip of the

* [The views expressed by Lesshaft (Lancet, 1882, vol. i. p. 406) on the vertical position of the stomach have since been gradually accepted by many writers. Ziemssen considers its occurrence very frequent, especially in women; in them it is usually the result of tight lacing; the lower ribs being fixed and the epigastrium compressed, no room is left for the distended stomach except by swinging on a vertical axis whose fixed point is the cardia. The result is well shown in Fig. 15.—Tr.]

† Meeting of July 17, 1886.

‡ *Loc. cit.*

sound is unnecessary when the abdominal walls are thin, while in stouter persons the instrument can not be distinctly felt."

4. *Auscultation.*—If we place our hands flat on the region of the stomach and give the abdominal walls a series of rapid consecutive shocks, or if we shake the body *in toto*, we can hear, either at a distance or with the stethoscope, sounds of a splashing character with a faint metallic timbre, the so-called succussion or splashing sounds, the *clapotement* of the French.* In themselves they have no pathognostic significance. They may arise in the transverse colon as well as in the stomach, and are frequently heard under perfectly normal circumstances immediately after the ingestion of a large quantity of fluid, when they can readily be produced by short and energetic contractions of the abdominal muscles. They only become pathognostic (1) when they are present some time after fluid has been taken, and (2) when they are positively produced in the stomach. At times the latter can only be determined by completely emptying (siphoning out) the stomach. If, then, the succussion sounds persist, they are to be referred to the intestines. These conditions are frequently disregarded, and a diagnosis of dilatation of the stomach is rashly made. In this way only can we explain the fact that certain French authors (Bouchard and others) find dilatation of the stomach not only in every dyspeptic, but that Bouchard finds it present in about 30 per cent of all sick people. This is an exaggeration which is not shared by sober-minded observers like Germain Sée and Dujardin-Beaumetz. Pauli was the first after Penzoldt† to call attention to a sound in the stomach like escaping vapor, similar to that made by uncorking a bottle of Seltzer water, and in fact this can occasionally be recognized on auscultating in the region of the stomach when marked fermentative processes are present. Of a different kind are the sounds called by Kussmaul‡ "cooing or clapping sounds" (*Gurr- oder Klatschgeräusche*), which,

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* Audhui. Du bruit de flot ou de clapotage de l'estomac comme signe de dilatation de l'estomac. Gaz. des hôpit., 1883, No. 47.—Girandeau. De la dilatation de l'estomac. Arch. général. de méd., 1885, p. 342. Duplay, in 1833, was the first to direct attention to this in France.

† Penzoldt. Die Magenerweiterung. Erlangen, 1877.

‡ Kussmaul, in Volkmann's Samml. klin. Vorträge, No. 181, published June 16, 1880.

as I have mentioned above, may be produced in many persons, both with and without dilatation of the stomach, by the active contraction of the abdominal muscles or by rapidly alternating pressure and relaxation on the passive abdominal wall. Contrary to the succussion sounds, they are best produced in the erect posture.

At times we can hear, even at a distance, the heart-sounds resounding with a metallic character from the stomach filled with air. Strümpell * speaks of sounds which could be heard at quite a distance and which were isochronous with respiration in a patient with dilatation of the stomach. The note produced in *Stäbchen-Plessimeter-Percussion* † also has a metallic character, and in favorable cases can even be used to define the limits of the organ against the coils of intestine (Leichtenstern).

The occurrence of the *deglutition-murmurs* can not be utilized in the diagnosis of dilatation. I have never been able to observe any characteristic change in them, although I have examined every accessible case for this purpose.

Rosenbach has suggested a method which is based upon auscultation of air blown through a tube which is introduced into the stomach. If we pour water into a healthy stomach, introduce a tube below its surface, and blow in air, we will then on auscultation hear large, moist, metallic râles, which disappear when the tube is slowly withdrawn as soon as its eye is above the level of the fluid. Therefore the surface of the fluid is assumed to be at the spot where the râles cease to be heard. If, after having thus determined this point, we pour an additional quantity of water, say one litre [quart], into a healthy stomach, we will find that the level of the fluid has become appreciably higher, while in the case of an existing dilatation very little displacement is said to occur. In practice this method is quite difficult to carry out, and may be placed on a plane with Leube's palpation of the sound, inasmuch as it is unnecessary for the recognition of large dilatations, while in less marked conditions it fails of its purpose.

* Berl. klin. Wochenschr., 1879, No. 30. Aus den Sitzungsberichten der med. Gesellschaft zu Leipzig.

† [This is a form of auscultatory percussion in which the percussion note is elicited by striking a pleximeter with some hard object, as a lead-pencil, handle of percussion-hammer, etc.—Tr.]

5. *Mensuration of the Stomach.*—The position of the greater curvature may be estimated by the distance to which a rigid sound can be introduced into the stomach till it meets with resistance. According to Penzoldt, this distance, reckoned from the incisor teeth, normally amounts to 60 centimetres [24 inches], and never equals the length of the vertebral column; in three cases of dilatation of the stomach it was 70 centimetres [28 inches], so that the length of both the introduced portion of the sound and of the vertebral column were equal. Disregarding the factors already mentioned, namely, that we can never be certain whether the tip of the sound has really reached the lowermost point of the stomach, or whether there may not be a vertical position of the organ, it is impossible to give an absolute figure for the distance to which the sound may be introduced normally, in view of the variable conditions of size, concerning which I have spoken.

I shall not stop to discuss such methods as the inflation of a rubber bulb introduced into the stomach (Schreiber) or estimations by means of the manometer (Purgecz), but finally shall consider the diagnostic value of the measurement of the stomach by filling it with water. For this purpose the stomach must be filled as full as possible and then be entirely emptied; but — when is it full? We must either rely on the statements of the patients, who generally experience a distinct sensation when the stomach begins to be more markedly filled, or we must wait till they vomit the superfluous quantity of water. Neither sign can be absolutely depended upon, since the point in question varies with the sensitiveness of the patient, and the capacity of the stomach is so different individually. Therefore we can only speak positively of an absolutely large stomach when its capacity is more than 1,500 c. c. [f ℥ l] of water.

Etiology of Dilatation of the Stomach.—Dilatations of the stomach are produced by two etiological factors: (1) *mechanical stenoses of the pylorus*, (2) *absolute or relative weakness of the expulsive forces* —in other words, atonic conditions of the muscularis. It is self-evident that in a normally acting stomach the relations between contents, muscular action, and resistance at the pylorus must be in the proper proportion; therefore any change in these factors must lead

to a disturbance of function, which in most cases gives rise to dilatation of the organ. However, the requisite relationship may be preserved by compensation, in spite of abnormal change of the individual factors, and only when this fails do we get functional disturbance, just as in cardiac disease there is no circulatory disturbance until the compensation of the valvular lesions, etc., becomes inefficient. Oser* has already made use of this explanation as the basis of his discussion of gastric dilatation, and it will also be sufficient for us.† For the purposes of compensation the organism has hypertrophy of the muscularis at its disposal; however, it is to be remembered that only rarely does the hypertrophy of the muscular layer manifest itself in an appreciable thickening, but that as a rule it is not recognizable, since the individual fasciculi are separated and at the same time spread out by the dilatation of the organ. However, if under such circumstances it were possible to conceive of the stomach being reduced to its normal size, the amount of muscular tissue remaining the same, we would find this layer quite markedly increased in thickness.

In order to gain a satisfactory insight into the nature of dilatation of the stomach we must above all recognize the fact that we have always to deal with a consecutive process, a symptom, but not with an independent disease, and that therefore the most varied causes may be involved, as long as they call into existence the preliminary conditions soon to be spoken of. To be sure, the clinical picture of dilatation of the stomach, when it is fully developed, is very uniform, and so marked when contrasted with this diversity of the etiological factors, that as a rule it predominates and more or less relegates the original trouble to the background. Yet, for this very reason, it becomes our imperative duty to seek for the cause in every case of dilatation of the stomach, especially since by its recognition the prognosis is by no means immaterially influenced.

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* L. Oser. Die Ursachen der Magenerweiterung. Wiener med. Klinik, 1881, No. 1.

† [Oser has graphically represented this relation in the formula $C > I + W$, in which C = contractility of the stomach, I = resistance from gastric contents, and W = resistance at pylorus. The results of disturbance of these factors in causing dilatation and the changes which are necessary to maintain the normal relations may be seen at a glance.—Tr.]

For, according to the character of this causative factor will there be a transient or permanent condition, a reparable or an irreparable disturbance. We must therefore differentiate, as I have already mentioned at the opening of this lecture, between functional and organic dilatations; i. e., between those forms of dilatation of the stomach which do not result in a material lesion of the motor apparatus together with its nerves—therefore those which can be cured—and those in which the circumstances will not permit such a result because severe degenerative processes have developed in the gastric wall. But at times the functional dilatations may even arise acutely; at any rate, they are always of relatively short duration, so that they do not lead at all to the classical symptoms of dilatation of the stomach, or only do so transiently; they run the course rather of dyspeptic conditions peculiar to the special underlying disease of the organ, chronic gastritis, atony, or the neuroses. Therefore I shall defer the discussion of these functional or reparable dilatations until I come to treat of the affections just mentioned.

It is at once apparent, however, that these two groups are not independent of each other, but that the first can and does become transformed into the second when the causative conditions persist.

Unfortunately, the latter is the rule, the former the exception; for in the majority of cases we are unable to remove the primary cause of the trouble even after having discovered it, partly because, in the very nature of the matter, we can only recognize the condition when it has reached a relatively advanced stage, and partly because it lies beyond our power, even at the beginning, to eradicate the causative factor. However, if the latter be the case, if we succeed in removing the cause, and if the dilatation has not become organic, it will then be possible to cure it. This seems to me to have been proved by a case of Klemperer,* which thus far is the only one of its kind in literature. It was as follows: Cicatricial stricture of the pylorus, produced by the corrosive action of hydrochloric acid, consecutive dilatation of the stomach (capacity 2½ litres [O vss.]), operation upon the stenosis, cure of the gastric dilatation, so that several months later the stomach of the patient, who died of

* Klemplerer. Verein für innere Medicin in Berlin. Meeting of February 4, 1889. Deutsche med. Wochenschr., No. 9, S. 170.

phthisis in his thirty-fifth year, although large, was found to be not truly dilated.

The mechanical factors which lead to the stenosis or occlusion of the pylorus are situated either in the wall of the stomach itself or extend to it from without. Among the most frequent causes of the former class and of prime importance are carcinoma and cicatricial contraction, whether this be due to direct cicatrization of an ulcer, or produced by inflammatory processes following ulcer or phlegmonous gastritis. Under the former circumstances it is not necessary for the carcinomatous proliferation to surround the pylorus like a ring; it may be situated above the pylorus and have warty or polypoid excrescences, which force themselves into the orifice somewhat like a cork. I observed such a condition in a case in which a very vascular polypoid tumor, larger than a walnut, was situated on the posterior wall of the stomach, its base being about 3 centimetres [1⅕ inches] above the pylorus, and which during life must have more or less completely occluded the passage like a ball valve according to its vascularity; the pylorus, although somewhat narrowed, would easily admit the little finger (Fig. 16).

Bernabel * reports a similar case, which is remarkable, however, by the formation of true pedunculated polypi. The largest was 6·8 centimetres [2¾ inches] in length, and was situated on the anterior wall of the stomach, 5 centimetres [2 inches] above the pylorus. In Cruveilhier † may be found the drawing of a tumor, about the size of a potato, situated in the duodenum immediately below the pylorus, which must have had the same effect as a true pyloric stenosis. Unique among such obstructions is the case described by Pertik, ‡ in which a diverticulum shaped like a glove-finger was situated in the duodenum at the level of Vater's papilla, which, according to the degree to which it was filled by the chyme coming from the stomach, must have prevented its passage through the duodenum.

Congenital stenosis of the pylorus may also be included among

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* Bernabel. Contribuzione al etiologia del vomito mecanico da polypo gastrico. Rivist. clin. di Bologna, 1882.

† Cruveilhier. Anatomie pathologique du corps humain. Livr. 4, pl. 1.

‡ O. Pertik. Beitrag zur Aetiologie der Magenerweiterung. Virchow's Arch. Bd. 114, S. 437.

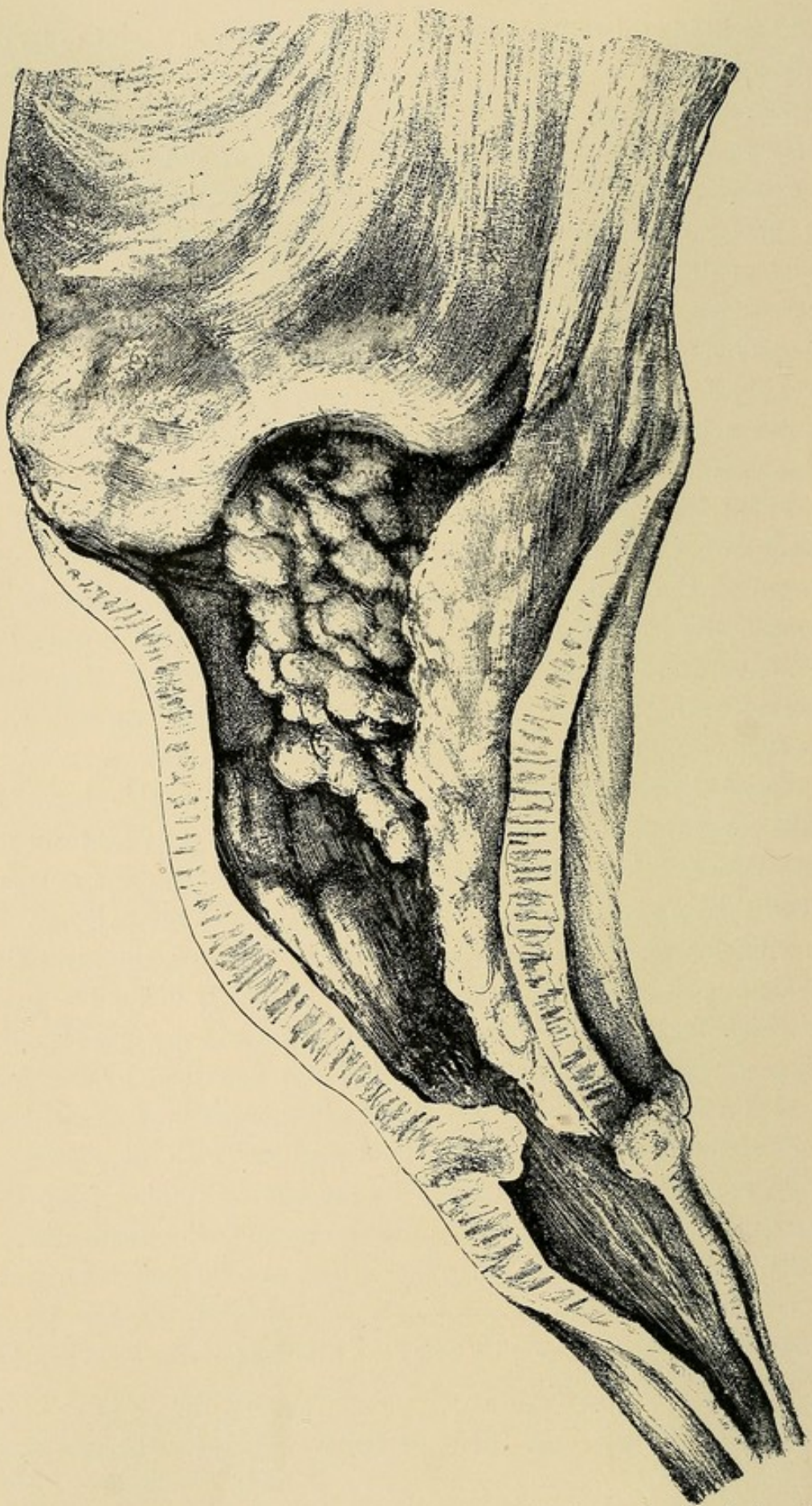


FIG. 16.—Very vascular, polypoid tumor, on posterior wall of stomach, 1¼ inch above the pylorus.

the mechanical constrictions; such cases have been described by Landerer* and R. Maier.† There may be either a round or a slit-like contraction of the ostium pylori, or the muscular portion of the pylorus may be hypertrophied, and the pyloric portion of the stomach present a spherical or conical appearance, in which latter case it projects into the duodenum like the cervix uteri into the vagina. This hypertrophy, by the way, can readily be distinguished from the form produced by chronic catarrh of the mucous membrane. It is very apparent that such stenoses may cause the development of a dilatation as soon as the expulsive power of the pyloric portion of the stomach becomes unable to overcome them—in other words, as soon as the antrum pylori passes from the stage of hypertrophic compensation into that of insufficiency. When this will occur depends naturally upon individual circumstances. While in these cases the obstruction to the emptying of the stomach is manifest, in other cases we find the pylorus patent after death, and yet have dilatation of the stomach, for which the factors of absolute or relative muscular insufficiency, soon to be discussed, can either not be applied, or are not sufficient to account for it.

Kussmaul‡ has shown by experiments on the cadaver that with great relaxation of the abdominal walls the pylorus may assume a vertical position due to the rotation of the full stomach, and at the same time so twist and compress the horizontal portion of the duodenum at its junction with the stomach that not a drop of fluid can escape into the duodenum. As can readily be understood, the lumen of the intestine may be occluded by bending, not at the pylorus, but somewhat below it, where the horizontal curves into the descending portion; this takes place when the stomach is filled and its ligaments relaxed, so that it drags the horizontal portion of the duodenum down with it. If, in addition, there exists a constricting stenosis of the pylorus, then dilatations of the duodenum, in the form of ampullæ, may be added to the dilatation of the stomach, as is typically depicted in the accompanying drawing,

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* Ueber angeborene Stenose des Pylorus. Inaug. Diss. Tübingen, 1879.

† R. Maier. Beiträge zur angeborenen Pylorus-stenose. Virchow's Arch., Bd. cii, S. 413.

‡ *Loc. cit.*

taken from a paper by Cahn,* which at the same time gives a good idea of the position of the stomach in marked dilatation (Fig. 17).

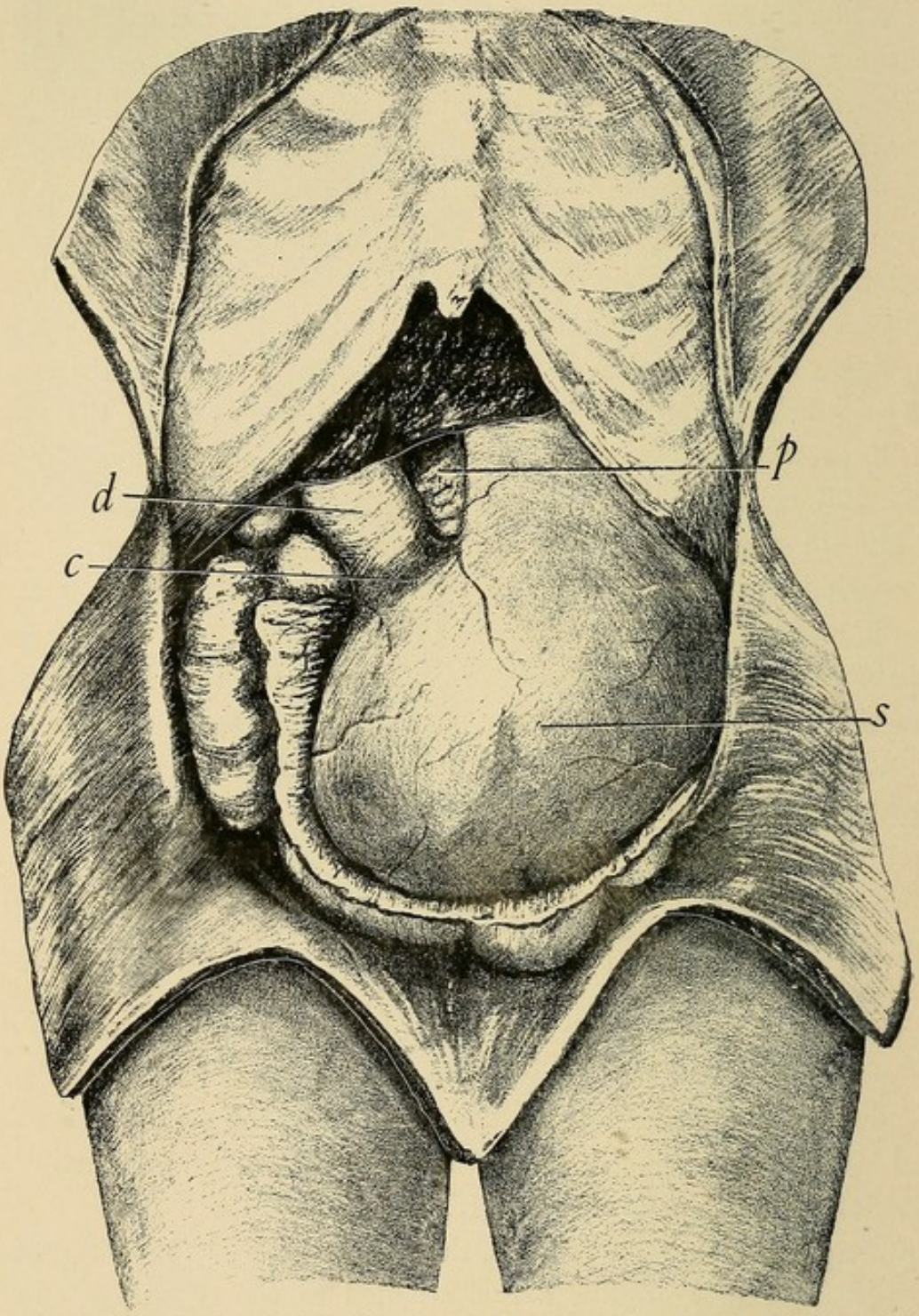


Fig. 17.—Cancer of pylorus, with dilatation of stomach and duodenum. Distance of the greater curvature from the symphysis = 4 ctm. [1⅝ inches]. Portion of the œsophagus in the abdominal cavity = 4 ctm. [1⅝ inches]. Length of lesser curvature = 10 ctm. [4 in ches]. *c* = carcinoma. *p* = pancreas; it has sunk behind the lesser omentum to the level of the second lumbar vertebra. *d* = horizontal portion of the duodenum; its vertical portion descends to the pelvic brim. *s* = stomach.

* Cahn. Ueber antiperistaltische Magenbewegungen. Deutsch. Arch. f. klin. Med., Bd. xxxv, S. 414.

An additional factor may perhaps be found in the following: While under the usual circumstances the demarkation of the pylorus from the duodenum consists only in a slight constriction or incline, but passes perfectly smoothly on to the stomach, we occasionally find an actual ring, so that on section of the stomach the pylorus looks as though a cord had been drawn underneath the mucous membrane. A small pouch is consequently formed on the gastric side of the orifice, which may easily become dilated from the pressure of food, and thus gradually lead to a true dilatation. Necessarily, an uncommonly firm closure of the pylorus would be requisite for this to occur—i. e., a spasmodic contraction. This brings me to the last cause which, situated within the stomach, is said to lead to gastric dilatation by closure of the pylorus—the spastic contractions of this orifice. Such a condition was very obvious in the case on which Sanctuary* performed an autopsy. The pylorus was quite patent, but above it lay an egg-shaped ulcer, surrounded by normal mucous membrane, 2½ inches long and 1 inch wide, the irritation of which, from the movements of the food, evidently produced a marked spastic contraction of the entire pyloric region. A pronounced dilatation of the stomach had been diagnosticated during life. However, of all the causes which have been brought forward to account for dilatation, where there is no tangible narrowing of the pylorus, spastic contraction appears to me to be the most doubtful; for it lies in the very nature of spastic contractions that they do not persist continually, but relax at times—consequently, that they can not produce any lasting obstruction. According to our present experiences, which appear to be pretty generally recognized, spasm of the pylorus is produced by excessive acidity of the stomach-contents; according to this, all cases of hyperacidity would finally have to lead to dilatation of the stomach, which, at least as far as our present knowledge goes, is surely not the case. Yet Germain Sée† has lately expressed the view that a very definite

* Sanctuary. Notes of Cases of Dilated Stomach, with Remarks. British Med. Journal, 1883, p. 613.

† Germain Sée. Hyperchlorhydie et Atonie de l'Estomac. Bull. de l'Acad. de méd. Séance, d. 1 Mai., 1888.

causal interdependence exists between hyperacidity—i. e., increased secretion of hydrochloric acid—and atony of the stomach, which may lead to its dilatation. Meanwhile, his cases do not present the picture of acute gastric dilatation, with its classical symptoms; they could much more readily be included among the functional dilatations, in so far as the question of dilatation of the stomach is concerned. Yet it is possible that the condition of the pylorus, just mentioned, in such spasms, might be an important factor in the development of dilatation. But, should we ascribe persistence to such a spasmodic closure of the sphincter, then naturally it must in time lead to a form of compensatory hypertrophy of the muscular layer at the pylorus; and to such a condition the cases of so-called idiopathic hypertrophic stenosis of the pylorus, found in literature, are probably to be referred. A well-observed case of this kind, with reference to the final result, is that reported by Nauwerk.*

A woman, twenty-three years old, had suffered for ten months with slight dyspeptic manifestations. After swallowing some cherry-pits symptoms of closure of the pylorus suddenly appeared, continuous, obstinate vomiting, and absolute constipation. Death followed three months later. The muscular layer at the pylorus was found to be 7 millimetres [$\frac{1}{4}$ inch] thick, the mucosa 4 to 5 millimetres [$\frac{1}{5}$ inch], the serosa 2 millimetres [$\frac{1}{12}$ inch], the pyloric orifice being quite patent. No neoplasm could be found either on macroscopic or microscopic examination. There were ten cherry-pits still present in the enormously dilated stomach. According to our present ideas, we would be compelled to regard this hypertrophy as having been caused by hypersecretion of acid.

The causes, situated external to the stomach, which may lead to stenosis or occlusion of the pylorus, are either tumors which exert pressure upon the pyloric orifice (or the duodenum), or which embrace and grow around it; such neoplasms arise either from the pancreas, the omentum, the retroperitoneal glands, or the liver. Minkowski† reports a rare occurrence of this kind in which he observed a hard tumor which was considered a cancer of the pylorus during life, combined with dilatation of the stomach, but which

* Nauwerk. Ein Fall hypertrophischer Pylorusstenose mit hochgradiger Magenerweiterung. Deutsch. Arch. f. klin. Med. Bd. xxi, S. 573–580.

† O. Minkowski. Ueber die Gährungen im Magen. Mittheilungen aus der med. Klinik zu Königsberg in Preussen, S. 163.

after death was found to be the gall-bladder entirely filled by a large calculus; this compressed the pylorus completely and led to the enormous dilatation. In this case examination for hydrochloric acid would have definitely excluded carcinoma, even though, as we shall see later, this is not positive; at any rate, it is at times absolutely impossible to differentiate between tumors of the liver or gall-bladder, or biliary calculi and neoplasms of the stomach. Further, if an old peritonitis gives rise to cicatricial bands which surround the pylorus or force it toward the posterior abdominal walls, and make traction upon or bend the pylorus—or the horizontal portion of the duodenum—we may also get pyloric stenosis. Rokitansky * has seen cases of gastrectasis which were caused by large scrotal herniæ exerting traction upon the stomach and dislocating it (and possibly also bending the duodenum?) Bartels was the first to call attention to the joint occurrence of wandering kidney on the right side and dilatation of the stomach, accounting for the latter by the pressure made by the kidney upon the duodenum; this form can not become marked unless its existence dates from childhood. Malbranc † agrees with him, and Schütz ‡ reports the case of a woman whose difficulties rapidly disappeared on leaving off her corsets, which were supposed to have exerted pressure on the dislocated kidney. Furthermore, Litten has called special attention to the connection between diseases of the stomach and change in position of the right kidney,# and has seen displacement of the right kidney and dilatation of the stomach occurring together in no less than 55 per cent of his cases. In common with Bartels he regards the dilatation as the primary trouble, and the wandering kidney as secondary to it; while I agree with Oser, Nothnagel, and Leube,‖ and wish to emphasize the fact that no causal relation exists in the majority of cases, but that it is a simple coincidence. Furthermore, in this question we must distinguish between the simple

* Rokitansky. Handbuch der pathol. Anatomie, Bd. ii, S. 178.

† Malbranc. Ein complicirter Fall von Magenerweiterung. Berl. klin. Wochenschr., 1880, No. 28.

‡ E. Schütz. Wanderniere und Magenerweiterung. Prager medicin. Wochenschr., 1885. January 14th.

Verhandlungen des Congresses für innere Medicin. Wiesbaden, 1887, S. 223.

‖ *Loc. cit.*, S. 225.

palpable and the true wandering kidney. Among seven cases of movable and displaced right kidney—i. e., true wandering kidney—which Brentano was able to collect in a few weeks in the policlinic of the Augusta Hospital, three women had gastric dilatation; among twelve cases of simple palpable kidney there was only one without dilatation of the stomach. I can thus confirm the fact that a movable right kidney and dilatation of the stomach frequently occur, especially in women, without on that account agreeing with Bartels, who believes that on deep inspiration the kidney is forced down by the liver, when at the same time a narrowing of the lower half of the thorax also exists, and that the duodenum is compressed between the liver and the kidney. To bring this about the kidney would necessarily have to be fixed; but its characteristic is just its mobility; hence it slips away, and it is only necessary to have seen in an animal how energetically the intestinal contents are forced on to appreciate how easily such an obstruction could be overcome. I think Landau* is right when he says that, even for physical reasons, the kidney would be unable to exert the necessary pressure on the gut.

The second great group of dilatations of the stomach arises from weakness of the gastric muscle, and differs from that first spoken of in that as a rule the stomach is dilated only to a slight degree, while the hypertrophy of the muscularis is absent. I shall describe these conditions as *atonic gastric dilatations* caused by *asthenia* or *akinesis* [*ἀ, without κινέω, I move*]† of the stomach. Predisposing factors are: 1. *Weakening of the muscular tone*, due either to excessive demands (perhaps traumatisms?) upon the muscle and its gradual relaxation, or to insufficient nourishment of the contractile elements of the gastric wall in anæmia, chlorosis, nervous affections, acute and chronic diseases of an exhausting nature, peritonitis, amyloid degeneration of the vessels. Thus we find

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* Landau. Die Wanderniere der Frauen. Berlin, 1881, S. 44.

† The ancients called conditions of this kind *frigiditas stomachi*. Todd was probably the first to use the term atony; Andral introduced the phrase *dyspepsie par asthénie de l'estomac;* Broussais designated it *dyspepsie asthénique*. The most varied dyspeptic conditions were included under this term.

that chronic gastric catarrh must also be included among the etiological factors of dilatation of the stomach. Since the catarrhal condition causes the ingesta to remain for a longer time than normal in the stomach, it is overburdened, and a relaxation of the muscle is produced, which, as we shall see when speaking of atrophy of the stomach, finally leads to separation of the fibers of the submucosa and muscularis; dilatation of the organ is the result, just as the bladder, when affected with catarrh, finally becomes the seat of paralytic dilatation. It is in this sense that we must understand Cloizier * when he includes deficient hygiene in combination with continual erect position of the body among the causes of dilatation of the stomach.

The excessive tension of the walls of the stomach is not only brought about by overloading the stomach with improper quantities of solid masses, with which the muscle is unable to cope, but also by the abnormal production of gases in the stomach, together with closure of the orifices; the latter may be of a mechanical nature from the commencement, and due to one of the aforementioned factors, or may be due to the occurrence of an abnormal fermentation of the ingesta, which only leads secondarily to muscular insufficiency. As Miller's † experiments have proved, and as daily experience confirms, such primary fermentations will always arise whenever an improper proportion exists between the micro-organisms which are present or which are introduced into the stomach, and the amount of hydrochloric acid, which normally has an antifermentative action; thus too many zymotic organisms may be introduced while the quantity of hydrochloric acid secreted is normal, or the latter may not be enough for their disinfection. As we know best from our observations upon the intestines, the products of fermentation, when absorbed, cause an irritation of the muscle, which, as long as the contractibility is intact, probably leads also to the simultaneous closure of the sphincters, and in this way causes an abnor-

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* Cloizier. De la dilatation dite primitive de l'estomac. Bull. méd., 1888, p. 1245.

† Miller. Einige gasbildende Pilze des Verdauungstractus, ihr Schicksal im Magen und ihre Reaction auf verschiedene Speisen. Deutsche med. Wochenschr., 1866, No. 8.

mally long detention of the fermenting masses in the stomach. Later, owing partly to mechanical distention, partly to the venous stasis intimately connected therewith, structural changes are produced in the mucosa and muscularis; also paresis and degeneration, and thus, finally, muscular insufficiency of the organ. Thus it is that we find dilatation of the stomach so frequently in gluttons, diabetics, insane patients with polyphagia, etc.; it may also develop from chronic gastric catarrh, or (probably most frequently) it may arise from a combination of both causes. It is especially due to Naunyn,* and his pupil Minkowski,† that these processes have been properly considered.

2. *Weakness and paralysis of the motor nerve-fibers of the stomach*, or diminished excitability of the nervous apparatus, presiding over peristalsis, may be caused by local lesions, such as destruction by ulceration of the branches of the vagus entering the stomach (Traube), or by processes of inhibition arising from other portions of the nervous system — for instance, the paralyzing influence exerted by chronic peritoneal exudations (Bamberger), or even by a simple catarrh of the stomach, just as paralyses of the muscles of the vocal cords are produced by laryngeal catarrh. Perhaps it is here that we must include those rare cases of atonic dilatation of the stomach which, quite contrary to the ordinary course of events, develop as the result of chronic, obstinate constipation, when, as a rule, just the opposite occurs. We know that there is no sharp line of demarkation between the peristalsis of the intestines and that of the stomach, but that, rather, the peristalsis of the upper portion of the intestines can be obliterated by the contractions of the stomach, as Braam-Houckgeest‡ has shown. Inversely, persistent sluggishness or paresis of the intestines might give rise to diminished peristalsis in the stomach. G. Sée and Mathieu# have also called attention to this

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* B. Naunyn. Ueber das Verhältniss der Magengährung zur mechan. Mageninsufficienz. Deutsch. Arch. f. klin. Med., Bd. xxxi, S. 225.

† Minkowski, *loc. cit.*

‡ Ewald, Klinik etc. I. Theil., 3. Aufl., S. 192.

G. Sée et Mathieu. De la dilatation atonique de l'estomac. Rev. de méd., 1884, 10 Mai, 10 Sept.; and A. Mathieu. Les phénomènes nervo-moteurs de la dyspepsie gastrique. Gaz. d. hôpit., 1888, No. 47.

point. I saw a very convincing example of this in a lady thirty years of age, who had suffered with obstinate constipation since childhood (the trouble, as is not at all infrequent, was hereditary in her family), and who, in the course of my observations, extending over a period of two years, although she had never before complained of stomach trouble, acquired a typical dilatation of the stomach, without, it is true, any marked signs of decomposition, but yet without any other referable cause.

3. Finally, the expulsive powers may be weakened by the *exclusion of a more or less sharply bounded portion of the muscular fibers of the stomach.* Circumscribed cancerous infiltration and ulcerations which do not stenose the stomach but destroy a portion of its muscle, result at times, if their growth be slow enough, in hypertrophic dilatation of the stomach. A similar condition is produced when broad bands of the muscular layer of the stomach are destroyed by inflammatory or ulcerative processes, and cause partial dilatation behind the site of the obstruction or complete gastrectasis. Very instructive pictures of this process may be seen in Cruveilhier's celebrated atlas of pathological anatomy.*

This, as far as I can see, exhausts the etiology of dilatations of the stomach. I shall now turn to the

Pathology.—I have already spoken of the gross anatomical changes, the variations in the size of the dilated stomach, and the changes in the position of the neighboring organs produced thereby—the intestines being forced into the pelvis, while the liver, spleen, and diaphragm may be displaced upward—as well as the nature and shape of possible neoplasms, to which I shall again revert when discussing the symptoms of the disease. At present the changes in the individual coats of the stomach are of special importance. It has been known for a long time that the muscularis may be totally or partially thickened, or apparently normal or thinned; a distinction has thus been made between hypertrophic and atrophic forms. Hypertrophy of the muscularis preponderates in the pyloric region, and occurs most frequently with cancerous or cicatricial stricture of the pylorus. Whether in such cases

* [Anatomie pathologique du corps humain. Paris, 1830–1842, 2 vols.—Tr.]

there is a true hypertrophy, or only an apparent thickening of the muscular wall of the stomach, on account of infiltration with cancerous elements, can frequently be decided only by careful microscopic examination. But at times we find the muscle at the pylorus hypertrophied, without the presence of any manifest neoplasm or cicatrix, and Lebert* claims to have found an increase in the thickness to 14 millimetres [$\frac{7}{12}$ inch]—generally it amounts to 5 to 6 millimetres [$\frac{1}{5}$ inch], which is already considerable; this he regards as the result of a chronic hypertrophic inflammation of the muscularis, produced idiopathically, and not by cancerous infiltration of the muscle. There can be no doubt that the hypertrophic form may gradually pass into the atrophic. The former occurs more frequently in youthful individuals, the latter, without exception, in the aged; so that in the numerous cases of dilatation of the stomach in old people on whom I have performed autopsies I have never found hypertrophy of the muscularis, it being much oftener, in fact in the majority of cases, of normal thickness, and far less frequently thinned. The individual muscle-fibers are normal in appearance; the nuclei stain well with picro-carmine. Since 1874 I have examined a large number of dilated stomachs microscopically, but I have never found hypertrophy of the individual muscle-cells, of which Lebert speaks, nor degeneration of these cells into a gelatinous mass (colloid degeneration), as described by Kussmaul and R. Meyer, and recently also found by Cahn; while frequently there existed a more or less extensive fatty degeneration. The interspaces between the individual muscular fasciculi appear enlarged and traversed by strands of connective tissue. Very often an infiltration of small cells is present, proceeding from the submucosa. The latter forms a wide-meshed tissue studded with numerous round cells, and its vessels widely dilated. The mucous membrane presents the picture of chronic gastritis in its different stages. In the glandular cells of the mucosa there is no change at all in many places; in others they are markedly cloudy and granular; in still others they show cystic degeneration, or have entirely disappeared in a round-celled infiltration, which

* Lebert, *loc. cit.*, pp. 525 *et seq.*

also fills and forces the meshes of the interstitial tissue apart. Nowhere can we recognize that they are hypertrophied. Neither do they appear to be increased in number. The interstitial tissue is considerably thickened and studded with numerous round cells; those ducts of the glands which are present are forced apart and separated by wide intervals, while normally they lie close together (Fig. 18). I have never found conditions which pointed to new

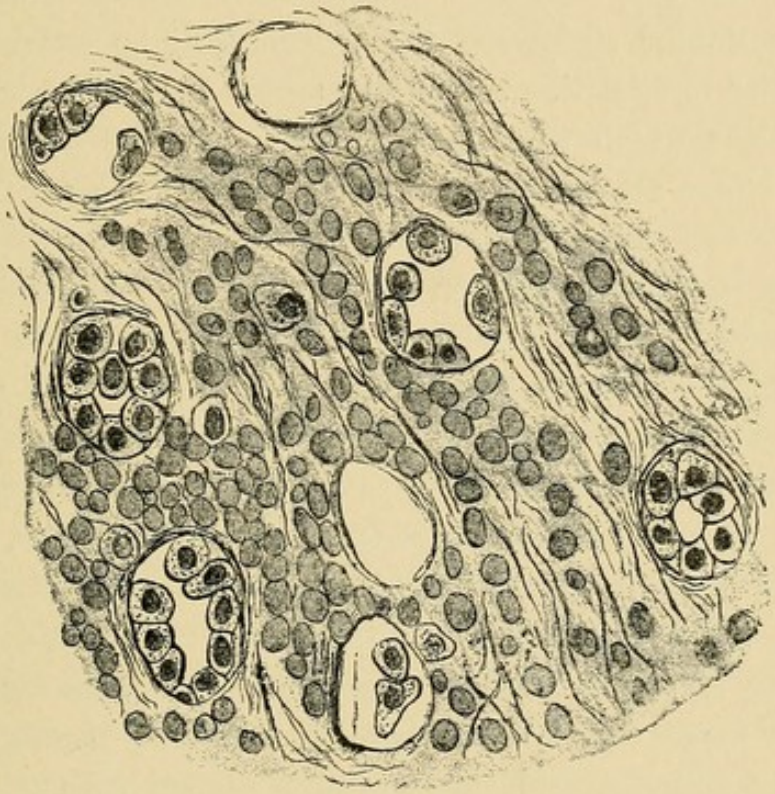


Fig. 18.—Cross-section through the mucous membrane of a dilated stomach. The ducts of the glands are forced apart, the interstices entirely filled by an infiltration of small cells. The glandular epithelium is unchanged in part, partly fatty, and in some places entirely gone. Single epithelial cells may be seen in the interstitial tissue.—Camera lucida.

formation or increase (hyperplasia or hypertrophy) of the glandular substance. In the great majority of cases the mucous membrane is spread smoothly over the muscularis, and is thinned rather than thickened; yet in the rare forms of hypertrophic dilatation the condition which the French call *état mammelonné* is developed, owing to the unequal growth of the mucosa and the muscularis, which leads to the former being thrown up into folds.

At first the dilatation of the stomach is found specially at the *cul-de-sac;* later on it involves the whole organ. A pathological

curiosity are the rare dilatation-like diverticula which are due to the persistent pressure of indigestible substances (coins, etc.), in the stomach.

Symptoms of Gastrectasis.—As a rule, patients with dilatation of the stomach, as may be inferred from the nature of its causes, are middle-aged or advanced in years. Yet the more extensive my experience becomes the more am I astonished at the frequency with which it occurs in younger persons, and—is not recognized. According to Pauli,* stenosis of the pylorus may be congenital and may give rise to dilatation. Andral † speaks of children being born with stomachs which filled the greater portion of the abdominal cavity. Similar observations have frequently been made, and only a short time ago at the policlinic I found a marked dilatation of the stomach in a girl eighteen years of age, who claimed to have heard succussion sounds (which were very evident at the examination) since her earliest childhood. In the last year and a half, in my own practice, I have seen five cases of considerable and, in part, very marked gastric dilatation in young people between the ages of fifteen and twenty-one—one a farmer's lad, one a pupil at the gymnasium, and three students. In only one had the trouble been recognized, the others having been treated for "chronic dyspepsia" or "nervous dyspepsia," and in none could a manifest cause for its origin be made out. Wiederhofer,‡ Comby,# Malibran,‖ and others have demonstrated and carefully studied dilatation of the stomach in children which they have ascribed to atonic and anæmic conditions.

Before speaking of the symptomatology of dilatation, let me state that we not so very rarely see cases which present the typical clinical picture of gastric dilatation as I am about to describe it to you, and yet in which there is no true dilatation of the stomach.

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* Pauli. De ventriculi dilatatione. Frankfurt a. M., 1839.

† Andral. Grundriss der pathol. Anatomie. Edited by Becker, 1830, ii, S. 91.

‡ Wiederhofer. Gerhardt's Handb. d. Kinderkrankheiten. Bd. iv, Abtheil. ii, S. 356 *et seq.*

Comby. De la dilatation de l'estomac chez les enfants. Arch. génér. de méd., Août et Sept., 1884.

‖ Malibran. Contribution à l'étude des ectasies gastriques. Thèse de Paris, 1885.

I shall designate such cases, as O. Rosenbach has done,* *gastric insufficiency*, or better, *motor insufficiency* of the stomach. I shall again refer to this in the course of my remarks on the symptomatology.

The symptoms of dilatation of the stomach always develop slowly. As a rule, dyspeptic troubles are the first to appear, and they may last for years; indeed, they may be the only symptom of an already developed dilatation. Thus it is that the latter is discovered only on a very careful examination of the patient; this occurred to me only lately in a young man whose father, a physician, had given him a letter with an explicit description of the symptoms on which he had based the diagnosis of nervous dyspepsia. In addition to the dyspeptic difficulties—anorexia, pressure and fullness after eating, tension of the abdomen, bad odor from the mouth, coated tongue, epigastric tenderness, *malaise*, oppression and pain in the head, irregular stool, etc.—we have a characteristic symptom in vomiting. At first this occurs frequently and comparatively soon after eating, being to a certain extent a therapeutic effort of the organism to relieve itself of the excess of the ingesta, while a portion is retained in the stomach, as urine is in a paralyzed bladder. Later the vomiting occurs less frequently in proportion to the increasing relaxation of the muscle and as the quantity of the collected masses to be evacuated becomes greater; finally—and this is always a bad omen—it ceases entirely. Then either the obstructing neoplasm has ulcerated, thus again opening the passage into the intestine, or a complete paralysis of the muscle has been developed. A characteristic feature of the vomit is its large quantity, which in individual cases has been quite astonishing, and is said to have been as much as 8 kilogrammes [17⅗ pounds]! Portal says that the stomach of the Duc de Chausnes, one of the greatest gourmands in Paris, could hold eight pints of fluid; and even larger figures are given. It is well known that at times more is vomited than has been eaten, since the remnants of former meals which accumulate in the stomach for a longer time are added. If the vomit, or the masses removed from the stomach through the tube,

* O. Rosenbach, *loc. cit.*

are allowed to stand in a glass cylinder, they soon separate into three layers, the upper one of brownish foam, a much larger middle layer of yellowish-brown, faintly cloudy fluid, and a lower one consisting of dark-brown, crummy, and slimy masses, chiefly remains of food. From time to time bubbles of gas rise up through the fluid, carrying particles of the deposit with them, while other fragments sink, since they are no longer supported by the carbonic-acid gas. Such a play of bubbles, similar to that which we see in a glass of champagne in which bread-crumbs have been placed, always indicates considerable yeast fermentation. Further, we find the ingredients of the food in the vomit in a more or less softened and digested condition; we also find varieties of mucor, sarcinæ, yeast, and numberless schizomycetes. At Kussmaul's suggestion Du Barry* examined these vegetable forms more carefully, and isolated them in pure cultures, but, it is to be regretted, without obtaining any definite pathognostic result. We are not justified, from the observations made by this author, in inferring a fermentative action from the presence and growth of the fungi; at all events, bacteria, yeast, and probably sarcinæ also have a definite typical fermentative action. Sarcinæ ventriculi, those peculiar colonies of cocci which occur in cubes or as tetrads, were first described by Goodsir in 1842; the extensive literature which has been written about them since then has been collected in detail by Falkenheim.† It is a matter of regret that the pathognostic significance of this parasite does not deserve the interest which was accorded to it by physicians. As early as 1849 Frerichs apologized for speaking about a subject "the literature of which is perhaps more extensive than its importance warrants"; thus Falkenheim also was unable to add anything new as to their occurrence or significance, while he established the important fact in the natural history of sarcinæ that at times, according to external circumstances, the same cocci may form either irregular masses or typical sarcinæ. Usually sarcinæ are present in small numbers or are entirely absent, yet at times in conditions favorable to their growth they may appear in large

* Du Barry. Beitrag zur Kenntniss der niederen Organismen im Mageninhalt. Arch. f. exp. Pathol. u. Pharmacol., Bd. xx, S. 243.

† Falkenheim. Ueber Sarcine. Arch. f. exp. Pathol. u. Pharmacol., Bd. xix.

masses, so that every drop of stomach-contents is really a pure culture of them; indeed, F. Richter* reports a case in which the inspissated masses of sarcinæ had led to complete closure of the pylorus.

But if, as I have said above, Du Barry was unable, with few exceptions, to refer definite processes of fermentation to individual fungi isolated from the contents of the stomach, their active participation as a whole is by no means excluded thereby, nor is it proved that their occurrence is insignificant and unimportant. I agree entirely with Minkowski† that their presence, as soon as they appear in larger numbers, invariably permits us to conclude that there exists a severe disturbance of the chemical functions, and that therefore the proof of their presence in the stomach-contents is not to be disregarded. The microscope discloses the presence, and in part also the variety, of the individual organisms; we may examine either the masses directly vomited or the aspirated stomach-contents, or its fresh filtrate. "In those cases in which, at the height of digestion, or some time after the ingestion of food, large numbers of fungi or bacteria are found in the stomach-contents, on microscopic examination, we may assume the existence of morbid gastric fermentation," says Minkowski; but he immediately adds that the view of what is meant by "large numbers" is subject to considerable uncertainty. For a few fungi can be found even in the contents of the healthiest stomach, where, indeed, they have no importance, since, as I have said above, their development is checked by the hydrochloric acid. This can be seen from the fact that the filtrate of normal stomach-contents may stand exposed for weeks, and even for months, without becoming cloudy or moldy, unless spores fall in from without. However, if large numbers of micro-organisms are present in the stomach-contents, in spite of the free hydrochloric acid, or if their reaction be neutral, or if the acidity be due to organic acids, there is immediately such a development of fungi in the filtrate that the variety of the predominating fermentation may be recognized even by mere inspec-

* Richter. Verstopfung des Pylorus durch Sarcina ventriculi. Virchow's Arch., Bd. cvii, S. 198.

† Minkowski, *loc. cit.*

tion. Thus we may find mold fungi—and this even in the presence of the hydrochloric-acid reaction in the filtrate—in the form of a white or gray scum upon the surface; or, after being cloudy at first, yeast may be deposited at the bottom of the vessel; or a more equally diffused turbidity, together with a strong sour odor, may be produced by the development of the lactic, acetic, and butyric acid fungi; or, finally, white zoöglea masses, which readily fall apart, may form upon the surface; these finally lead to complete decomposition of the albumen, and to an alkaline reaction, the process being accompanied by the odor of decay. In this way we can in a given case come to a fairly rapid approximate conclusion as to the predominant fermentation fungi, provided we are sure that they have not gained access thereto *post festum*—i. e., from the air of the room. The latter possibility can only be excluded, unless complicated apparatus and procedures are employed, by proving the presence of the fungi immediately after getting the stomach-contents—i. e., by microscopic examination. The latter is, therefore, indispensable; and, since also, in the most favorable cases, it always takes at least twenty-four hours, and usually longer, before the filtrate "germinates," the diagnostic value of the conditions described above, so highly spoken of by Minkowski, becomes markedly diminished in their essential features, although they will always be of pathognostic interest.

At times the vomit contains remnants of food, such as pits, fish-scales, etc., which, as the patients can prove, had been eaten months before. Werner* found 17 plum and 920 cherry pits in a dilated stomach, which must have stayed there since the previous cherry-season—i. e., fully three quarters of a year. But at times such things remain in stomachs which are not dilated. Thus, lately, in the stomach-contents obtained from a neurasthenic I found a small piece of fish-skin, which, according to the positive statement of the patient, must have been in the stomach for three and a half days.

The chemical relations of the gastric juice in dilatation of the

* Werner. Zur Casuistik des Magenkrebses, etc. Würtemberg. med. Correspondenzbl. 1869, 22–24. Could not the man have eaten cherry-pie or dried cherries in the interim?

stomach, in so far as this is not dependent upon the presence of a cancer, seem to be unchanged qualitatively. Should the latter be the cause, we will find all the anomalies of secretion which will be explicitly discussed in the lecture on carcinoma of the stomach. If, on the other hand, we have to deal with cicatricial contractions of the pylorus, atonic conditions of the muscle, hypersecretion, etc., we find, almost without exception, either the usual or increased quantities of hydrochloric acid, peptone, and propeptone, and the peptic action is satisfactory, though usually somewhat retarded. In 33 cases Riegel* found 0·10 to 0·46 of hydrochloric acid; in 20 cases which I titrated, the acidity due to hydrochloric acid varied between 50 and 80 = 0·17 to 0·30 per cent of that acid. The presence of hydrochloric acid can be understood when we recollect that, as far as the microscopic picture permits us to judge, the ducts of the glands are for the most part unchanged, and that the usual secretion of mucus in catarrhal conditions, manifestly due to the marked acidity of the stomach-contents, is reduced to a minimum, and that a so-called mucous catarrh of the stomach does not exist.

However, this picture of the normal condition of secretion is complicated by the fermentations which take place in the stomach, and which cause secondary decompositions of the stomach-contents. In another place† I have given the schema of the fermentation of carbohydrates, which, depending upon the abnormal decomposition of sugar, appears at times in the form of the so-called oxidation-fermentation (*Oxydationsgährungen*), alcohol, aldehyde, and acetic acid being formed from the sugar; or at other times lactic-acid fermentation sets in, in which the sugar is first decomposed into lactic acid, and later into butyric acid, carbon dioxide, and hydrogen. Both fermentative processes are due to the presence of specific organized ferments, among which we can name yeast, oidium lactis, and a number of bacteria, the recognition and isolation of which are to be especially ascribed to Hüppe. Both processes may occur together, and in rare cases may be combined with the products of cellulose fermentation; though it is questionable whether the latter,

* Riegel. Beiträge zur Diagnostik und Therapie der Magenkrankheiten. Zeitschr. f. klin. Med., Bd. xi, Heft 2 u. 8.

† Ewald. Klinik etc. I. Theil, 3. Auflage, S. 125.

namely, methane, and sometimes olefiant gas, are derived from the stomach, or whether they have not rather regurgitated from the intestines into the stomach. The best-known case of this kind is that described by Ruppstein and myself,* of a patient who, according to his own statement, "had at times a vinegar-factory and at others a gas-factory in his stomach," in whom, therefore, the fermentation was sometimes combined with a predominant production of acid, and at other times caused a collection of gas. When the latter condition was present, he could ignite the eructated gases through a little roll of paper or a cigar-holder, by holding a lighted match in front of it; the result was a faintly illuminating flame. In the vomit Ruppstein demonstrated the presence of alcohol, acetic, lactic, and butyric acids, while I found the gases to be composed of carbon dioxide, hydrogen, methane, traces of olefiant gas, oxygen, nitrogen, and sulphuretted hydrogen.† However, under the usual circumstances, it will only be necessary for us to demonstrate the presence of lactic, butyric, and acetic acids, and in practice we can content ourselves with the proof of the first two. It is striking that the total acidity of the stomach-contents is not, as a rule, excessively high, even in cases of very marked decomposition, in spite of the pungent odor, and in spite of the complaints of the patients concerning the acidity of the regurgitated or vomited masses; this is evidently due to the fact that when the acids are formed they become rapidly converted into neutral or basic salts. This is also the reason why the conversion of starch into sugar is but slightly changed. Granulose is but seldom found; we most frequently get erythrodextrin and large quantities of achroödextrin or maltose.

Another form of abnormal chemical change leads to the prod-

* A. Ewald. Ueber Magengährumg und Bildung von Magengasen mit gelb brennender Flamme. Reichert's und Du Bois' Archiv, 1874, S. 217.

† [The literature on this subject will be found in a paper by J. McNaught. A Case of Dilatation of the Stomach, accompanied by the Eructation of Inflammable Gas. British Medical Journal, 1890, vol. i, p. 470. In this case the analysis of the gas was as follows:

CO_2	56·0 per cent.
H	28·0 " "
CH_4	6·8 " "
Residual air	9·2 " "
	100·0 —Tr.]

ucts of decomposition of albumen—amido-acids and ammonia—which are characterized by their peculiar foul odor, and under the microscope by the prevalence of cocci, vibriones, and masses of zoöglea, some of which may be seen spinning about in the field in a lively manner. The reaction of the stomach-contents is, then, usually neutral; or, if the basic products of the decomposition of albumen are in excess, it may even be faintly alkaline. At any rate, because there is either an absence of hydrochloric acid from the commencement, or because it is neutralized by the products of decomposition spoken of, an opportunity is given for progressive decompositions which combine with the above-mentioned processes of fermentation, and thus may produce very varied clinical pictures. As a rule in such cases we have to deal with large degenerating neoplasms.

While the stagnation of the stomach-contents exerts no appreciable influence upon the secretion of the mucous membrane, as long as the secreting elements are intact, it disturbs absorption very seriously. This goes hand in hand with the paresis of the motor elements. The tests with iodide of potassium and with salol show the retardation of the absorptive and motor functions. The result of the former may be obtained from half an hour to a whole hour too late, and I have seen the latter absent as long as two and three hours. Nevertheless, it is by no means asserted that, in all or in particular cases of gastric dilatation, these reactions are always typically retarded. It must always be borne in mind, however, that they explain only a function, and not a group of symptoms, and that a markedly dilated stomach can very well display normal or nearly normal efficiency in this direction. But, under such circumstances, the disturbances which might otherwise develop tend, as a rule, to be comparatively slight. Thus in fourteen cases of typical dilatation of the stomach, in which I used the salol test, I found in five that there was no appreciable delay in the splitting up of the salol. In three of these cases, too, the subjective symptoms of dilatation of the stomach were by no means marked, proving that the ingesta were promptly passed on into the intestine, thus compensating for the dilatation.

It is very apparent that these different disturbances of function react one upon the other. The development of the products of de-

composition paralyzes the muscularis, and this paralysis favors the stagnation and with it the further decomposition of the ingesta. The disturbed function of absorption not only delays the removal of absorbable substances, but also interferes with their further formation. In view of the experiments of Schmidt-Mühlheim, Cahn, and others, we must assume that the power of the gastric juice to form peptone ceases as soon as the percentage of the latter has reached a certain height, just as alcoholic fermentation is suspended as soon as a definite quantity of alcohol has been formed. Now, since the peptones are neither absorbed nor transferred to the intestines at the proper time, it follows that the rest of the nitrogenous food is not attacked by the gastric juice; and, hence, we find so many wholly or partly undigested masses in the stomach in spite of the excessively long time during which the ingesta remain in the organ.

On the other hand, it is evident that all these conditions may be present and may manifest themselves without the existence of a really marked dilatation, but rather of motor insufficiency, or what the ancients called atony of the stomach. They are then, it is true, less marked, yet at times they may reach a high degree of intensity, as the case spoken of above, of the patient "with the gas-factory," proves, in whom, quite contrary to our assumption of a dilatation of the stomach, based, it is true, upon what we would to-day consider insufficient examination, there existed an almost concentric hypertrophy of the stomach with a stenosing carcinoma of the pylorus.* Such cases, therefore, as I have mentioned above must be designated motor insufficiency of the stomach; these will be discussed more carefully when speaking of the chronic inflammation of the gastric mucous membrane and of the neuroses. From these considerations we can see that very appreciable dilatations of the stomach may occur, in which the injurious effects are equalized by efficient compensation on the part of the absorptive and motor functions. Thus, some individuals may for years have an abnormally large stomach, which causes them little or no trouble, just as many

* A similar anatomical case was described by Diemerbroeck in 1685 (and cited by Penzoldt, Die Magenerweiterungen) in order to prove that a hard drinker must not necessarily have a dilatation.

people live for years with valvular lesions in ignorance of the existence of their trouble, since compensatory hypertrophy of the ventricle equalizes the defect of the valve. But some day this compensation fails, and then suddenly, or in a surprisingly short time, all the symptoms of dilatation appear. These are the cases in which the dilatation has apparently arisen acutely, and which are spoken of especially in English literature.* Thus, accidentally from the results of the salol test, I was able to prove the existence of marked gastric dilatation by inflating the organ in two old persons who had been in the *Berliner Siechenhaus* for years without having complained of any special stomach trouble.

As the disease progresses the nutrition is affected more and more; a highly marked marasmus appears. While vomiting occurs less frequently, the foul-smelling eructations and flatulence are increased. The pressure of the dilated stomach causes displacements of the neighboring organs, especially the lungs, heart, liver, and intestines, together with disturbances of their functions. Dyspnœa and palpitation are increased according to the extent to which the diaphragm is forced upward by the stomach filled with ingesta or distended by gases. Obstructions to the portal circulation and their consequences appear. The bowels, as a rule, are sluggish, and can be moved only by enemata or strong drastics; and the stools even then are usually not soft, but consist of hard masses mixed with water and mucus. An unusual symptom, but when present a very conspicuous one, is the peristaltic unrest of the stomach, first described by Kussmaul, to which I have already alluded above [page 113]. Powerful waves are seen passing slowly over the stomach from right to left, and from above downward; they may also affect the lower sections of the intestines, and even in rare cases take an antiperistaltic course (Cahn). Naturally, this presupposes a marked obstruction at the pylorus in connection with relatively intact muscle or innervation.

Not only is absorption scanty or checked in the stomach, but it must also be markedly diminished in the intestine, which is but

* For example, Hilton Fagge, On Acute Dilatation of the Stomach, Guy's Hosp. Reports, xviii, pp. 1–22; and Albutt, On Gastrectasis, Lancet, 1887.

insufficiently provided with chyme from the stomach at long intervals. This is especially true of the absorption of water, causing an abnormal dryness of the muscular and nervous tissues and of the skin; the latter is roughened almost like in the last stages of diabetes, and at times thickly covered with furfuraceous scales. To this dryness Kussmaul* ascribes a nervous phenomenon observed by him which manifested itself by painful spasms of the flexors of the arms, the calves, and the abdominal muscles, with which at times a kind of nystagmus, mydriasis, emprosthotonos, as well as disturbances of consciousness, were associated, together with a condition which closely resembled, if it really was not, the *tetany* which appears after acute infections, rheumatism, conditions of great exhaustion, etc. These attacks begin with painful sensations in the stomach and other regions of the body, as well as with a feeling of oppression, and may at times last for many hours. Kussmaul is inclined to attribute the cause of these attacks to a sudden increase in the deficiency of water in the already parched tissues of the patient like those occurring in cholera, the sudden change being due to vomiting or lavage. On the other hand, we find similar phenomena in other diseases; for instance, in convalescence from typhoid, and especially in relapsing fever, in which such a factor could not come into consideration. In a case observed by Gerhardt,† he calls attention to the fact that the convulsions began in the upper and not in the lower extremities,‡ as in cholera, and ascribes their occurrence to the absorption of the products of decomposition in the stagnant masses in the stomach. Then, however, they should not have appeared during rational treatment, which is exactly what took place in Kussmaul's cases.

According to this it seems that the disturbed absorption of water and the resultant dryness of the tissues may in individual cases be

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* Kussmaul. Ueber die Behandlung der Magenerweiterung, etc. Deutsch. Arch. f. kl. Med., Bd. vi, S. 455. Also Laprevotte, Des accidents tetaniformes dans la dilatation de l'estomac. Paris, 1884.

† Gerhardt, quoted by Zabludowski. Zur Massagetherapie. Berliner klin. Wochenschr., 1887, S. 443.

‡ This was also observed by Dujardin-Beaumetz et Oettinger: Note sur un cas de dilatation de l'estomac continuée de tetanie généralisée. L'Union méd., 1884, Nos. 15 and 18.

the cause of an abnormal irritability of the nervous system which may become intensified sufficiently to present the picture of tetany; in other cases, however, owing to the absorption into the blood of the products of decomposition, there may appear an auto-infection characterized by nervous depression, which has been aptly named "*coma dyspepticum*." Fr. Müller * has reported two cases of the former kind in which, in addition to the symptoms already mentioned, there was a distinct increase in the mechanical and electrical excitability of nerve and muscle; Minkowski † mentions the occurrence of deep coma in the course of a case of dilatation of the stomach, the patient dying in this state two days later; while Litten observed similar though not such intense conditions in cases of acutely developed dyspepsia, and obtained the ethyl-diacetic-acid reaction [Gerhardt's Burgundy-red reaction] in the urine. ‡ This seems to point to the formation and absorption of substances which are normally not present in the gastro-intestinal tract, or, at any rate, not normally absorbable; yet from the stomach-contents of his cases of tetany Fr. Müller failed to isolate a poisonous alkaloid or toxin, perhaps, as he himself says, because the masses examined, although they had an unpleasantly sour odor, did not have the typical odor of decay and no very marked decomposition had taken place. Finally, therefore, the possibility remains that this form of tetany represents a reflex process proceeding from the stomach, and for which many analogies, collected by Müller, could be found, of which I will only mention the convulsions caused by worms. Tetany is always a severe complication of gastric dilatation, for, of the eight cases collected by the author just mentioned, five were fatal, a mortality of 62·5 per cent.#

As long as the disease pursues its course undisturbed, the urine in dilatation of the stomach manifests no special changes. I have

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* Fr. Müller. Tetanie bei Dilatatio ventriculi und Achsendrehung des Magens. Charité-Annalen, 1888, Bd. xiii, S. 273.

† Minkowski, *loc. cit.*, p. 163.

‡ M. Litten. Eigenartiger Symptomencomplex in Folge von Selbstinfection bei dyspeptischen Zuständen. Zeitschr. f. klin. Med., Bd. vii. Supplementheft, S. 81 u. ff.

[See also M. Loeb. Tetany from Gastric Dilatation from Pyloric Cancer. Journal of Nervous and Mental Diseases, New York, November, 1890; Martin, La Loire médicale, November 15, 1890.—Tr.]

never observed the peptonuria spoken of by G. Sée and found by Bouchard in 7 per cent of his cases, although I have examined many patients for that purpose. At times, in the later stages of the disease, the quantity of the urine is diminished, though this is not usual. Perhaps this, like the alkalinity of the urine, which may be observed under certain circumstances,* is to be referred to the regular emptying or washing of the stomach undertaken in the course of treatment. Quincke believes the cause to be the deficient absorption of the acid of the stomach by the gastric mucosa, whereby an important factor in the acidifying of the urine is removed. This is quite possible so long as the changes in the chemical functions connected with dilatation are not remedied. On the contrary, it seems to me that the greater the care which is taken to improve the organ by systematic lavage, the more favorable must the conditions of absorption become, and that therefore the urine should be acid rather than alkaline. This is also corroborated by an observation of Winkhaus,† who collected the urine in separate portions at various periods during the day in a patient with a marked gastrectasis; the urine was alkaline as long as the fermentation in the stomach was not interfered with, but invariably became acid some time after the stomach was washed out. Moreover, it depends entirely on the actual cause of the dilatation whether any quantities of hydrochloric acid worth mentioning are secreted by the stomach.

Diagnosis.—Were I to follow the usual plan and now take up the diagnosis of dilatation of the stomach, I would simply have to repeat what has already been said, for whatever has reference to the diagnosis has already been fully discussed; it is just in dilatation of the stomach that the differential diagnosis is relegated more than elsewhere to the background. It is apparent that we must guard against confounding this condition with distention of the colon, ovarian cysts, sacculated ascites, hydronephrosis, and echinococcus cysts; however, on careful examination by the methods given, these can hardly claim our earnest attention. On the whole, the tend-

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* Quincke. Dilatatio ventriculi mit Durchbruch in das Colon. Eigenthümliches Verhalten des Urins. Correspondenzbl. für Schweizer Aerzte. 1874. No. 1.

† H. Winkhaus. Beitrag zur Lehre von der Magenerweiterung. Inaug. Diss. Marburg, 1887.

ency of physicians is to make the diagnosis of "dilatation of the stomach" rather too often than too seldom, except, as I have already mentioned, when it occurs in young persons. It would be of very great importance were we able to sharply distinguish between insufficiency of the stomach and true gastectrasis. This is easy as long as we have to deal with the group of symptoms of a dilatation when no truly dilated stomach is present—under such circumstances it may be extremely difficult to exclude a primary catarrhal condition—yet it is impossible, and the diagnosis can only be made *ex juvantibus* when, with a relatively short duration of the disease and poorly marked symptoms, a megastria exists at the same time, and thus simulates an incipient gastrectasis. In advanced cases we can not remain in doubt, even under such circumstances.

Course and Prognosis.—Both are intimately connected with the primary cause of the gastric dilatation. If it be due to a malignant tumor, the duration of life is dependent upon the course of the cancerous disease and the prognosis is always unfavorable; yet we must not forget that remissions may occur in the course of such processes which under the influence of rational treatment may produce a relatively good condition for weeks, and even for months. It is to this fact that the majority of the cases reported "cured" can probably be referred. I, at least, have never seen such a gastric dilatation cured, but I have repeatedly observed that such periods of improvement threw doubt upon the diagnosis till it was finally confirmed at the autopsy.

When the dilatations are caused by constricting cicatrices, or by atonic conditions of the gastric muscle, they run a slower course, and the prognosis is on the whole more favorable. But here, too, alas! we must say, "*Prævalabunt fata consiliis!*" Such patients carry their dilated stomachs about with them for years, and under appropriate treatment and diet can lead an endurable life—indeed, one almost free from all difficulties; but they never dare forget that every "step from the path"—i. e., every dietetic error—which need by no means be gross, but simply a very slight departure from the prescribed diet, entails not only a momentary feeling of sickness but usually severe disturbances, which sometimes can not be relieved at all; for it is a peculiar characteristic of all dyspeptic conditions

of a severe and chronic nature that they not only may relapse easily, but that these relapses last longer and are worse than the first attack. But it must be specially emphasized that the treatment of dilatations of the stomach when they are recognized early offers us a very grateful field for treatment, unless, which is not unusually the case, they have been treated in the mean time with all manner of purposeless "stomach medicines." We can very safely promise such patients a very marked improvement in their trouble; in fact, were we only to regard the subjective symptoms, we could promise a cure. But, if we did, such a falsehood would be punished in the future. As far as my experience goes, even these dilatations can not be cured, and the final prognosis is always unfavorable; at least, in four cases which I have had the opportunity of watching for years—over six and as long as eight years—I have found the stomach just as large as ever when I distended it, in spite of subjective improvements and even apparent cure; the result has been just the same in the many cases of dilatation of the stomach of this category which I have had the opportunity of observing for shorter periods of time. When the stomach is once dilated we are unable to draw it together again like a tobacco-pouch, any more than an eccentrically hypertrophied heart (excepting the isolated cases of acute cardiac dilatation) ever returns to its normal condition. As soon as the muscular and glandular tissues have been forced apart and infiltrated by an abundant proliferation of interstitial tissue; as soon as the muscular fibers have undergone fatty or other degenerations; as soon as the ducts of the glands have been destroyed or have undergone cystic degeneration—in short, as soon as atonic atrophy of the walls of the stomach has appeared, the game is lost. Gradually our therapeutic and dietetic measures lose their efficacy, and the patients die of marasmus, and with more or less marked dropsical effusions.

We can only expect a decided improvement, or even a cure of the gastric dilatation, when the process is in its earliest stages and is produced by functional disturbances, atony, deficient innervation, or catarrhal conditions of the mucous membrane, or when the obstruction to the emptying of the stomach is immediately removed by operative procedures, as in the above-mentioned case of Klem-

perer. Here the relaxed muscle may regain its tone and the mucous membrane its normal structure and function, the interstitial exudation may be absorbed, and the organ *in toto* brought back to its original size. It is very evident that all this is only possible provided the anatomical changes have not exceeded a definite and very limited degree; this is quite analogous to the conditions of other organs—the bladder, for instance.

Those cases of dilatation of the stomach which arise from a chlorotic or anæmic condition, and which have been described as cured, can not be classed with the true dilatations, as I have defined them above, but belong to the group of gastric insufficiency, which may at times be combined with a megastria.

The treatment* of dilatation of the stomach must fulfill two indications: 1. By means of a carefully selected diet, and appropriate medication, it must ease and assist gastric digestion as much as possible, and even supply nutriment to the organism in another way. 2. It must prevent stagnation of the stomach-contents and must expel them either upward or downward, and must also check the fermentative processes which develop in the stomach.

The quantity of food in dilatation of the stomach should be as limited as possible. We must restrict the use of fluids as far as we can; thin soups, large quantities of alcoholic beverages, mineral or other waters, and much tea or coffee, are to be entirely avoided. I make use of milk even in only small quantities, and give it in teaspoonful or tablespoonful doses at frequent intervals. Under such circumstances the most rational course to pursue, if possible, would be to use Schroth's dry diet (*Trockenkur*).† But since the treatment must extend not over short periods of time, but over months, and even years, this is not applicable, and we must therefore satisfy ourselves with a modified dry diet. Germain Sée, strange to say, considers the withdrawal of fluids unnecessary, since, he thinks,

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* [See also valuable paper by Oser, Wiener med. Presse, Sept. 25, 1889.—Tr.]

† [This very energetic treatment, as modified by Jürgensen, consists in giving the patient as many dry rolls as he wishes, and also a third to two thirds of a pound of lean meat and a pint of light claret wine; no other fluids are allowed, except on every third or fourth day, when drinking is permitted. Wet packs at night. Before the cure, fluids are gradually withdrawn, and after it they are gradually increased. The treatment lasts about a month.—Schlesinger, Hülfsbüchlein, etc., S. 45.—Tr.]

they are absorbed the most rapidly and easily. This is a fatal error, for there is also a delay in the absorption of fluids; they remain in the stomach, and not only do they favor fermentation, but through their weight also mechanically dilate the organ. The use of the peptone preparations is to be recommended; for instance, Koch's or Kemmerich's meat peptones, meat peptone chocolate, Maggi's peptone pastilles, [Valentine's] meat-juice, etc., which contain much nourishment in a small volume.* I have lately found condensed peptonized milk to be very serviceable; it has an agreeable taste, and can be purchased in small packages as the so-called "*Muttermilchpatronen*," or of a gelatinous consistency in larger boxes. The patients also like meat-powder,† which can easily be made at home from dried and pulverized meat; it is made into a broth, with the addition of spices. It is evident that all easily fermenting foodstuffs, especially amylaceous foods and the vegetables and fruits which contain much sugar, are to be absolutely avoided; and it is only as a concession to the imperative necessity for starchy foods that we permit the patients to have a small quantity of bread, say 75 to 100 grammes [℥ ijss. to iijss.] daily—i. e., two or three rolls. The decomposition of the fats evidently takes place late and slowly, for in washing out the stomach six to seven hours after a meal we find the fat floating in large and small globules on the surface of the water, and no intense odor of the fatty acids is noticeable, which is always the case unless the stomach is systematically washed out. However, since the fats seem to exert an irritant action on the mucous membrane, their use is to be restricted as much as possible. The strength of the patient may be kept up by means of small quantities of strong wine or strong, unsweetened coffee or tea. Nutrient enemata form an important aid in nourishment; they may be given in the form which I have spoken of, or as suppositories of peptone, the use of which can be continued for weeks or months. By such means nourishment by the mouth may be reduced to a minimum for days—i. e., until the condition of gastric digestion has been improved as much as possible; enemata also possess the ad-

* [Analogous preparations are Rudisch's sarcopeptones, Carnrick's beef peptonoids, Bush's bovinine, etc.—Tr.]

† [Parke, Davis & Co.'s Mosquera's Beef-Meal may be used for this purpose.—Tr.]

vantage of preventing the lack of water in the tissues by means of the fluids introduced (Liebermeister).

Hydrochloric acid in large doses is an excellent remedy for all gastric dilatations which are not dependent upon pure atony of the muscle. We may commence with ten to fifteen drops of dilute hydrochloric acid, taken through a glass tube in a tablespoonful of water every hour. Salicylic acid pure, or in the form of salicylate of bismuth, in doses of 0·3 to 0·5 gramme [gr. ivss. to vijss.], as well as benzin, are to be recommended. Minkowski recommends the use of carbolic acid in large doses—0·1 [♏ jss.]! and over—to be taken in pills before meals. I have seen good results from the use of creasote, which was given by Mannkopff as early as 1861, in cases of gastric fermentation, in doses of 0·1 to 0·2 [♏ jss. to iij] several times daily. If carcinoma of the stomach exists, it is best to use a maceration of condurango, with the proper quantity of hydrochloric acid. In case there is much pain in the stomach, I make use of the sedative and antiseptic action of chloral, combined with cocaine, as follows:

℞ Cocain. hydrochlor..... 0·3 [gr. jvss]
Chloral hydrat..... 3·0 [gr. xlv]
Aq. menth. pip..... 50·0 [f ℥ j ℈]
Aq..... 100·0 [f ℥ iij ℈]
M. Sig.: Tablespoonful, p. r. n.

Dujardin-Beaumetz speaks highly of introducing large doses of bismuth, 50 grammes, suspended in 500 c. c. of water [℥ jss. bismuth to O j water], from which the drug is said to be deposited on the gastric mucous membrane;* injections of morphine are eventually unavoidable. Atonic conditions of the muscle require the exhibition of strychnine, as extract or tincture of nux vomica, which had been formerly recommended by Skjelderup and Duplay,† who did not draw this sharp distinction. It can be given without bad effects in large doses—0·1 to 0·15 [gr. jss–ij ¼]! of the extract *pro die*. Dr. Wolff has proved at my clinic that it also increases the production of hydrochloric acid.

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* Bullet. génér. de thérapeutique, 1883, No. 1.
† Arch. génér. de méd., 1883, Nov., Dec.

The cathartics and drastics have always played an important part in the therapy of gastric dilatation; they are really of service, probably by sympathetic stimulation of the gastric peristalsis, not only in evacuating the intestines but the stomach as well, as soon as they have passed the pylorus, or, indeed, have been absorbed at all, neither of which is always the case. Penzoldt was able to directly prove the beneficial effect of Carlsbad salts in lessening the quantity of the stomach-contents, for the quantity removed from the organ while the salts were used amounted to 850 c. c. [f ℥ xxviij], while without them, the condition being otherwise the same, they measured 1,525 c. c. [3½ pints]. Kussmaul recommends drastic pills, composed of ℞ Extr. colocynth. spirit. (G. P.), 0·5 [gr. vijss.]; extr. rhei comp. (G. P.) *sive* extr. aloes aquos., scammonii, āā 2·0 [gr. xxx]. M. Ft. pil. no. xxx. Sig.: Before dinner. I have frequently used aloin subcutaneously with good results.

To meet the second of the two indications given above, lavage, the sovereign remedy in the treatment of dilatation, is to be used. I will disregard the many appliances devised for this purpose, because, to my mind, they are like carrying coals to Newcastle. The use of the stomach-tube, with a funnel attached to it, and the cleansing of the stomach by the alternate introduction and removal of large quantities of water, is the simplest and at the same time an entirely efficient method. We must not stop until the water returns clear or only very slightly turbid, but by all means entirely free from fragments of food and flakes of mucus. At times, toward the end of the operation, after the water has come back clear for some time, it suddenly becomes turbid again from the presence of large masses of stomach-contents; this occurs especially when there are well-marked pouches in the stomach, the contents of which are only stirred up toward the last by the entrance of the water or the bearing down of the patient. We must allow all the time we can for the possible digestion of the food which may be in the stomach, and therefore we must only empty the stomach when large accumulations are present—i. e., to wash out only six or seven hours after the principal meal. Besides the actual washing out which is to prevent the mechanical overloading of the stomach, we conclude the operation with irrigation of the mucous membrane

with antiseptic or antifermentative solutions. In cases of very marked fermentation we can clean the walls of the stomach more quickly and thoroughly by washing out the stomach in the morning before breakfast when the viscus is empty, as Naunyn and Minkowski have also advised. I have had patients in whom the morning lavage produced much better results than that done in the evening. As antiseptics we may use solutions of salicylic acid 0·3 to 0·5 per cent, or borax 2 to 4 per cent (dissolved in hot water), or sodium subsulphate 10 to 20 per cent, as well as a great number of other disinfectants, such as naphthalin, resorcin, benzoic acid, permanganate of potash, etc. These substances, the efficacy of which is well known, should suffice.

The advantages which accrue from this procedure are so apparent that it is really incomprehensible why this method should not have been introduced earlier into therapeutics. To avoid repetitions I shall not add anything further on the benefits of lavage of the stomach, for its manifold advantages can readily be recognized. However, of one of these I must speak, for it appears very frequently, if not always—namely, the effect on the stools. Many patients who have had to contend with habitual constipation throughout the whole course of their illness have had free passages after the washings, especially at the commencement of the treatment. Kussmaul,* who has called attention to this effect of lavage, always considers its absence an ominous sign; in other words, he believes that the persistence of obstinate constipation always indicates an irreparable disorganization of the stomach and an incurable stenosis of the pylorus. *But this much is certain, that in scarcely any other place in the whole range of the therapy of diseases of the stomach can we attain such brilliant results as we can in the treatment of a case of protracted dilatation of the stomach.* The disgusting vomiting, the feeling of fullness, the eructations, the dyspeptic difficulties, and the cerebral symptoms either cease entirely or become markedly improved. Unfortunately, in true dilatations, as I have stated above, these results are merely palliative.

* *Loc. cit.*, p. 467.

How often shall we wash out the stomach? Daily, or at longer intervals, or as often as several times a day? I consider daily washings at the time specified to be indispensable and also sufficient. But they must be conscientiously continued for a long time—the patients soon learn to do it themselves—and we must not be guided alone by the subjective sensations of the patient. Should the latter's apparently good condition induce us to allow longer intervals to intervene, so-called relapses are sure to occur, since stagnation and its consequences will always return. The present technique is so simple and safe that less can be said against it than, for instance, against long-continued catheterization in hypertrophy of the prostate. I have as yet never seen any unpleasant accidents occurring after lavage, yet we find a case reported by Martin * in which death suddenly occurred six hours after a tube had been introduced into a dilated stomach with stricture of the pylorus. No injury of the viscus was found at the autopsy, and, since sudden collapse and death may occasionally occur in cases of cancer without any cause at all, it appears to me that this was simply a coincidence.

Massage and faradization of the stomach I consider adjuvants of lavage. The former, if intelligently applied, forces the contents of the stomach into the intestines, and in this way dilates the pylorus by means of mechanical pressure. Yet we must avoid forcing masses into the duodenum which are too acid or too acrid, which can not be sufficiently neutralized by the intestinal juices, and which produce conditions of irritation in the mucous membrane of the intestine. Zabludowski,† of Gerhardt's clinic, has published very good results from the use of massage in dilatation of the stomach, together with an exact account of the technique employed.

Up to the present time it has been difficult to say whether faradization of the abdominal walls had any effect upon the gastric muscle, and whether it was not rather entirely limited to the contraction of the abdominal muscles. Pepper,‡ in a case of dilatation due to cancer of the pylorus with plainly visible peristalsis, was

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* Martin. Death after washing out Dilated Stomach. Lancet, 1887, No. 2.

† Zabludowski. Zur Massagetherapie. Berliner klin. Wochenschrift, 1886, S. 443.

‡ Pepper. A Case of Scirrhus of the Pylorus, etc. Phila. Med. Times, May, 1871.

unable to stimulate the latter by either the faradic or galvanic currents. However, it has been shown by the experiments made with the salol test by Dr. Sievers and myself, and also by Einhorn, that the passage of the stomach-contents into the intestine is really hastened by energetic external faradization in the region of the stomach. Brunner* obtained the same result, for he observed that the test-breakfast disappeared much more rapidly than usual from the stomach when the abdominal walls were energetically faradized, although, it is true, the salol test left him in the lurch. The effect would be more certain if we applied the electrodes locally, introducing one into the stomach and placing the other upon the abdominal walls or in the rectum, so as to include the entire digestive tract in the current, and thus to obtain very powerful action. [See page 66.] Cold douches and applications are said to have a tonic effect upon the muscle-fibers of the stomach, as well as the so-called Scotch douche, as recommended by Winternitz and Baum.†

Finally, we must think of *dilatation or excision of the stenosis.* I can do no more than mention these procedures here, and therefore simply call your attention to the fact that quite a series of successful operations, either excision of the constricting tumor or forcible dilatation of cicatricial stenosis, has been published during the past few years. Thus, Hubert describes two cases of forcible digital dilatation of cicatricial stenosis of the pylorus which were operated upon by Prof. Loreta in Bologna, and apparently were radically cured.‡ A method which may be worthy of special consideration is that proposed by Heinecke and Mikulicz, of splitting the stricture longitudinally and then passing the sutures transversely; a number

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* W. Brunner. Zur Diagnostik der motorischen Insufficienz des Magens. Deutsche med. Wochenschr., 1889, No. 7.

† Wiener med. Presse, 1873, No. 17. ["This consists of a stream of water, the size of a finger, whic his directed against the region of the stomach. The temperature of the water changes every twenty seconds between 80° and 50° Fahr. (26° and 10° C.), and is continued for three minutes." Decker, Münch. med. Wochen., May 28, 1889. Reviewed in Annual of Univers. Med. Sc., 1890, vol. i, C. p. 9.—Tr.]

‡ Hubert. Deux cas, etc. Jour. de méd. de Bruxelles, Avril, 1883, pp. 309 to 318. [Also Loreta, Lancet, April 26, 1884; Bull and Kinnicutt, "A Case of Cicatrical Stenosis of Pylorus relieved by Loreta's Operation." New York Medical Record, June 8, 1889. This paper gives results of twenty cases.—Tr.]

of good results have lately been obtained by this method.* However, I must leave this field to the surgeons, to whom the clinician can only refer suitable cases with as exact a diagnosis and prognosis as possible. The results of my personal observations on this subject lead me to believe that operative gastric surgery has a great future before it, and perchance the time is not far distant when we will excise a lancet or leaf shaped piece from a dilated stomach in the same way that we treat prolapse of the vaginal mucous membrane and of the uterus by wedge-shaped excision.† How our views and hopes have changed since the time when Kussmaul,‡ as recently as 1869, feared "that he would meet with quiet or outspoken scorn" by the mere mention of such possibilities!

I shall now apply the foregoing remarks to some practical examples; for this purpose I have not selected hospital cases, with the results of autopsies, but such patients as we meet in daily practice:

The first patient is a railroad secretary, fifty-two years of age, whose previous history I shall read to you in his own words:

"Ten months ago, in the beginning of last year, I was taken sick with loss of appetite, constipation, slight *malaise*, and also a cough, with expectoration. On the 14th of June, a year ago, I went to Görbersdorf, in Silesia, at the advice of my physician, and remained there under treatment, at the institute of Dr. Römpler, until July 10th. On July 10th I went to Carlsbad, where the diagnosis of dilatation of the stomach was made. I was treated there till August 14th (five weeks); the physician told me that I was at the proper spring. At Carlsbad I drank three half-glasses of *Schlossbrunnen* daily, and besides took four *Sprudel* and eight mud-baths (one every third day). The action of the baths was always sedative for several hours. In general the treatment at Carlsbad affected my body quite unfavorably, my strength was not correspondingly increased, and a slow improvement could only be observed at intervals of

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* [Senn. The Surgical Treatment of Pyloric Stenosis, with a Report of Fifteen Operations for this Condition. New York Medical Record, November 7 and 14, 1891.—Tr.]

† [This prophecy has practically been fulfilled in the three cases recently reported by Bircher (Correspondenzbl. für schweizer Aerzte, Jahr. xxi, No. 23). Bircher's method of operation consists in exposing and drawing out the stomach by an incision parallel with the free border of the left ribs; a fold is then made in the stomach large enough to reduce it to its normal size; the greater curvature is sutured with silk nearly on a line with lesser curvature. The fold hangs within the stomach. In one of the cases there was no return of the symptoms after thirty months. See Am. Jour. Med. Sc., 1892, vol. ciii, p. 333.—Tr.]

‡ *Loc. cit.*, p. 485.

from four to five weeks. After the 10th of August I was under the treatment of another physician."

When I first examined this patient, who was sent to me by his family physician on the 24th of October, although he was thin, he by no means looked sick. Lungs and heart normal; liver not enlarged; its lower edge can be felt distinctly a finger's breadth below the free margin of the ribs. Spleen not enlarged; the stomach, however, showed the following changes: Even on mere inspection of the abdomen, and especially on looking at it against the light, with the patient lying down, I can see a slight protuberance the size of a five-mark piece [about the same as silver dollar] in the region of the umbilicus, and extending to the right; it projects so slightly above the surface of the abdomen that it is only recognizable by the relief given by its shadow. Otherwise the abdominal walls are smooth, not too relaxed, with neither trough-like depression nor abnormal vaulted projection. Palpation reveals a tumor at the place mentioned, about the size of an apple, hard, nodular, easily movable, which does not descend on respiration, and entirely insensitive to pressure. Tapottement produces loud succussion sounds. No slapping sounds (*Klatschgeräusch*). The inguinal glands are about the size of a pea, but there are no other adenopathies. The patient has taken a test-breakfast. I introduce the stomach-tube, and on expression obtain about 100 c. c. [℥ iij$\frac{1}{3}$] of a thin fluid, which contains some remnants of the roll. I now inflate the stomach with the double bulb, and you can see that the tumor is displaced somewhat to the right and downward, and that the contour of the stomach becomes very distinct. By sight alone, but better by means of percussion, I can locate the greater curvature 3 centimetres [1$\frac{1}{3}$ inch] below the umbilicus. Examination of the stomach-contents, which have meanwhile been filtered, reveals the total absence of hydrochloric acid, faint peptone reaction, large amounts of propeptone, erythrodextrin, fatty acids, but no lactic acid. I must tell you that at a former examination I ascertained that the filtrate of the stomach-contents did not digest albumen, and that from the examination made six hours after a dinner consisting of meat, potatoes, bread, and bouillon the same results were obtained. Neither yeast-cells, sarcinæ, nor cancerous elements are present. The patient took 1 gramme [gr. xv] of salol yesterday, and has brought us the urine voided three quarters of an hour, an hour and a quarter, and an hour and three quarters afterward. You see that in the last portion we get an indistinct violet coloration on adding ferric chloride, but that I must first shake up the urine with ether in order to obtain a positive though only a weak reaction.

In view of all this there can be no doubt that the diagnosis is *cancerous stenosis of the pylorus, with consecutive dilatation of the stomach.* It is interesting that in this case the disease began so insidiously, and that it pointed so little to the stomach as its seat, that probably, in connection with a then-existing bronchial catarrh, the suspicion of phthisis could arise, which led to his being sent to Görbersdorf. I have seen excellent results in the treatment of phthisis in Görbersdorf, but carcinomata can not also be cured there! The case is so far a favorable one in that, on the one hand, the bodily strength is relatively good, and, on the other, the

tendency to decomposition of the stomach-contents is comparatively slight. In the way of treatment the patient has been taking condurango, with hydrochloric acid, and for the past week his stomach has been washed out regularly every second evening, six hours after his dinner; considerable quantities of stomach-contents, brown in color, have always been brought up. I proposed to the patient to have the tumor excised, which, according to competent authority, can be done in this case. However, he feels so much easier and better under the present treatment that he can not decide upon having it done, and thus, as is alas so frequent, the favorable moment for undertaking it will pass by.

The second case, which I will deal with at less length, concerns this fifty-two-year-old, large, strongly built, somewhat pale woman. For about a year and a half she has suffered severely with acid eructations. To this has been added a constant loss of appetite, and partly owing to this, partly because she has kept a strict diet, her nutrition has suffered considerably. No difficulties in swallowng. Vomiting has been very infrequent, lately every fortnight, and is said to have consisted of very sour, slimy masses, mixed with but slightly changed remnants of food; blood has never been present. Stools hard and sluggish. The urine has been repeatedly examined, with negative result. The patient was formerly very healthy, vigorous, and active about the house, and has borne nine children. Although I pass over the examination of the other organs, in which there is nothing abnormal, I wish to call your attention to the relaxed condition and markedly vaulted projection of the abdominal walls, on which I can at once produce loud succussion sounds. I can not palpate a tumor anywhere, yet I feel the pulsations of the aorta. The patient "expresses" a light-brown fluid—she had some meat and coffee four hours ago; on inflation with air the entire abdominal cavity immediately becomes evenly distended, so that we can see the lower border of the stomach running just above the symphysis; the whole abdomen appears like an evenly inflated balloon. The salol test does not show any retardation. The filtrate of the stomach-contents has an acidity of 48 per cent with a decinormal soda solution, and distinctly contains free hydrochloric acid, peptone, only traces of propeptone; it also digests well. Lactic acid is present in small quantities.

The diagnosis of gastric dilatation, which can not be doubted, does not seem to have been made before. The question arises, To what can *the dilatation* be referred? A previous ulcer may be rejected with great probability on account of the absence of pain, and altogether on account of the previous good general condition. Thus, also, tumors of any kind whatsoever may be excluded, and, granted that further observations yield no results different from to-day's, we can only have to deal with a cicatricial distortion or adhesion, or with a primary atony of the gastric muscular fibers. Even though the former could be a result of puerperal peritonitis which had run a latent course, yet this is only to be surmised. At any rate, the prognosis is favorable for improvement within a short time in view of the presence of free hydrochloric acid. I have persuaded the patient, who has come from a distance, to enter the sanitarium, where I shall treat her with an appropriate dry diet, systematic lavage, strych-

nine, and faradization of the stomach; and at the close of this course I shall again present her to you.*

The third case I present is a young student, twenty-one years of age, strong and apparently healthy. He has complained for fifteen months of distention of the abdomen, with pressure and fullness there, capricious appetite, irregular bowels, and, when these symptoms are present, of poor sleep, headaches, brief attacks of dizziness, and conditions of anxiety. He therefore keeps a strict diet, refrains from all *Kneiperei*, and tends to hypochondriasis. The tongue is clean, eructation and vomiting have never been present, the stomach-contents as well as the size of the stomach are normal, and we would be inclined to regard this case as one of nervous dyspepsia, were it not that the iodide of potassium and salol tests both agree in showing retardation of absorption and motion. I therefore do not hesitate in pronouncing this a case of gastric insufficiency, and the result of the treatment adopted seems to justify the diagnosis. For two weeks he has taken 0·03 [gr. ½] of extract of nux vomica three times daily, and has been faradized every other day. Since this time the attacks have not appeared.

In these three cases I believe I have presented various types of dilatation and insufficiency of the stomach. You can see from this how the simple diagnosis of "dilatation of the stomach" does not suffice, and how much treatment and prognosis are influenced by the recognition of the underlying cause.

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* To prove to what errors even the most careful single examination is liable in making a diagnosis, I wish to add, while correcting the proof-sheets, that after about three weeks' observation the hydrochloric acid disappeared permanently, and at times in certain positions of the patient, and with a definite fullness of the stomach, a small tumor, hardly the size of a walnut, was palpable in the pyloric region. I have purposely abstained from changing anything in my former remarks regarding this case. I have heard that the patient died several months later, of "cancer of the stomach." (Addition to the second edition.—E.)

LECTURE V.

CANCER OF THE STOMACH.

GENTLEMEN: Although it may be interesting to learn, from the various statistics which are published from time to time, that between 0·5 and 2·5 per cent of the total mortality is due to cancer of the stomach, and that 35 to 45 per cent of all cases of cancer involve the stomach, yet such facts have only a nosological interest. Of far greater importance is the question, *At what age* do persons most frequently succumb to gastric cancer? The various statistics, of which Brinton's, based upon 600 cases, and Welch's, upon 2,075 cases, are the most important, agree tolerably well in proving that three fourths of all cancers of the stomach occur between the fortieth and the seventieth years of life. The maximum liability is between the fiftieth and the sixtieth, but, according to Lebert, it lies between the forty-first and the end of the sixtieth year. It is very rare before the thirtieth year; congenitally it almost never occurs, and the case reported by Wilkinson * must be regarded as a very great rarity. According to decades, its occurrence is as follows:

	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.
Welch.....	2	55	271	499	620	428	140	..
Brinton...	¼	11	31	63	88	100	52	60
Lebert †...	3		55	96	95	61	13	1

* Quoted by W. Hayle Walshe. The Nature and Treatment of Cancer. London, 1846, p. 146. [Other very early cases of gastric cancer may be found in Welch's article in Pepper's System of Medicine, vol. ii, p. 534, 1885. Dujardin-Beaumetz asserts that all cases of cancer of the stomach diagonsed in children have been mistakes. Bulletin génér. de thérapeutique, September 15, 1890.—TR.]

† Lebert reports 162 cases.

Thus the frequency in the four decades, between the thirty-first and the completed seventieth year is 94·6 per cent. But, as already stated, these figures are only based upon the relative morbidity of the different ages to the total morbidity from cancer. If the frequency of the disease were calculated for the total number of people living in each decade, then the ratio would increase in an ascending scale, and would not show a diminution after the sixtieth year. Modifying factors then arise (like those recently calculated by Würzburg for phthisis), the relative frequency of which, as estimated for the total number of people living at that period, steadily increases with advancing age.

Sex appears to exert no influence on the frequency of gastric cancer; at all events, Fox's tabulation of the statements of seven writers shows that, of 1,303 cases, 680 were males and 623 females; in other words, both sexes were about equally affected, if we allow for the coincidences which are unavoidable in such a small series. Ledoux-Lebard,* from a study of the mortality statistics of Vienna, announces a mortality which is about the same for both sexes (100 in 25,000 deaths in a city of a million inhabitants). Of Welch's 2,214 cases, 1,233 were men and 981 women. If the general belief is true that a gastric ulcer may be transformed into a cancer, and that ulcer of the stomach is especially frequent in women, then these statistics (in which the women are actually in the minority) prove that this change is not of frequent occurrence.

It would be very important if we could come to a definite conclusion regarding *the heredity of cancer*. Not alone in the diagnosis of a suspicious case, but also in the prognosis as to the probable duration of life of the children of cancerous parents, an important part is played by this question of the heredity of cancer, it being self-evident that cancer of the stomach is included in the general sphere of carcinomatous affections. All authors who have studied the origin of carcinoma, even to the most recent date (a good *résumé* of this discussion will be found in J. E. Alberts's book †), agree that cancer is hereditary in the sense that the predis-

* Ledoux-Lebard. Arch. génér. de méd., Avril, 1885.

† J. E. Alberts. Das Carcinom in historischer und experimentell-pathologischer Beziehung. Fischer, Jena, 1887.

position is transmitted from the sufferer to his descendants, and this it is which may develop under certain conditions. But what are these conditions which influence the transmission and subsequent development of the disease; how often are the subjects attacked —in other words, how frequently do the children of carcinomatous parents acquire the disease, and what cause may be discovered for this? This is really the practical side of the question; but, strange to say, it is scarcely broached in these works, while its great importance is manifest, and confronts us daily. But here, instead of positive numerical data, we are almost exclusively compelled to use more or less subjective (and hence unreliable) opinions, while the information obtained from the relatives of the deceased patients is always interpreted very differently by different physicians, yet nearly always in the view of heredity.

The life-insurance companies, which, naturally, are vitally interested in this question of the heredity of cancer, do not, as a rule, reject a candidate on account of the death of one parent from this disease; yet it is considered to increase the risk, and a higher premium must be paid. This is based upon their practical experience: thus, for example, in a period of fifty years, from 1829 to 1878, the Gotha Life Insurance Company had 334 deaths from cancer; of these, 31—i. e., 9·3 per cent—were hereditary. Even so experienced and practical an observer as Lebert asserts that, where it is possible to watch the health of entire families during a large number of years, indubitable cases of heredity may be observed. This agrees with the experience of many old practitioners. Not alone may cancer of the stomach be directly transmitted from parents to children, but more frequently the preceding generation has had a different variety of cancer; in mothers the uterus or mamma has been especially frequently involved. In Lebert's cases heredity was observed in 7 per cent. Well known and frequently quoted is the case of the Napoleons, of whom Napoleon I, his father, and his sister Caroline died of gastric cancer, which occurred in two generations of the family. Nevertheless, in this and similar statements, no attention is paid to the fact that the disease often occurs in families in which there is no hereditary predisposition. H. Snow, physician to the London Can-

cer Hospital,* has answered the question, to the effect that in 1,075 cases of carcinoma in different parts of the body, 167—i. e., 15·7 per cent—stated that the disease had already occurred in their families, it being understood that the transmission is not always direct, but that it has affected more than one member of the family. On the other hand, among 175 patients who were under treatment for non-cancerous affections, 46—i. e., 26 per cent—admitted that cancer had occurred in their families; and in two other series, of 78 and 79 cases respectively, the former being healthy individuals, the latter patients with pulmonary diseases, the relative percentages were 19·2 and 11·3. It is manifest that statistics of this kind are very uncertain, since it can not be demonstrated whether the patients in question have not or would not have fallen victims to the disease. At all events, the statistics show that in a malady which occurs as frequently as carcinoma, coincidence may play a great part in its etiology; and it would therefore be well in an individual case not to lay too great a stress on a possible heredity.

Etiology.—In discussing this question of the hereditary transmission of carcinoma of the stomach, I have already encroached upon the question of the *individual causes* of the disease. In general, it must be admitted that we are just as ignorant of the etiology here as elsewhere. I may enumerate a list of so-called etiological factors, because in a number of cases we have observed a transient connection, and a more or less evident transition, which is called cause and effect; yet it is not known why these causes are in some cases followed by a carcinomatous proliferation, and why in others there is no reaction whatsoever. Nevertheless, some of the factors to be mentioned presently occur so frequently that they must exert some influence on the origin of carcinomatous tumors. A discussion of this question is in place in a general consideration of the nature of carcinoma; this lies within the province of general pathology, and hence is out of place here. The assertion that Cohnheim's theory of misplaced embryonic cells does not explain the origin of cancer, but that it is due to the pernicious action of micro-organisms,

* H. Snow. Is Cancer Hereditary? British Medical Journal, October 10, 1885.

is as yet only a presumption, which Alberts, Schill, and Scheurlen * have been investigating experimentally, though without any definite results.

Here I must refer you to the text-books on pathological anatomy. I must simply limit myself to a brief *résumé* of the possible etiological factors. All of these partake more or less of the character of irritants which may be due to the ingestion of acrid substances, or which may result from acute or chronic inflammatory processes. Among these may be included corrosion by nitric acid and arsenic; of the former, Andral is said to have reported an example, but the case is not reported in the reference which is copied from one book to another; the latter is regarded as a causal factor by Dittrich; yet this is at all events doubtful, since Walshe found a large quantity of arsenic encapsulated in the stomach of a patient without any further changes in its tissues.† Traumatisms have been repeatedly cited as causes of gastric cancer. For example, Alberts ‡ reports the following case: A man who up to his fiftieth year had always enjoyed good health stumbled and fell against the handle of his umbrella. Three weeks later gastric symptoms appeared, and after a year the patient died of carcinoma ventriculi. A moment's consideration, however, will show that this and similar observations can not definitely settle this question, since they are not absolutely conclusive. Who can tell whether there was not already a latent cancer, and that the traumatism simply accelerated its growth?

Even in olden times inflammatory conditions of the mucous membrane of the stomach were included among the causes of gastric carcinoma. Such views may be found in the writings of Boerhaave and Van Swieten, and in the older works they are met with more frequently in proportion as the nature of the disease is less known. But very recently Schuchardt,# in a monograph entitled Contributions to the Origin of Carcinoma from Chronic Inflammatory Conditions of the Mucous Membranes and Skin, claims that a chronic or

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* Alberts, *loc. cit.*, pp. 183 *et seq* —Scheurlen. Verhandlungen des Vereins für innere Med. vom 28. Nov., 1887, in Deutsche med. Wochenschr., No. 48.

† Walshe, *loc. cit.*, p. 167.

‡ Alberts, *loc. cit.*, p. 195.

Schuchardt. Beiträge, etc. Volkmann's Sammlung klin. Vorträge, No. 257.

hyperplastic condition precedes the formation of the neoplasm, and that, while this condition does not necessarily cause the latter, yet it favors it to a high degree.

Chronic gastric ulcers may also be classed among the predisposing factors. Lebert has observed the direct transformation of ulcer into cancer, and Dittrich the simultaneous occurrence of both conditions. Brinton cites cases in which the lesion, macroscopically an ulcer with thickened edges, was accompanied by unquestionable metastases in the liver and lungs; and even states that "an unhealed ulcer may at times cause the development of cancerous cachexia." * C. Meyer † describes a case of simple ulcer occurring with carcinoma of which the cell-nests, although only in the immediate vicinity of the ulcer, were visible as smooth nodules which had developed from the epithelium of the ducts of the glands. Heitler ‡ reports three similar cases (without microscopic examination), and remarks that the diagnosis *carcinoma ventriculi ad basim ulceris rotundi* is not at all rare in Vienna. Hauser # has histologically demonstrated the transition of ulceration into carcinomatous proliferation, and asserts that in one of the cases examined by him he found not only the secondary development of carcinoma in a gastric ulcer of very long standing, but that "occasionally a cancer may develop from an affection of the gastric glands, even in the sense of the theory proposed for carcinoma by Thiersch and Waldeyer." Flatow ‖ reports a similar case from the Pathological Institute at Munich. This case is important because the patient was only twenty-six years old, and the history of ulcer was beyond doubt. The cancer was near the pylorus, and in its center was an old scar with a smooth base. As the result of his microscopical examination Flatow says, "Evidently there was at first a cicatricial mass, and this facilitated an atypical proliferation of epithelium."

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* Brinton, *loc. cit.*, p. 243.

† C. Meyer. Ein Fall von Ulcus simplex in Verbindung mit Carcinom. Inaug. Dissertation. Berlin, 1874.

‡ Heitler. Entwickelung von Krebs auf narbigem Grunde in Magen und in der Gallenblase. Wiener med. Wochenschr., 1883, No. 31.

Hauser. Das chronische Magengeschwür und dessen Beziehung zur Entwickelung des Magencarcinoms. Leipzig, 1883, S. 70 und 73.

‖ H. Flatow. Ueber die Entwickelung des Magenkrebses aus Narben des runden Magengeschwürs. Inaug. Dissert. München, 1887.

Concerning the other chronic irritants of the mucous membrane which are supposed to favor the development of cancer, the various exceptions are so evident that a discussion on the unreliability of such evidence is superfluous. In Beau's statement that gastric cancer is often preceded by a period of "idiopathic dyspepsia,"* the word often ought to be changed to seldom. For, on the contrary, it is surprising how frequently the patients assert that they have always had sound stomachs, and that they have always been moderate in eating and drinking. While the gluttons have themselves to blame to some extent for their dilated stomachs, the unfortunate sufferers from gastric cancers have not even the melancholy satisfaction that in the days of health their stomachs at least afforded them especial joy and pleasure!

Pathological Anatomy.—I shall refrain from giving exact details of the histological features of carcinoma of the stomach, as my experience on this subject has only been an ordinary one, and I can only repeat the facts which you will find more or less thoroughly described in many books. After a thorough investigation, Waldeyer was the first to teach that the disease is developed from the glandular elements of the mucous membrane—i. e., from the peptic glands, and especially from the mucous glands of the pylorus. The process is an atypical glandular proliferation which bursts through the muscularis mucosæ, and extends into the submucosa. Here circumscribed cancerous nodules are formed; these coalesce later on, and thus necessitate the subsequent flattened growth. Coincidently there is an active growth of the connective tissue which soon exceeds the proliferation of the glandular elements, and thus at first produces an hypertrophy of the connective tissue, while the glandular elements still remain normal. Later, it extends along the proliferated glandular tubules and manifests itself as a small-celled infiltration about the cancer nodules. This growth of the connective tissue appears to exert a decided influence in determining whether the developing cancer will be of the schirrus, encephaloid, or colloid variety. But, as I have already said, I merely wish to mention these things superficially, and shall simply recall that any of the

* Beau. Gazette d. hôpit., 1859, p. 390.

various forms of cancer—*schirrus*, *encephaloid*, *colloid*, *polypoid*, and *telangiectatic*—may occur in the stomach. All authors state that the first is the most common: according to Brinton, it occurs in 75 per cent of all cases, while the colloid is found only in from 2 to 8 per cent. If we agree with Waldeyer,* that the nature of the disease consists in "an atypical transformation of epithelium," then the above-mentioned individual varieties are one and the same fundamental process, and, as actually occurs, often change into one another.

Scirrhus, *carcinoma simplex* or *fibrosum*, with its predominant development of dense connective-tissue stroma, and with relatively few cell-nests, has a firm and compact structure. It occurs sometimes as large masses or tubercles, sometimes as small nodules; at times multiple, but oftener as a diffuse infiltration. It creaks when cut, and the section presents an almost cartilaginous tissue of a white, grayish-yellow, or dull yellow color, with yellow or red spots scattered here and there; it may, however, have a smooth and shining surface, almost like bacon.

Where there is a tendency to ulceration we find a rich vascular network, and also an extensive diffuse redness; where ulceration has already begun, an undulating fissured surface is presented by the ulcer, which is covered with ragged greenish-yellow or black detritus. Of frequent occurrence are fatty degeneration and atrophy in some parts, while in others it continues to grow. Firm pressure will cause a small amount of turbid, milky cancer juice to exude.

Encephaloid cancer, *carcinoma medullare*, is soft, has very little connective-tissue stroma, but is very rich in vessels and cells; the growth is spongy, and cuts easily; the cut section is whitish-yellow in color, and resembles brain matter both in color and consistency. It undergoes colloid degeneration more frequently than does the scirrhus. Extravasations of blood are frequent, and are marked by their characteristic discoloration.

If the cells in an otherwise well-developed stroma show from

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* Waldeyer. Die Entwickelung der Carcinome. Virchow's Archiv, Bd. lv. S. 54.

the beginning a tendency to undergo colloid degeneration, then the whole growth assumes a gelatinous appearance somewhat resembling glue. Thus arises the *colloid carcinoma*, *carcinoma alveolare* or *galatinosum*. On cutting and scraping, a true cancer juice does not exude, but instead gelatinous fragments.

Villous carcinoma, *Zottenkrebs*, *carcinoma villosum*, is produced by villous or papillary outgrowths in the scirrhus or medullary varieties. If the development of blood-vessels predominates, the growth is called a *telangiectatic carcinoma* or *fungus hæmatodes*. Finally, if there are numerous hæmorrhages into the cancerous tissues, any of the varieties of the neoplasm may assume the character of a *melanotic carcinoma*.* As I have already indicated, these various forms may coexist in almost every variety.

In all these types the bundles of muscular fibers are more or less infiltrated, and undergo hypertrophy; the muscularis becomes paler, less elastic, and fragile; at times, however, atrophy may result. Secondary inflammatory processes, with thickening and adhesions to the adjacent organs, are observed in the serosa.

Having thus briefly recalled to mind the chief characteristics of the different varieties, I shall now speak more in detail of the topographical features or the *localization* of cancer of the stomach, and of the results thereof.

We must first distinguish between tumors which grow especially on the surface, and involve large areas of the mucous membrane, and those which attack only a small portion. The former are by far the less common, and are usually of the medullary or colloid variety; they are characterized by a nodular or roughened surface like a grater; they are flattened rather than projecting high above the surface; other peculiarities are the frequency of assuming the villous form, the occurrence of blood extravasations and adhesions to the adjacent organs, especially to the peritonæum and omentum. In such cases the greater portion of the stomach from the cardia to the fundus may be converted into a carcinomatous mass, yet such

* [Such discolored cancers ought not to be confounded with true melanotic tumors. Welch could find no record of true primary melanotic cancers of the stomach; all of those cases have proved to be melanotic sarcomata. Welch, *loc. cit.*, p. 561, foot-note.—Tr.]

an occurrence is a great rarity. Otherwise, the greater curvature usually remains free, and the neoplasm preferably extends on the posterior wall along the lesser curvature. Generally the organ is not increased in size, but rather diminished to a firm, sausage-like tumor. I have preserved such a medullary cancer involving the entire organ, which I obtained at an autopsy; the capacity of the viscus was scarcely 200 c. c. [f ℥ vjss.] of water. The scirrhus variety involves the whole organ much less frequently; such a case is pictured in Fig. 19, which is taken from Carswell's Atlas.* Usually scirrhus follows the second of the above courses—i. e., it remains in a circumscribed portion of the stomach, and tends to grow in depth and height as opposed to the superficial extension of the medullary and colloid varieties. This, however, does not exclude its multiple occurrence in several parts of the mucous membrane of the organ, as, for example, at the pylorus and the lesser curvature or the *cul-de-sac*.

Concerning the *situation* of the cancer, nearly all the statistics agree that in about one half of the cases the pylorus is involved: according to Brinton, 60 per cent; Lebert, 59·6 per cent; Katzenellenbogen,† 58·3 per cent; Luton,‡ 57 per cent, etc. In between 10 and 11 per cent (Luton, 7·8 per cent) it is the cardia or the lesser curvature; in the remainder the lesion is scattered over the greater and lesser curvatures. The fundus is attacked least frequently of all; such a case with extension to the spleen was described by Tüngel.# Among the 1,300 cases reported by Welch, 19 were situated in the fundus. At all events, the orifices are the favorite sites—70 to 75 per cent; thus cancer differs markedly from ulcer in this respect, as the latter involves the orifices about five times less frequently—i. e., 16 to 18 per cent.

The situation and extent as well as the consistency of the neoplasm influence *the shape and position of the stomach* in the following ways:

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* [Sir Robert C. Carswell. Pathological Anatomy. Illustrations on the Elementary Forms of Diseases. London, 1833–'38.—Tr.]

† Katzenellenbogen. Beiträge zur Statistik des Magencarcinoms. Inaug. Dissert., Jena, 1878.

‡ Luton. Nouv. dictionnaire de méd. Paris, 1871.

Tüngel. Klinische Mittheilungen aus dem Hamburger Krankenhause, 1860, S. 108.

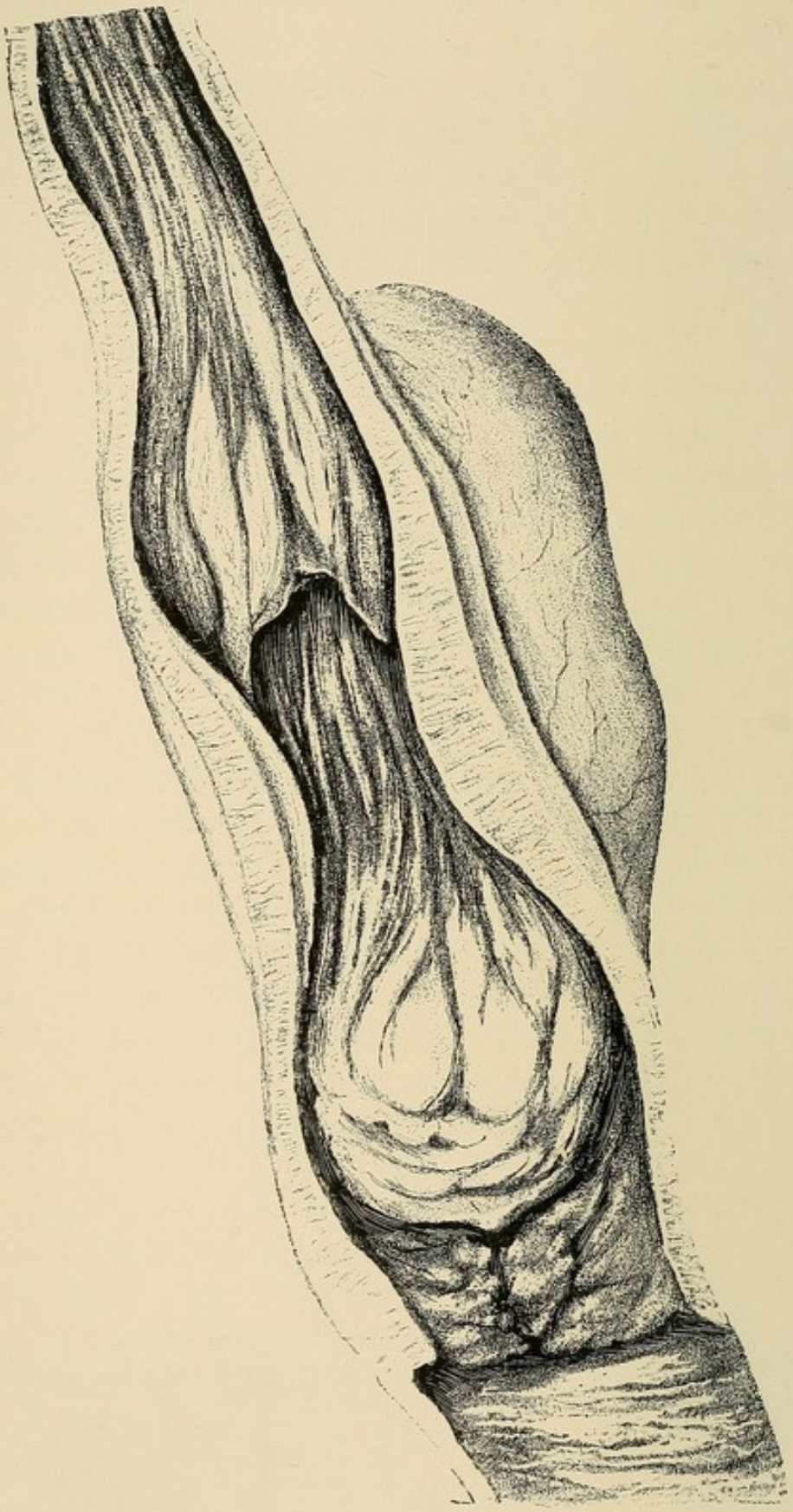


Fig. 19.—Scirrhus ventriculi totalis (reduced to one fifth).

1. The viscus may become *smaller* by a concentric contraction, as where a firm tumor involves the stomach *in toto*—i. e., infiltration of the mucosa and muscularis; or, finally, even a narrowing of the lumen by extension inward, as shown in Fig. 19. It may also result from tight strictures situated at the cardia; as a consequence of this, the absence of the normal pressure of the contents of the stomach upon its walls causes the organ to contract into the smallest possible volume, since it must yield to its elastic tissues; its diameter may be diminished to that of the large intestine, as occurred in a case reported by Canstatt.* The following drawing (Fig. 20) was made by me from a case which I had under observation. While the patient was alive the pancreas and stomach could be palpated through the relaxed abdominal wall as a hard nodular tumor.

2. *Dilatation* is always the result of a tumor obstructing the pylorus. Here the stenosis may be due to all the various causes which have been fully described under dilatation of the stomach.

3. *Changes in the position of the stomach* are produced by the weight of the tumor; this may be so marked that either the fundus or the pylorus alone or both together may be dragged down deeply into the pelvis, and may contract adhesions with its organs, the ovaries, uterus, bladder, etc.

4. *Distortions, bends, and constrictions of the stomach* may be developed as a consequence of the inflammatory adhesions with adjacent viscera, or of the extension of the new growth in the stomach itself.

These different conditions show in what varied ways the shape and situation of the stomach may be altered.

Gastric cancer occurs so overwhelmingly frequently as a primary growth that a case like that reported by Cohnheim, in which the primary tumor was situated in the mamma, must always be considered a very great rarity.† On the other hand, it is not exactly rare to find the disease occurring simultaneously in a remote organ —as, for example, cancer of the stomach may coexist with a similar

* Canstatt. Klinische Rückblicke. Erlangen, 1851, S. 178.

† [Thus far thirteen cases of secondary carcinoma of the stomach have been reported. See J. S. Ely, A Study of Metastatic Carcinoma of the Stomach. American Journal of the Medical Sciences, June, 1890, p. 584.—Tr.]

growth in the uterus or ovaries, and no evidence can be found to indicate a metastasis from either organ. Dittrich has never seen

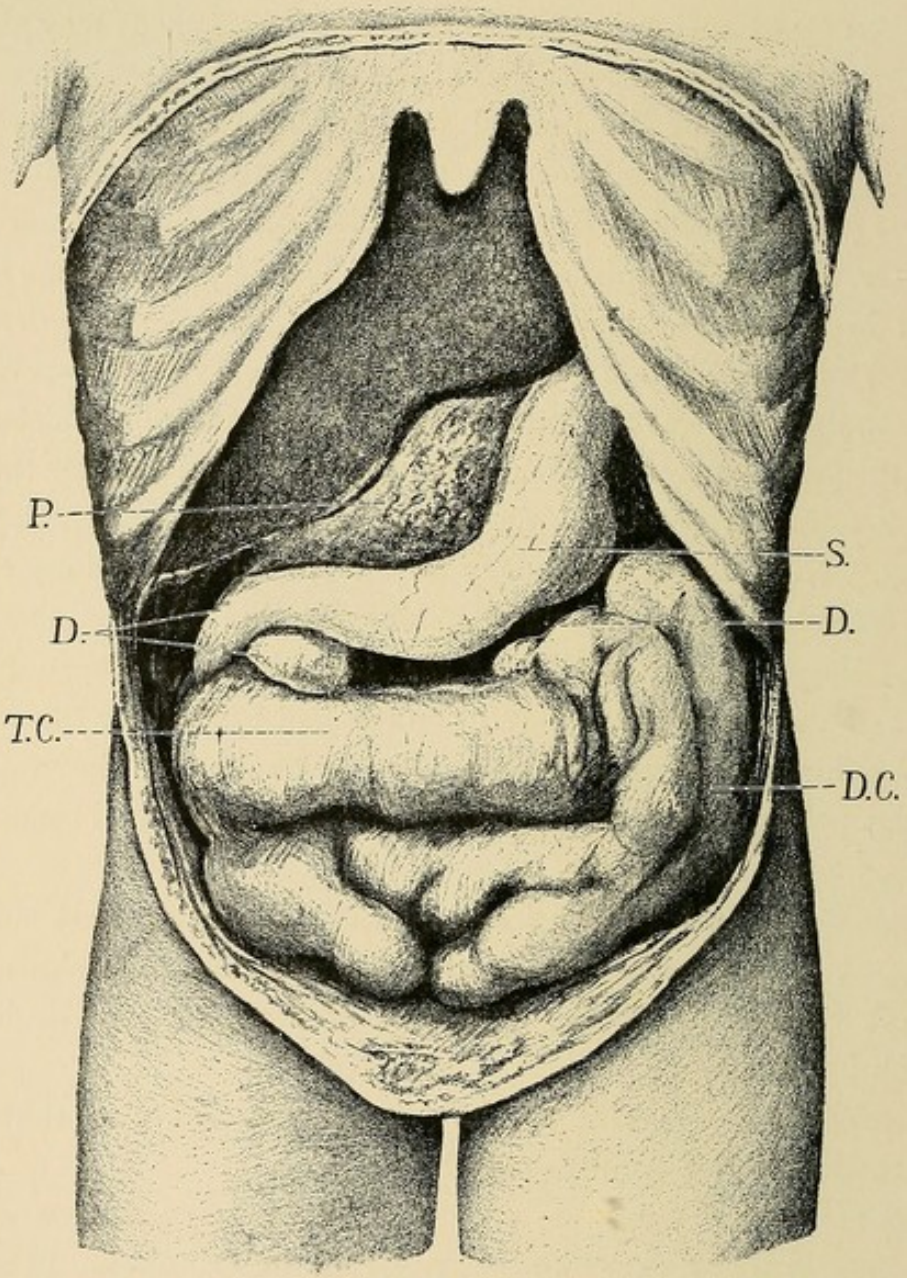


Fig. 20.—Carcinoma of the Cardia. Contraction of the Stomach. Mr. T. died April 10, 1885. *s*, stomach; *d* duodenum; *p*, pancreas; *tc*, transverse colon; *dc*, descending colon.

the simultaneous occurrence of the disease in the stomach and uterus. Recently I performed an autopsy in a case in which there was found an immense cysto-sarcoma of the uterus, and a carcinomatous infiltration of the pylorus. *Secondary cancerous metastases* are, as is well known, by no means rare; they may affect any part of the organism in about three out of four cases. The liver is

involved in 25·6 to 30 per cent; the peritonæum in 13·7 to 22·7 per cent; the lungs and pleuræ in 0·6 to 6·2 per cent; while in 160 cases collected by Dittrich the rectum was involved only twice and the ovaries once. However arbitrary such figures may be, according to the cases at the disposal of individual writers, the evidence as to relative frequency of these metastases, as given by Lebert, is as follows: in the liver, 40·9 per cent; peritonæum, 37·5 per cent; lungs, 8·3 per cent; ovaries, 4·5 per cent. Lange's* analysis of 210 cases at the Berlin Pathological Institute gives different percentages: 30·9, 17·6, 0·71, and 0·14, respectively. Of greater practical interest is the simultaneous occurrence of metastases in important organs; as, for example, in the liver and lungs, which Lange found ten times—i. e., 4·7 per cent. Although Brinton asserts that the occurrence of metastases in the liver naturally lessens the danger of involvement of the lungs, yet it would seem more probable that, with the establishment of two cancerous depots, the chances of infection by transportation through the vascular system would be increased. I must confess, however, that my own experience corroborates Brinton's statement.

That cancer and tuberculosis do not exclude each other, or that both may perhaps be attributed to a scrofulous diathesis, as was formerly supposed, needs no further discussion at present. Disregarding statistical data—as for example, Lange, who found them together in 8·1 per cent of his cases—all doubt on the subject has been removed by the direct observation of tubercle bacilli in the pulmonary deposits in lungs which are also cancerous. It must be confessed, however, that it is at times very difficult to decide whether small cavities are due to softening of tubercular or metastatic carcinomatous nodules.

In many cases we can explain the path of the metastatic infection by way of the blood or lymph vessels; in others we must think of direct extension in the continuity or along extra-vascular channels; as, for example, the extension of a pyloric cancer to the edge of the liver or the gall-bladder; the involvement of the

* Lange. Der Magenkrebs und seine Metastasen. Inaug. Dissert. Berlin, 1877.

colon from a tumor on the greater curvature, or of the diaphragm and lungs from one situated at the cardia (Carswell and Virchow*).

The formation of thrombi in various places remote from the stomach is also to be explained by vascular transportation in so far as they are not due to the cachexia, the altered condition of the blood, and the slowing of the circulation, just as is seen in the veins of the lower extremities. It has been repeatedly asserted that the composition of the blood is altered, especially a lessening of the number of the red blood cells, and of the solid constituents of the plasma. I shall consider this topic further when discussing the symptomatology. Andral and Gavarett† state that the percentage of fibrin is variable. There is nothing characteristic in these changes, but they are more or less peculiar to all cachectic conditions.

The swelling of the lymphatic glands occurs less frequently in this disease than in neoplasms elsewhere which are in close connection with the lymphatic system—for example, the mammary gland. Brinton has observed it in only 23·5 per cent of his cases, although Welch gives a higher figure, 35 per cent. We must, however, distinguish between a simple swelling and cancerous degeneration of the glands. The latter would be observed much more frequently if attention were not alone paid to the glands which are visible and palpable, but also to the entire lymphatic system. Lebert gives the high percentage of 54·5, though Katzenellenbogen places it lower, 40 per cent. The swelling of the supraclavicular glands, which was first claimed by Henoch and Virchow, and later by many others,‡ to be a pathognomonic symptom, is, in my experience, a rare and by no means constant occurrence.

Ulceration occurs to a very variable extent in gastric cancer, sometimes as simple superficial erosions, sometimes as a single round or oval ulcer, not infrequently having an orifice like a crater with a thick, wall-like edge. Ulceration occurs most frequently in the medullary variety, less often in the scirrhus, and least of all in the

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* Virchow. Die krankhafte Geschwülste, I, S. 54.

† Andral et Gavarett. Rech. sur la composit. du sang, p. 238.

‡ Troisier. Les gangliones sus-claviculaires dans le cancer de l'estomac. Gaz. hebdom., 1886, No. 42.

colloid. Although the process usually has a progressive tendency, yet sometimes carcinomatous ulcers may be found with the central portion cicatrized (whence the saying that cancer is curable), but in the edges of which new foci continue to be formed. Erosion of the blood-vessels may lead to small or large hæmorrhages with their subsequent tissue-changes. If the mucous membrane is totally destroyed, we then find the submucous connective tissue covered with florid, blackish fragments of the destroyed membrane, or its surface may be entirely bare, excepting here and there a few vascular loops. In a similar way arise the villous fungosities on the surface of an ulcerated carcinoma; yet these must be carefully distinguished from the benign true polypi of the mucous membrane.

Ulceration may lead to *perforation;* this is comparatively infrequent. Brinton estimates its occurrence at about 4 cent. The intestines and peritonæum are most frequently involved, especially the transverse colon; these communications being sometimes of a fairly large size. If an adhesive peritonitis has preceded, the perforation may at times lead to the formation of an encapsulated sac, which in rare cases may perforate the abdominal wall in the form of an abscess. Altogether sixteen such cases have been reported, according to a compilation by Mislowitzer;* to these must be added another case, which occurred in Gerhardt's clinic. Dittrich has seen a case in which the perforation was into the ileum after complete closure of the pylorus had taken place; and thus by natural means a collateral communication between the stomach and intestines was established, such as we endeavor to obtain by operation in similar cases.

General Clinical History.—Cancer of the stomach is an exceedingly insidious disease, and at the outset is not to be distinguished from other affections of the organ which lead to dyspepsia. Brinton's epigrammatic description, "Obscure in its symptoms, frequent in its recurrence, fatal in its event," is true even to-day in spite of the great improvement in our diagnostic and therapeutic resources. Irregularity and impairment of the appetite, slowing and disturbance of digestion, a feeling of pressure, fullness, and tension in the

* E. Mislowitzer. Ueber die Perforationen des Magencarcinoms nach aussen. Berlin, 1889.

epigastrium, also regurgitation of food and a tendency to nausea, together with more or less obstinate constipation, open the scene. It is only gradually that pain in the stomach, local or diffused or cardialgic in character, is added; then vomiting occurs, usually without any great exertion and without marked nausea. The tongue becomes thickly coated, and especially in the morning has a tenacious white fur, which is scraped off with difficulty and is soon renewed. Lebert seldom found the tongue coated, and considered this cleanness of the tongue one of the most important paradoxical manifestations of the disease. My experience is, however, different; I have, indeed, seen patients whose tongues remained relatively clean, yet such cases are exceptions. The coated condition of the tongue either *in toto*, or with the exception of the edges and isolated papillæ which project like berries, is, quite on the contrary, to be regarded as an important point in the differential diagnosis from gastric ulcer. A striking repugnance toward meat, and other anomalies of taste and appetite, precede complete anorexia. (One of my patients stated that claret suddenly tasted like ink. One of Brinton's patients abruptly lost all desire for smoking, although strongly addicted to the habit. This, combined with a cachectic appearance, led the physician to diagnose a cancer which was subsequently demonstrated, although the other symptoms did not indicate it.*) The taste becomes flat and "pasty," bitter or sour, or the mouth may become foul in spite of all attempts at rinsing and cleansing. The pain becomes more intense, and at times paroxysmal, and occurs not only after the scanty meals but also between them and at night. Vomiting is more frequent; while at first the vomit consists chiefly of mucus, remnants of food, and watery fluid mixed with bile, in time the food is vomited in a more and more undigested condition. The vomit is sometimes tasteless, sometimes sour, has a penetrating or offensive odor, and where perforation has occurred into the intestines it may even have a fecal odor. Besides containing various kinds of epithelium and micro-organisms (Fig. 21), the vomited matter may often contain blood, either in small amounts as bright-red

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* *Loc. cit.*, p. 195. Although Brinton considers this diagnosis a "matter of professional instinct," yet it strikes me as having been more a "matter of hazard"!

streaks in the mucus, or in large quantities as bright-red or brownish-red clots or brown, chocolate-colored to black coagula and



Fig. 21.

masses — the well-known coffee-ground vomit; these differences are due to the length of time the blood has remained in the stomach, and to the extent of the decomposition caused by its contents.

The vomit from which this drawing was made consisted of a clear, reddish fluid, with a light, flocculent deposit, in which dark-brown particles resembling snuff were suspended. The filtrate contained no free acid, but small amounts of lactic acid were present; has no digestive action unless hydrochloric acid is added. Under the microscope may be seen the outlines of red blood-cells, granular masses stained with blood-pigment, epithelium of the œsophagus and stomach—some of which look like peptic cells, others are distinctly cylindrical. There are also yeast-cells, and also cells of another variety of fungi (*Hyphomyceten*), probably an aspergillus. A dense network of delicate and coarse fungus filaments (which is merely indicated in the figure) incloses the above-mentioned brownish detritus which is visible to the naked eye. There are also many cocci and drops of fat. The peculiar fibers to the left of the figure, resembling elastic fibers of the lungs, are from the connective tissue of the ingested meat. I have repeatedly observed these fibers, even in the artificial digestion of meat. The patient asserted that he had taken only milk for three weeks. There is no reason to doubt the truth of this assertion; what we find simply proves how long such remnants may remain in the folds of the mucous membrane.

The coffee-ground vomit is not, as was formerly supposed, pathognomonic of cancer of the stomach; yet it must be admitted that in this disease the blood remains in the stomach for a longer period than in the other diseases of this organ which lead to hæmorrhages and these subsequent changes.

In most cases there now appears a palpable (or also visible) tumor, which is most frequently situated in the triangle formed by the free lower border of the ribs and the linea umbilicalis [a horizontal line passing through the umbilicus]; it is somewhat higher in men than in women, in whom the lower situation is due to the downward displacement of the liver.

Rather early, and not at all proportional to the subjective feelings of the patient, occur marked loss of strength and progressive emaciation; the superficial fat and the muscles rapidly waste away, till the sufferer soon drifts into a state of extreme marasmus and exhaustion. One of my patients, with a distinct tumor but with a surprisingly good subjective condition, complained only at first that his limbs were becoming weak in climbing stairs. Soon the characteristic pale-yellow color of the cancerous cachexia makes its appearance. After severe hæmorrhages the countenance acquires an anæmic or at times a dropsical puffiness, especially under the eyelids. The eyes sink in, the cheeks become very prominent, the features pointed, and the patients look much older than they are. Profound depression of a melancholy nature may alternate with restlessness and excitement. The picture may be complicated by neuralgias, headaches, dizziness, and tinnitus aurium. The metastases in other organs, the liver, intestines lungs, etc., the insidious or the acute perforations may produce a variety of complications which in individual cases are manifested by characteristic symptoms. Certain occurrences are especially significant of a fatal termination. Among these is fever, which is neither a marked nor a constant symptom, yet by no means as rare as is commonly supposed. Its course is irregular, ranging usually between 38° and 39° C. [100·4° and 102·2° Fahr.], rarely reaching 40° [104° Fahr.], and may, as I saw in one case, assume a purely hectic character. At times absolutely or almost afebrile periods may alternate with such high febrile movements as can only arise from secondary in-

flammations. In addition, I see that Hampeln,* in a very interesting paper on the symptoms of obscure visceral carcinomas, has very accurately described two cases of gastric cancer with an intermitting fever, which was so marked that chills followed by fever and sweating were present, and the possibility of the existence of malaria had to be carefully considered.

An interesting case of the latter variety recently came under my observation at the Augusta Hospital.

A man forty-seven years old was admitted December 6, 1888. Present illness began about two years ago with symptoms of dyspepsia. In September, 1888, had hæmatemesis and also passed blood *per anum*. He was treated in the hospital during October for "ulcer of the stomach," and was discharged improved. On December 3d, violent vomiting, but no hæmatemesis.

On admission he was placed on a milk diet, it being supposed that a gastric ulcer was present. An irregular fever with evening exacerbations to 39·6° C. [103·3° Fahr.] soon manifested itself. The pains in the epigastrium continued, and became variable in their situation, being sometimes more marked to the left, sometimes to the right. The stomach-contents contained no free hydrochloric acid. The patient became more and more emaciated, so that finally a small tumor could be palpated in the right hypochondrium near the border of the liver. Icterus was not present. A diagnosis of cancer of the stomach and liver was made. On January 5, 1889, he had a marked chill, which recurred several times; the pains in the epigastrium increased, and from now on to the patient's death on February 20, 1889, the fever remained continuous, and a delicate friction sound could be heard near the edge of the liver. A diagnosis was made of perforation of an ulcerated cancer following an adhesive inflammation and agglutination of the adjacent tissues, and also a localized peritonitis. The autopsy revealed the presence of an ulcerated carcinoma about the size of an apple, which was situated on the lesser curvature, and which reached to and was adherent to the diaphragm. The surface of the liver was studded with numerous slightly elevated white nodules, all of which showed recent adhesions to the parietal peritonæum.

Among the terminal symptoms belong dropsical swellings and effusions into the serous cavities; inflammatory processes may also occur in the lungs, pleuræ, and kidneys. As death approaches, delirium may occasionally be present; this is to be regarded as a delirium due to inanition. Death is due to marasmus; the agony is brief. Consciousness remains clear for a long time, yet disappears

* P. Hampeln. Zur Symptomatologie occulter visceraler Carcinome. Zeitschr. für klin. Medicin, Bd. 8, S. 232.

as death approaches, so that a conscious death-struggle does not occur.*

As a rule, the course of cancer is progressive, irresistible, and advancing toward a fatal termination. Occasionally, longer or shorter periods may occur in which the process seems to stand still, in fact even to retrograde. Such occurrences may lead to diagnostic errors and doubts. A very striking example of this occurred to me at the beginning of my practice.

The patient, a gentleman sixty-two years old, became ill very gradually with symptoms which rendered a diagnosis of gastric carcinoma probable, but it could not be made absolutely. The patient felt worse and became weaker ; he vomited, had severe pains in the region of the stomach, especially on pressure ; absolute anorexia and obstinate constipation. A medical charlatan diagnosed the case as an affection of the spleen, and prescribed rhubarb wine and gruel with stewed prunes ! But—the patient improved, and, as I heard later, ate his gruel with great relish ; he even went out again, and swore by his doctor. This went on for about two months; then the old symptoms returned, and the patient became marastic quite rapidly and died. I saw him again a short time before his death, and could then positively demonstrate a tumor at the pylorus, which was about the size of a fist.

Such periods of apparent improvement I have repeatedly observed. Most experienced physicians know of them ; they certainly occur much more frequently than the text-books would lead us to suppose.

The duration of the disease may vary from between three to six months to two, three, or more years ; on an average it lasts between six and fifteen months ; a shorter course is at all events exceptional. It always terminates fatally : cases of cured cancer of the stomach have been repeatedly reported, yet they have never been positively proved. The cases reported by Dittrich, Lebert, Friedreich, and others, may have been mistaken for gastric ulcers or the superficial cicatrices which have already been described. Thus, in one of my cases of cancer of the breast, I found in the stomach a radiating cicatrix with thick, callous edges and a marked atrophy of the mucous membrane in the vicinity. It would have

* [Dyspnœic coma, as in diabetes, may also occur in the latter stages of gastric cancer. Gerhardt's reaction may or may not be present in the urine. See Welch, *loc. cit.*, pp. 534 *et seq.* Tr.]

been reasonable to suppose that this was a healed primary carcinoma of the stomach with metastases in the mammary gland. But the microscope showed just the reverse. The base of the scar was formed by firm, dense connective tissue, while in the immediate vicinity of the border in the submucosa scattered cell-nests were found; these could only be regarded as the beginning of a cancerous process. The process was thus a cancer which had developed in the cicatrix left after the healing of an ulcer (*vide* Ulcer of the Stomach). The opinion that this was a cicatrized carcinoma was also excluded, because such an abrupt transition from purely fibrous tissue to recent carcinomatous proliferation as was present in this case is never found in a cancerous cicatrix.

The above clinical picture is only schematic, and in an individual case numerous modifications may occur. Writers have taken great pains to determine *the relative frequency of the occurrence of the various symptoms*, and in the works of Brinton and Lebert you will find analyses carefully prepared from relatively large numbers of cases. In practice, i. e., in the diagnosis of a suspected case, such statistics have only a relative value, and are more interesting for the nosology of the disease. If we remember our statistics never so well, who will guarantee that a given case is the rule or an exception?

To illustrate the above, I present the accompanying half-schematic drawing (Fig. 22) of a case in which a colloid cancer involved the lesser curvature, and, being partially covered by the left lobe of the liver, could not be palpated during life. The patient was a tailor, forty-eight years old, who had never complained of pain, and had never had hæmatemesis. A probable diagnosis of cancer of the stomach had been made at the clinic of Prof. Frerichs, solely upon the marked anorexia and the progressive cachexia, and by the careful exclusion of other diseases. The fact that hæmatemesis occurs in 42 per cent (according to Lebert, in only 12 per cent) of the cases, and that a tumor is absent in 20 per cent, would have decided this case neither positively nor negatively.

For the sake of completeness, however, and because it may nevertheless be of some assistance, I shall not withhold the following figures. They are based upon an analysis of 250 cases reported

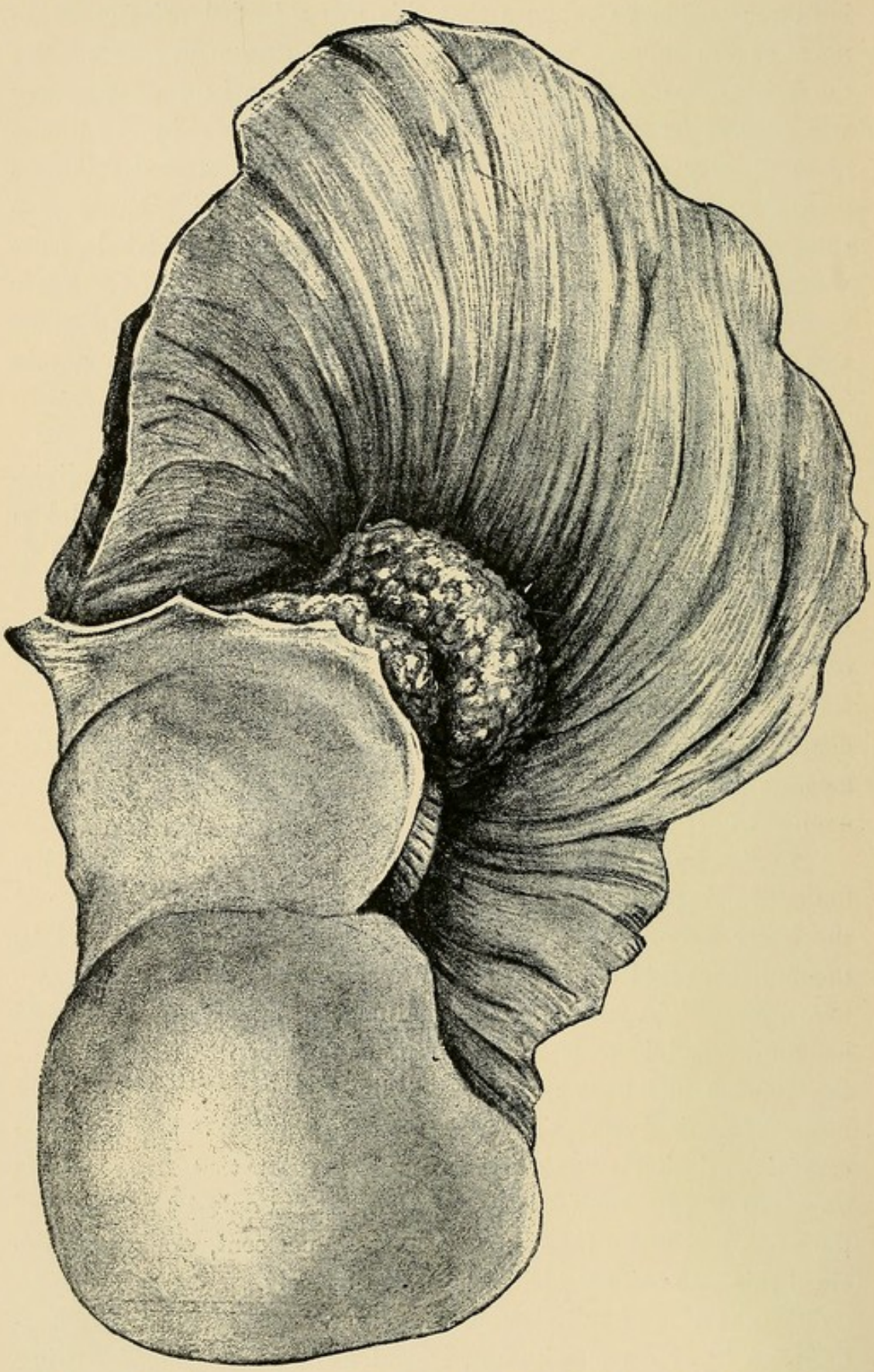


Fig. 22.—Mr. R., died March 17, 1874. Colloid cancer of lesser curvature of stomach.

by Brinton and 88 and 145 cases respectively collected by Lebert.*

Loss of appetite occurs in 45 per cent; often is observed only toward the close of the disease; rarely the appetite is increased

Pain is present in 92 per cent (Lebert, 75 per cent). It is frequently absent in old people. Brinton claims that pain between the scapulæ indicates a cancer on the lesser curvature. In the case which I have just cited there was no reference to such an interscapular pain, and my own experience leads me to consider that the significance of this symptom has been exaggerated.

Vomiting occurs in 88 per cent (Lebert, 80 per cent). It is most frequent where the orifices are involved. Nevertheless, a marked stenosis of the pylorus may exist without the occurrence of vomiting. While in most cases it occurs a considerable time after the meal (one, two, or three hours), yet it may take place much sooner, and in drunkards and very debilitated persons may even be present in the morning when the stomach is empty. There is thus nothing typical in the time of its occurrence.

Hæmatemesis is noted in 42 per cent of Brinton's cases. Lebert distinguishes large hæmorrhages from the stomach from true melæna or melanemesis [the vomiting of black altered blood]; the frequency of the former he estimates at only 12 per cent.

A *tumor* is present in 80 per cent of the cases, according to both Brinton and Lebert. It is seldom palpable before the third to the sixth month; usually it is only distinct in the second half of the course of the disease, or during the last months of the patient's life.

The *bowels* remain regular in only 4 to 5 per cent of the cases. In the vast majority there is constipation, or constipation alternating with diarrhœa; the latter is a manifestation of a catarrhal condition of the intestinal mucous membrane, due to the irritation of hard fecal masses, or of products of decomposition which have not been carried off. A gastro-intestinal fistula may be formed, and fæces and gases may reach the stomach, or the stools may

* A Ott (Zur Pathologie des Magencarcinoms, Inaug. Dissert., Zürich, 1867) has added 33 additional cases from Prof. Biermer's clinic, and has obtained substantially the same results,

become lienteric (i. e., the presence of undigested food in the fæces). Yet Rampold* has observed a communication between the stomach and transverse colon and an adjacent loop of intestine in a patient sixty-six years of age, who gave no definite symptoms indicating a gastric lesion; it must be noted, however, that the patient also suffered from dementia paralytica. Murchison† has called attention to the fact that stercoraceous vomiting will be absent when the contents of the stomach pass directly into the colon, since there can be no formation of fæces. Finally, we must mention one peculiarity which is observed where the orifices of the stomach are involved by the cancer—i. e., the breaking down of the new tissue may cause the symptoms due to the stenosis to disappear, and thus, at times, an improvement may seem to have occurred.

The *condition of the blood* deserves especial notice. Laache‡ describes a lessening of the number of the red blood-cells in this disease; Lépine# calls attention to the temporary occurrence of numerous microcytes, whose number may be estimated at one half that of the red blood-cells. Eisenlohr‖ and Schneider,^ besides the above changes, observed a relative and even an absolute increase in the number of white blood-cells, so that the condition of the blood may resemble that of pernicious anæmia, or even of leucocythæmia; Schneider also says that "these so easily recognized changes in the blood may become a not unimportant item in the differential diagnosis."

Diagnosis.—Although, taking all in all, the diagnosis of the disease may be made from what has already been stated concerning the development, course, and general symptomatology, yet there still remain certain important diagnostic features, the consideration of which I must not omit. I shall begin with the one which

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* Rampold. Hufeland's Journal, 5. Stück, 1836.

† Quoted by Henoch. Klinik der Unterleibskrankheiten. Berlin, 1863.

‡ S. Laache. Die Anæmie. Christiania, 1883.

Lépine et Germont. Note, etc. Gazette méd. de Paris, 1877, No. 14.

‖ Eisenlohr. Blut und Knochenmark. Deutsches Archiv für klin. Med., Bd. 30, S. 495.

^ G. Schneider. Ueber die morphologichen Vehältnisse des Blutes bei Herzkrankheiten und bei Carcinom. Inaug. Diss. Berlin, 1888.

is of most recent origin, and which has given rise to somewhat too precipitate and exaggerated hopes. I refer to—

1. *The absence of free hydrochloric acid in the stomach-contents.* It was a great triumph of Prof. Kussmaul's clinic to have first methodically investigated the subject. The opinion was originally expressed by R. von den Velden, that cancer of the pylorus, accompanied by dilatation of the stomach, leads to a suppression of the secretion of hydrochloric acid. This view was soon indiscriminately applied to all varieties of cancers of the stomach. But even the combined labors of numerous investigators, and not the least, of the above-mentioned clinic, have shown that this statement can not be maintained in its entirety; yet it has led to results of great diagnostic and therapeutic significance.

But historical justice demands that we think of an investigator who, years ago, so thoroughly studied the question of the occurrence of hydrochloric acid in gastric cancer that the knowledge of his conclusions would have spared us much needless discussion. Remarkably, however, his labors, splendid for the age in which he lived, have so absolutely passed into oblivion that even his own countrymen nowhere speak of them. Golding Bird, Physician to the Islington Dispensary, and Professor of Medicine at Guy's Hospital in London, in 1842,* in a man forty-two years old, with pyloric cancer and dilatation (verified by autopsy), determined the relation of hydrochloric and the organic acids in a series of examinations of the vomit, the methods employed being faultless even to-day.† In about three weeks three estimations were made, the results of which led Bird to conclude that, "during the more irritative stage of the disease, free hydrochloric acid is present in the vomit in considerable quantities, but it gradually diminishes in proportion to the patient's loss of strength; and that the organic acids increase proportionally as the free hydrochloric acid diminishes." It is worthy of note that, by a control-experiment on a healthy subject (an emetic

* Golding Bird. Contributions to the Chemical Pathology of some Forms of Morbid Digestion. London Med. Gazette, 1842, vol. ii, p. 391.

† Distillation of the volatile acids, incineration of the residue, boiling with dilute nitric acid, and estimating the silver salt with and without the addition of soda.

dose of sulphate of zinc was given thirty minutes after a moderate dinner), free hydrochloric acid, but only a very small quantity of organic acids, could be demonstrated; another experiment, on a patient with cancer of the liver and dilatation of the stomach resulting from pressure of the tumor on the pylorus showed a somewhat lessened amount of free hydrochloric acid but large amounts of combined hydrochloric and organic acids.

In these investigations it may be possible that a little confusion may exist in the relation of the free to the combined hydrochloric acid and the organic acids, because the diet and the time of the emesis were not precisely determined; yet Bird's deductions are not to be questioned, and are of great importance. Bird himself was conscious of this, but complains of the amount of time demanded by these studies, and it seems he did not pursue them further. In this way they passed into obscurity, and it was only recently that this subject was again taken up, but with new methods.

The subject has been and is still being investigated by a daily increasing array of clinicians and physicians. To show you the extent of this discussion I need merely mention in chronological order the names of von den Velden, Ewald, Kietz, Thiersch, Riegel, Kahn and von Mehring, Jaworski and Gluczynski, Bamberger, Kraus, Dreschfeld, Rosenbach, Krukenberg, Rosenheim, and many others. Unquestionably the largest amount of material was collected by Riegel, who recently reported sixteen cases of cancer of the stomach, in which three hundred and six separate examinations were made.* It will be superfluous to follow the views expressed *pro* and *con* by the various writers, especially since it seems to me that a definite decision has been or soon will be reached. For the question has been much simplified since all have finally agreed as to what is to be understood by the absence of free hydrochloric acid—i. e., the results either of the color tests described in the first lecture, or of careful chemical analyses. It is apparent that the practical importance of the former tests, in so far as they give a uniform result, is not diminished by theoretical considerations based upon the latter.

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* *Loc. cit.*, p. 430.

It can very well be maintained, as I have always done, that carcinoma regarded as a histological neoplasm, in no way lessens or destroys the secretion of hydrochloric acid. This has recently received additional and almost superfluous corroboration by the unearthing of Bird's researches. But, whatever view is taken, it would nevertheless be a valuable diagnostic criterion, provided other complicating factors did not interfere with the determination of the presence of hydrochloric acid—but not of its secretion. Each is correct. When the new growth is confined microscopically and macroscopically (which by no means always correspond) to a limited area, when the accompanying catarrh of the mucous membrane is moderate, and when there is no atrophy, then the secretion of hydrochloric acid may remain ample till it disappears with the approach of death; or it may be much diminished, as occurs in all cachectic conditions. However, in the vast majority of cases one of the above-mentioned factors plays a prominent part, and the secretion of hydrochloric acid is either entirely annihilated or is reduced to so small a quantity as not to be demonstrable with the ordinary tests. This would afford us an exceedingly good diagnostic criterion but for the fact—be it said with regret—that a diminution in this secretion may occur in other pathological conditions of the gastric mucosa. These include atrophy and amyloid degeneration of the membrane; self-evidently, poisoning or corrosion, in which a large portion of the mucous lining is destroyed; mucous catarrhs and certain neuroses depending upon or associated with a disturbance of the innervation of the gastric glands. It is manifest, as I have already stated, that acute injuries of the gastric mucosa, poisoning, and acute indigestion may cause a loss of glandular activity, just as in an acute catarrh of the kidney there is a marked diminution of its secretion, or as an injection of atropine into Wharton's duct dries up the salivary secretion. Likewise, in my own person I found that the stomach-contents were absolutely free from hydrochloric acid during a very transitory nicotine poisoning; on another occasion, during a sea-voyage, I could obtain no reaction with Congo paper in the food which was vomited one hour after breakfast. Such conditions are only of short duration, and rapidly disappear after the removal of the irritant or under a suitable diet. The experiments of Wolf-

ram* show that, while fever is present in all the acute infectious diseases, the gastric juice contains no hydrochloric acid and exerts no digestive action either within or outside of the organism. We also know concerning certain chronic diseases—for example, Addison's disease (Köhler), pernicious anæmia, many cases of pulmonary phthisis (C. Rosenthal)—that the secretion of hydrochloric acid is reduced to a minimum, and no free acid can any longer be detected.

But even physiologically there are very marked variations in the amount of acid produced; the free acid depends essentially upon the quantity of albumen which is converted into acid albumen or peptones, which absorb the HCl or form loose combinations with it. Thus free acid may be present or absent in the gastric juice after eating the same food, but with varying conditions of secretory activity. We must, therefore, heartily agree with Riegel when he demands that a positive opinion should only be expressed after examinations which have been conducted a long time, and with the aid of a suitable therapy. Normally, the production and secretion of the hydrochloric acid are so regulated according to the demands of the ingesta that free acid is immediately present in sufficient quantity to give a distinct reaction with the color-tests, etc. This does not occur in the vast majority of cases of cancer of the stomach. But this does not depend upon some influence of the cancer on the production of HCl, but is simply due to the accompanying catarrhal, inflammatory, or atrophic conditions of the gastric mucous membrane. If these are absent the acid is secreted abundantly, as in the case reported by Bird, another by Cahn, and still another reported later which had been observed by von den Velden.† But if, during our observation of such a patient, one of the above processes involves the gastric mucous membrane and becomes more marked, or if the organism gradually becomes weaker and weaker, and if with this the functions of the organ primarily involved naturally give way first, then the transition from the occurrence of hydrochloric acid to

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* Announced by Gluczynski. Ueber das Verhalten des Magensaftes in fieberhaften Krankheiten. Deutsches Arch. für klin. Med., Bd. 33.

† Cahn. Verhandlungen des VI. Congress. für innere Medicin, 1887, S. 362 und 373.

its absence may take place in a relatively short space of time. In this way I explain Bird's case, and also one which came under my own observation.

Mr. R., merchant, forty-two years old, was seen in consultation on January 7th. He had suffered for a long time from "chronic catarrh," and had complained of a severe burning sensation in the stomach for several months. He was admitted to the Augusta Hospital, and while there was treated with the stomach-tube and was very much benefited by it. He learned to wash out his stomach and did it frequently, especially as he sought in this way to remedy his frequent dietetic errors.

The patient was a haggard man, with a dry skin and retracted abdomen ; he lay in bed on account of weakness. Heart and lungs negative. There was a small movable tumor at the pylorus about the size of a walnut, slightly tender on pressure. No succussion sound. The stomach when distended reached to the umbilicus, causing the tumor to move downward and somewhat to the right. During the introduction of the tube by himself he vomited slimy, yellowish-green, offensive masses of neutral reaction ; accordingly, no free acid was present. No glandular swellings. Urine clear and acid. Stools irregular.

The stomach-contents, after taking the test-breakfast on the following morning, *undoubtedly contained a considerable amount of hydrochloric acid* and small quantities of lactic acid, peptone, and propeptone. The stomach-contents digest slowly.

In view of the presence of hydrochloric acid, a diagnosis was made of a non-carcinomatous hypertrophy of the pylorus (cicatrization of an old ulcer ; muscular hypertrophy accompanying a chronic catarrh (?)).

But on the following day the patient vomited bloody masses and complained of severe burning pain in the stomach, and an almost intolerable dryness of the mouth, pharynx, and œsophagus. Vomiting recurred very frequently during the next three weeks in spite of a rigorous diet and regular lavage of the stomach. Each time the stomach-contents were abundant, of a bloody color, or contained broken-down coagula ; fragments of food were also present. Hydrochloric acid was never found ; on the other hand, large quantities of yeast-cells, bacteria, and mucus could be seen. The reaction was usually neutral ; if acid, it was due to acid salts or lactic acid. On two different occasions the test-breakfast was given *lege artis*, and each time the absence of hydrochloric acid was noted. The tumor remained unchanged and could be felt more or less distinctly, according to the fullness of the stomach. The patient suffered intensely, lost strength rapidly, and urgently wished the removal of the tumor by operation. In view of the large quantities of "stomach-contents" which were siphoned through the tube from the patient's stomach—often amounting to four or five litres [nine to eleven pints]—dilatation of the stomach was diagnosed, although a repetition of the distention of the viscus with air again gave no positive evidence thereof. I could not quite explain this peculiar condition, but I expressed to my colleagues the suspicion that the siphoned fluid came from the intestines

rather than from the stomach, the fluid having regurgitated into the latter through the rigid and thus incompetent pylorus.

At the patient's request, Prof. Sonnenberg resected the pylorus on January 30th—i. e., about three weeks after the first examination. At, and surrounding the pylorus, was a hard tumor, the size of a walnut, which so narrowed the orifice that the tip of the little finger could be inserted only with difficulty. Several glands in the ligamentum gastro-colicum were enlarged to the size of cherries. The stomach was not dilated.

After the operation everything went smoothly and for the first few days the patient's condition was excellent. On the fourth day there was a slight febrile movement, followed by marked collapse ; the patient died on the evening of the fifth day. At the autopsy I found that some of the sutures (catgut and silk) had suppurated, causing a localized purulent and adhesive peritonitis which may be regarded as the cause of death. The mucous membrane in the line of sutures was hyperæmic, *but elsewhere was entirely uninvolved.* On the other hand, the muscularis as far as the fundus was infiltrated and thickened. A piece of the fresh tumor was immediately placed in absolute alcohol, which was subsequently frequently changed ; microscopical examination showed that it was a scirrhus carcinoma which was almost entirely limited to the muscularis, infiltrating it in broad bands. *The greater part of the mucous membrane was entirely normal*, or at most only slightly infiltrated by an interstitial proliferation of small cells from the submucosa. In places there was more atypical growth of the glandular tubules, and cysts of various sizes were found toward and in the submucosa. *On comparing this section with a preparation from a catarrhal stomach no marked differences could be found.* The same was true of pieces of tissue which were taken at the autopsy from the fundal and cardiac portions. In the affected area the submucosa was sharply defined from the mucosa on the one side and from the infiltrated muscularis on the other ; even with the naked eye its wide-meshed fibrous structure could be recognized.

The great significance of this case is manifest. *It proves that with a localized cancer and an intact mucous membrane the secretion of hydrochloric acid may continue up to a short time before death ; and under such circumstances conclusions based upon the demonstration of this acid may be erroneous.* The peculiar features connected with the siphonage of the stomach are an additional interesting point of this case. The distention of the stomach with gas afforded reliable data ; and the large quantities of fluid which were obtained without any exertion are only to be explained as above. There was thus a true and actual insufficiency of the pylorus. Nevertheless, it may be said that the duodenum could not be distended. This can be readily understood if the large capacity of this part of the intestine be compared with the small amount of air which can

be pumped in. Finally, the admixture of blood in the stomach-contents, which was constantly observed toward the close of life, remains entirely inexplicable; the autopsy afforded no clew; therefore, as in other cases, we must assume the occurrence of gradual rhexis from the vessels.

Since the observation of this case a number of careful investigations have been made on the relations of hydrochloric acid to cancer of the stomach; of these I shall only quote the following: In eight cases of this disease which were carefully studied, both anatomically and chemically, Stienon * reports that four gave no reaction to the color-tests, while the other four gave temporary, more or less positive results. In fourteen examinations made on two cases with the method of Cahn and von Mering, positive reactions were obtained, the amount of hydrochloric acid varying between 0·4 and 2·3 per thousand, but the color-tests gave a negative result every time. The microscopic examination convinced him that the disease is frequently, if not usually, accompanied by an atrophy of the glands, and to this may be due the absence of hydrochloric acid. This may be true of many but by no means of all the cases of gastric cancer, because experience teaches us that the accompanying affection of the mucous membrane may restrict itself to a more or less extensive and intense inflammatory process (catarrh).

A very comprehensive study of this subject was also made by Rosenheim † with the aid of Cahn and von Mering's method. In fourteen out of sixteen cases of gastric carcinoma he could never demonstrate *free hydrochloric acid* at the height of digestion; in another it was present temporarily; in still another it was not alone present, but there were even hyperacidity and hypersecretion. In regard to the latter case it must be noted that the color-tests for hydrochloric acid were almost always negative, and that the statement of the presence of hyperacidity is based upon a method (Cahn and von Mering's) which is not free from objections. Yet this is at present

* L. Stienon. Le suc gastrique et les phénomènes chimiques de la digestion dans les maladies de l'estomac. Journal de Méd. de Bruxelles, October 5, 1888.

† Th. Rosenheim. Ueber atrophische Processe in der Magenschleimhaut in ihrer Beziehung zum Carcinom und als selbstständige Erkrankung. Berliner klin. Wochenschr., 1888, No. 51–52.

of minor interest as compared with the unanimous result of the investigations of these writers, namely, that under certain conditions free hydrochloric acid may be present in cancer of the stomach.

In this disease the stomach-contents, containing no free acid, exert no digestive action, even on the addition of hydrochloric acid, or of small quantities of normal chyme. The reason for this I gave long ago in my answer to Riegel's experiment upon this point, i. e., that the HCl is seized by the excess of albumen, and hence does not come into action. Had Riegel added the acid till free HCl could be demonstrated, his trial of digestion would have been successful, since pepsin is seldom absent. For the other ingredients of the gastric juice, the *pepsin* and *rennet* are not lessened to the same degree as the hydrochloric acid. The products of the action of pepsin, the peptones, are found almost without exception even where neither free hydrochloric nor lactic acid is present. Hence pepsin must have been secreted, and sufficient free HCl to form peptone must have been present at some time. The majority of these filtered stomach-contents form not alone propeptone but also true peptone, if they are acidulated to about two per thousand of free HCl. Boas (*loc. cit.*) claims to have found rennet even where free HCl was absent. The explanation of this apparent paradox lies in the fact that the secreted HCl combines with any free bases, weak salts and albumen and its derivatives, while the ferments remain free; and of the latter we know that their action only begins to be lessened when the products of fermentation are present in excess. The relation of these three elements [hydrochloric acid, pepsin, and rennet], and the mode of determining them, will therefore depend very much upon the nature of the food and the energy of the secretion—the effects of the variety and extent of the lesion of the mucous membrane being self-evident.

But the important fact remains that free hydrochloric acid is usually absent in carcinoma of the stomach. Unfortunately, the diagnostic value of this circumstance is decidedly affected by the occurrence of this same loss in the other conditions which I have already mentioned. *But, granting this, the proposition, which I was the first to announce, is still true, that the demonstration of the presence of hydrochloric acid points with very great probability*

against the existence of cancer of the stomach; for the cases of this disease in which there is a positive reaction to the carefully applied tests are so rare that they have very little bearing on the question.

Under certain conditions (stagnation of the ingesta or the introduction of easily fermenting food) the hydrochloric acid may be replaced, or may be accompanied by lactic acid, fatty acids and their salts, which may impart an acid reaction and penetrating odor and taste to the contents of the stomach. Of especial interest, however, is the fact, which has been repeatedly observed in this disease, as well as in other affections of the stomach, that, with an absolute loss of the hydrochloric-acid reaction, this deficiency in the digestive function has been replaced for a long time by the vicarious action of the intestinal digestion, or by the formation of large quantities of lactic acid (or eventually of acetic acid).

2. *The presence of specific tissue elements in the vomit, or in the masses raised through the stomach-tube.* I have already spoken in general of the constituents of the vomit; here I need only recapitulate that in the advanced stages of this malady we may find a very great variety of fungi, yeast-cells, sarcinæ, bacteria, pavement and round epithelial cells, with large nuclei, single nuclei, and nucleoli, and large masses of detritus colored brown to a dark green, and mixed with all kinds of remnants of food. But the present question is, Is it possible to recognize specific cancerous tissue? This is certainly impossible with isolated epithelial cells. It must be admitted with regret that, in spite of all the time and labor which have been expended, no means have yet been discovered by which we can distinguish specific cancer-cells from the ordinary varieties of epithelial cells found in the stomach-contents, some of which are derived from the walls of that viscus, while others, from the mouth and œsophagus, have been swallowed. Even Brinton said: "But mere isolated cells or nuclei scarcely justify a decision." Lebert, in his *Physiologie pathologique*, pictures cells with six or more concentric layers, which he considers specific cancer-cells, "*globules cancéreux à paroix concentriques.*" These cells are nothing more nor less than starch granules. For my part, I only consider conclusive the concentrically stratified aggregations of

cells, true cancer-cell nests, such as are shown in Fig. 23. In the case from which this specimen was obtained it was even of decisive value.

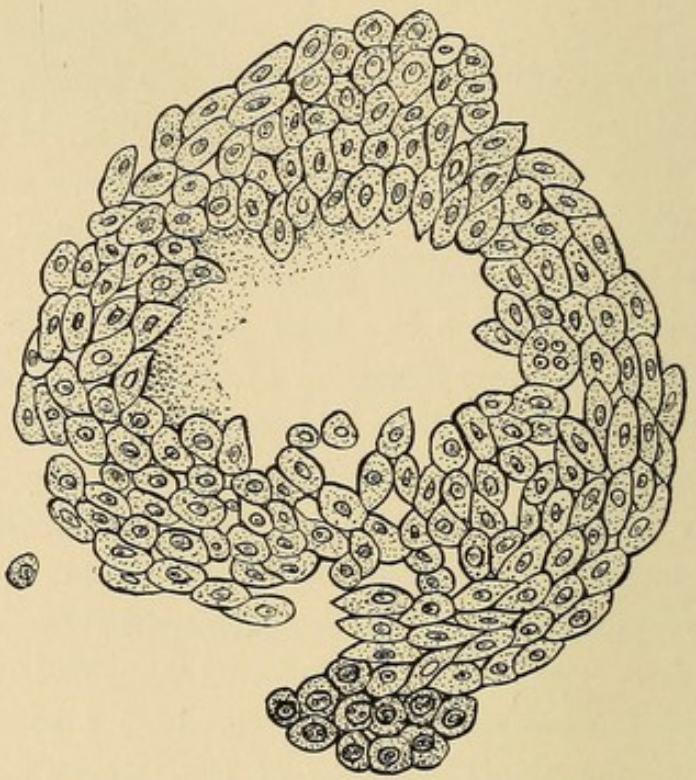


Fig. 23.—Cancerous cell-nest raised through stomach-tube. (From Mr. L., December 11, 1886. Sketched with camera lucida.)

Mr. L., about thirty-five years old ; no inherited diseases ; has been complaining for the last six months of anorexia, pain in the epigastrium, and frequent vomiting ; no tumor nor cancerous cachexia. By means of the stomach-tube large masses of mucus were obtained every time ; hydrochloric acid could never be demonstrated. The diagnosis lay between a severe mucous catarrhal gastritis and an occult neoplasm. On renewal of the examinations faint blood-streaks were seen, and a small, firm particle was obtained ; from this the above preparation was made. By its means alone the diagnosis was established, and the death of the patient about two months later verified its correctness.

But even such specimens as the one in question may give rise to errors. It occasionally happens that very small pieces of the gastric mucosa may be detached where the membrane is very vulnerable, even when a cancerous neoplasm is absent. If such a piece is placed on a slide, the pressure of the cover-glass may cause the epithelium surrounding an excretory duct to assume a concentric stratification closely resembling a cancerous cell-nest. The drawing of such a specimen is given in Fig. 23 ; it, together with a large

shred of the epithelial lining of the stomach, was found in the wash-water while washing the stomach of a patient twenty-eight years old, suffering from a mucous catarrhal gastritis, with no symptoms of cancer, and whose improvement was continuous. Later on, in the discussion of the catarrhal conditions of the stomach, I shall be able to present to you unmistakable specimens *in toto* of the detached epithelium of the stomach.

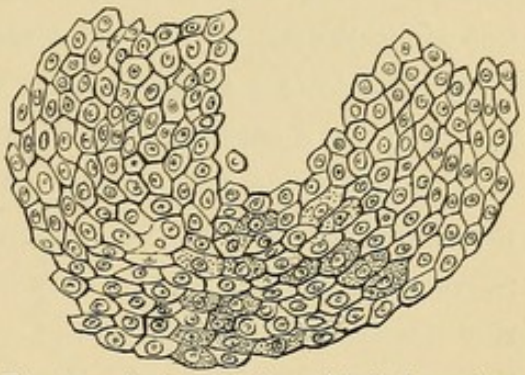


Fig. 24.—A piece of the epithelial covering of the mucous membrane of the stomach, resembling a cancerous cell-nest. (From Mr. K., March 10, 1887. Sketched with camera lucida.)

In three cases of gastric cancer Rosenbach * found pieces of the tumor in the wash-water; he claims that even macroscopically (it is surprising that no microscopical examination was made) they may be differentiated from detached portions of the mucosa by characteristic punctate hæmorrhages penetrating into the tissue, and by the old brownish-black blood. I myself have never observed such specimens, and, in spite of Rosenbach's assertions to the contrary, I would consider them rare, and as being entirely dependent upon the nature of the neoplasm.

3. *The cancerous tumor.* Concerning the character of tumors in the stomach, and the peculiarities of the diagnosis of them, I shall only remark, in passing, that it is self-evident that to be palpable they must be situated upon the greater curvature, or at the pylorus, and that neoplasms situated upon the lesser curvature are beyond the reach of the palpating fingers, especially if the growth is along the surface and is overlapped by the liver; such a condition was present in the case from which Fig. 22 was taken; and, finally, that tumors on the lesser curvature can only be palpated when the stomach occupies an abnormal position. It is equally obvious that the palpation of stomach tumors may be rendered impossible by the development of ascites or cancerous peritonitis.

* O. Rosenbach. Ueber die Anwesenheit von Geschwulstpartickelschen in dem durch die Magenpumpe entleerten Mageninhalt bei Carcinoma ventriculi. Deutsche med. Wochenschr., 1882, No. 33.

For a long time it was considered an irrefutable axiom that movement of gastric tumors with respiration became possible only after adhesions had been contracted with the liver. But even this rule is not without exceptions. At a recent meeting of the *Gesellschaft der Charité-Aerzte zu Berlin*, Fr. Müller exhibited a stomach totally involved by a carcinoma, without any adhesions to the neighboring viscera, and yet which, during life, descended with every inspiration, as a result of the flattening of the diaphragm. A similar movement of the tumor may be transmitted from the liver when the neoplasm lies close to the edge of the liver without the formation of any adhesions. At the Policlinic I have repeatedly and carefully examined a patient with such a tumor, the size of a fist, situated on the greater curvature near the pylorus; it was freely movable both with the fingers and by distending the stomach with air; the descent with every movement of inspiration was very noticeable. But such cases are always exceptional; and, indeed, their occurrence as such merely serves to strengthen the general rule above stated.

It is also important to bear in mind that most tumors feel much larger to the palpating finger than they really are, and that they may change their position according to the fullness of the stomach or intestines. In like manner a good idea of the size and situation, whether in the stomach or in one of the adjacent viscera, is not seldom only obtainable after the distention of the stomach or intestines. To distinguish a deformity on the lower border of the liver, especially in the left lobe, such as frequently result from tight lacing in women, or a true tumor of the liver, pancreas, or spleen from a new growth in the stomach, may at times be very difficult; at other times it is even impossible. The reverse may also occur, and a carcinoma of the stomach may be regarded as belonging to the left lobe of the liver. Thus Ott,* after giving a very careful description of such a case, says:

"The complete degeneration of the entire stomach even to the region of the liver, the rigid infiltration of the greater curvature, the diminution in size and contraction of the organ which enabled one to grasp the

* Ott. Zur Pathologie der Magencarcinome. Zürich, 1867, S. 60.

greater curvature, and which caused it to feel like the edge of the liver—all of these factors led to this deception."

It is equally difficult to decide whether a thickening at the pylorus is due to hypertrophy of the muscular coat, cirrhosis, foreign body encapsulated in the stomach,* cicatrized ulcer, localized peritoneal exudate, or carcinoma. Carcinomata of the omentum or of the intestines, which may be lying alongside of the stomach, may at times be recognized by a simple distention of the gut with air. Leube very properly calls attention to the possibility of mistaking the pancreas for a growing tumor of the stomach, since the progressive emaciation of the patient permits the pancreas to be more easily palpated through the relaxed abdominal wall. Frequently the question can only be decided after prolonged observation by the eventual growth of the suspected tumor, the occurrence of cancerous cachexia, the formation of metastases, and swellings of the lymph glands; but sometimes even these signs may fail, and the autopsy alone can reveal the true condition. In all these cases the examination of the stomach-contents is of great importance. If the usual amount of free hydrochloric acid is present after the test-breakfast, we may say with tolerable certainty that the stomach is not involved. That this is not always true was shown in the case described in detail on page 191. On the other hand, I wish to relate two cases in which this examination placed the diagnosis beyond doubt:

On November 24th a colleague, Dr. X., sent to me Mrs. W., thirty-three years old, a small, emaciated woman, who had borne four children. She complained of almost continuous pain day and night in the epigastrium. The pains were independent of eating, have lasted more than six

* These foreign bodies which may simulate malignant tumors are usually spherical or ovoid agglomerations of hairs which have been swallowed. But similar errors may arise from "shellac calculus" (*Shellackstein*), as occurred in a carpenter who mistook his varnish for liquor; other foreign bodies of a similar nature have given rise to errors. See Palemon Best, Death from Accumulation of Hair in the Stomach of a Woman, British Medical Journal, December 11, 1869, and other English authors. The eating of hair seems to be a favorite occupation of English women; still, unless I am mistaken, a similar case was reported by Schönborn.

[Another German case may be found in O. Bollinger. Eine seltene Haargeschwulst im menschlichen Magen. München. med. Wochenschr., 1891, Bd. 38, S. 383. The case of Schönborn, alluded to above, may be found in Arch. für klin. Chirurg., Bd. 29, S. 609; the ball of hair, which was mistaken for a movable kidney, was successfully removed by operation.—Tr.]

months, and were temporarily ameliorated by the use of Carlsbad water. The patient belched frequently, but had a good appetite, and had never vomited.

The tongue was not coated; the abdomen was somewhat pendulous, and its walls relaxed. Close to and on the right of the median line was an easily movable tumor, which was painful on pressure; to the right and external to this was a second tumor, smaller, and descending with inspiration (gall-bladder). Distention of the stomach with air revealed a dilatation and a descent of the greater curvature to midway between the symphysis and umbilicus. The stomach-contents contained an abundance of free hydrochloric acid, but no products of fermentation or decomposition. Further questioning revealed that the patient had occasionally suffered from gastralgia. Diagnosis: Dilatation of the stomach resulting from a cicatricial stenosis of the pylorus, and hypertrophy of the muscularis as a sequel of an ulcer at this point. The proof of this was the continuous improvement and gain in strength after methodical lavage and suitable diet. No cancerous cachexia was present.

The diagnosis of this case was possible only by knowing the result of the examination of the stomach-contents; and, having ascertained this, it was rendered sufficiently certain. It is well known that a hypertrophy of the muscularis in the pyloric region may absolutely simulate a neoplasm; as examples, I refer to the case reported by Virchow,* and to another published by myself:†

The latter case was as follows: H. S., fifty-six years old, teacher from Salzwedel. The man, of a very large and powerful frame, was much emaciated and cachectic. The abdomen was relaxed and very flaccid, as in a multipara. In the umbilical region close to the surface could be felt a broad, flat, slightly nodular tumor, which reached on the right to the axillary line and on the left to the parasternal line. Deep inspiration gave rise to a feeling of false movement—i. e., the sliding of the abdominal wall simulated the movement of a tumor. The patient was very dyspeptic, suffered severely from belching, and vomited occasionally. It was self-evident that there was a carcinoma of the omentum; the only question in doubt was whether there was also a cancer of the stomach, as was indicated by the dyspeptic manifestations. The examination of the stomach-contents revealed an abundance of free hydrochloric acid, acidity 50;‡ the filtrate had a digestive action. An involvement of the stomach was thus excluded. The correctness of this diagnosis was verified by the autopsy.

In large tumors percussion may reveal a circumscribed area of dullness, yet it is hardly necessary for me to state that the percus-

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* Virchow. Wiener med. Wochenschr., 1857, No. 26.

† Ewald. Berl. klin. Wochenschr., 1886, No. 32.

‡ [See p. 22.—Tr.]

sion note will vary considerably according to the amount of air in the stomach and intestines, and according to the force used. The best results are obtained by very delicate direct percussion with the finger, or by auscultatory percussion. Small tumors may at times be inaccessible to both percussion and palpation by a twisting of the stomach on its axis, yet they may be rendered demonstrable by inflation of the stomach or intestines.

At times the tumor may pulsate distinctly when it lies upon the aorta and is lifted by it. This pulsation, which may be very marked, and owing to the retraction of the abdominal parietes may seem to be just beneath them, is distinguished from pulsation of the aorta by the fact that a tumor only expands in a vertical direction, while the aorta does so both vertically and laterally. However, this does not always suffice; if the tumor surrounds the aorta, as occurred in Ott's case,* all the symptoms of an aortic aneurism may be present: transverse and vertical pulsation, systolic bruit and distinct thrill over the tumor, smallness of the femoral arteries, even a swelling in the back may be present; we may sometimes also observe symptoms which are exactly similar to those occurring when a calcareous annular infiltration has developed in the walls of the aorta and has caused a stenosis of the vessel and a dilatation above the site of the stricture. At all events, a differential diagnosis in such cases is out of the question.

Hard fecal masses in the transverse colon or jejunum may simulate a tumor; hence the rule: Always previously evacuate the bowels thoroughly in every doubtful case. This is so self-evident that I ought scarcely to mention it. Yet in practice I find that this point is very frequently disregarded, in spite of the fact that it is mentioned in every text-book.

In many cases there is continuous pain at the site of the neoplasm; its manifold character has already been discussed under the general symptoms. In other cases the pain varies, at times ceasing entirely or being simply manifested as a vague burning sensation or oppression in the epigastrium. The exacerbations of pain are usually due to fresh inflammatory processes or the development of

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* Ott. *Loc. cit.*, p. 73.

new tumors, or finally to traction on the walls of the stomach, owing to the firm adhesions with the adjacent movable viscera. Propagation of the pain downward into the umbilical and suprapubic regions renders it very probable that the neoplasm is advancing along the peritonæum; occasionally distinct friction sounds may be heard, especially in the hepatic region; sometimes a rubbing may also be felt.

4. *The cancerous cachexia.* The peculiar condition of patients with cancer, which is called the cancerous cachexia, appears almost without exception sooner or later in the course of the disease, and has afforded various authors an opportunity to write more or less poetical descriptions. Unfortunately, this condition may give rise to errors both positive and negative. The latter are due to the fact that it is usually absent at the beginning or during the first half of the disease, just at the time when it would be of the greatest service to render a diagnosis certain. I have already had an opportunity to present to you a patient who undoubtedly had been suffering for months from a cancer at the pylorus, and yet his severe malady would have been suspected by no one.

A few weeks ago I was called to see a patient in whom I could very easily palpate an immense nodular tumor, occupying the entire epigastrium, and also adherent to the liver. The patient claims to have been well up to two weeks ago and to have followed his usual occupation till then; also that neither his family nor his friends noticed anything peculiar about him. The first symptoms noticed were jaundice and œdema of the lower extremities, which appeared suddenly. Even when I saw him there was no trace of a true cachexia, and yet the neoplasm was evidently of long standing.

On the other hand, you will not infrequently see persons with a typical cancerous cachexia, and whose history, as well as the results of the examination, point strongly toward cancer, yet after a longer or shorter course of treatment they recover entirely, and thus afford a most striking proof to the contrary. Disregarding manifest diseases whose nature may be discovered, it is almost superfluous to say that in this class of patients the most important place is occupied by hysteria in all its varieties. Every physician knows to what extent the emaciation and loss of strength of hysterical patients may sometimes reach. Even if we disregard the other characteristic

symptoms as a whole, it will be observed that in hysterical cachexia the turgescence of the skin is well preserved, in marked contrast with the condition of the skin in cancer; this is a valuable diagnostic sign. The differentiation is rendered still more difficult in the hysteria of male subjects.

Some time ago I was associated with a local colleague in the treatment of a man, forty years old, who had lost thirty pounds in two months; he had quite a marked but not extreme cachexia, and a variety of symptoms, among which were complete anorexia, marked fetor of the breath, and oppression over the epigastrium; these led to the suspicion of a rapidly growing organic lesion. In addition, the patient also suffered from palpitation of the heart and attacks of dyspnœa, apparently of a severe form; he also had strange sensations, especially a very peculiar and annoying feeling as if his limbs were "dead and ice-cold." Other physicians had expressed an unfavorable prognosis, and this had not failed to exert a very depressing effect on his already irritable disposition. He lay in bed for weeks and protested that he was unable to leave it. The latter symptom, the cardiac palpitation, the dyspnœa, the peculiar sensations for which we could find no cause either in the circulatory or respiratory system (there was a moderate dullness on the right side posteriorly, but this proved to have been due to a temporary atelectasis)—all these led us to assume the presence of hysteria complicated with a very severe gastric catarrh, possibly due indirectly to the latter. We began suitable treatment, and its success proved the correctness of our supposition; all of the symptoms disappeared, and the patient was discharged cured, after four weeks' treatment, including washing out the stomach with a watery solution of thymol; the other drugs used were hydrochloric acid, bromide of potassium, and valerian.

In this case the patient's age was an important factor, pointing against the presence of a neoplasm. But here also very remarkable sources of error may be encountered.

On June 19, 1886, a physician consulted me about his mother, a lady a little over fifty years old, who was so extremely emaciated and feeble, the skin so sallow and dry, that at first glance she looked as if she had cancerous cachexia. She had severe stomach symptoms, especially pain after eating; she was not relieved till she had belched repeatedly. In consequence of this she kept a very strict and innutritious diet, and had emaciated as described above. On closer observation, or rather waiting, it became evident that the whole trouble was hysteria. She suffered from such an attack of belching during the first examination; for almost half a minute the gas was raised with a rapid succession of hiccoughs and with a rumbling noise almost like thunder, and yet the abdomen was not much distended. This was frequently repeated at short intervals, the whole attack giving one the impression of a brief cyclone. The results of the physical and chemical examination of the stomach were normal, and the same was true of the stool as was ascertained later.

The diagnosis of hysteria had naturally been already made by other physicians, and the entire array of nervines had been tried. I thought of a case which I had seen long ago at the clinic of Prof. von Frerichs, in which an hysterical spasm of the glottis promptly ceased whenever the electrodes were placed upon the cervical vagi and an induced current passed through them. This expedient was similarly successful in this case, as the attack ceased instantly on applying the current. But, as I wished to effect a permanent as well as a temporary cure, I concluded to wash out the patient's stomach at regular intervals, on the presumption that the mechanical irritation and the harsh treatment of the gastric mucous membrane would thus lessen the hyperæsthesia of the organ. I shall leave undecided whether this presumption was correct or whether the good result was due to the erratic whim of an hysterical patient, which has so frequently contributed to the success of what seemed to be the most wonderful remedies. At all events, these troublesome symptoms disappeared after five *séances*, and according to a recent report have never returned.

Let this suffice to emphasize once more the fact, which is already well known, that the cancerous cachexia regarded alone, and as the only symptom, is of doubtful trustworthiness.

Finally, I must discuss the **differential diagnosis** in so far as it has not already been considered. The lesions in question are especially gastric ulcer, severe catarrhal gastritis, atrophy and amyloid degeneration of the mucous membrane of the stomach, and marked cases of hysteria and neurasthenia. I must premise that at times a sharp differentiation of these conditions may be impossible during life; in other cases there may be phases in the course of the disease in which every factor for a positive diagnosis may be lacking. At all events, the presence or absence of free hydrochloric acid affords a degree of certainty unattained until a few years ago. That it is not always absolute I have already endeavored to impress on you; for it may be absent not alone in carcinoma, but it may also be permanently wanting in severe gastric catarrhs, and in atrophy of the gastric mucosa, and may also not be found for a long time in hysteria, and even in neurasthenia. Then there are also the unquestionable although rare cases of cancer without loss of hydrochloric acid. The same is true of ulcer of the stomach, where, although as a rule there is hyperacidity, yet cases occur in which the secretion of hydrochloric acid is scanty. From these statements you will once more be able to appreciate the value of the estimation of hydrochloric acid. I think that you will agree

with me that even though it is not a touchstone, as some enthusiasts would claim, yet it is a diagnostic aid of the greatest value.

The demonstration of the presence of a tumor will remain as ever the most important and decisive feature. Here we must be careful not to mistake tumors situated outside of the stomach, or hypertrophic tumor-like thickening at the pylorus, gastroliths, and similar lesions already discussed on page 312 *et seq.* Where a tumor has not been demonstrated the diagnosis may be only relatively certain; thus it is not at all positive in atrophy of the gastric mucosa, which may completely simulate a slowly and steadily growing carcinoma because both hydrochloric acid and rennet are permanently absent. The absence of the cancerous cachexia may be of importance, since it appears to be less developed in atrophy. But not a few cases have been reported in which extensive carcinomatous processes ran their course without any special symptoms. Thus Storer * reports a case in which almost the entire stomach underwent colloid degeneration without causing any marked disturbances of digestion and vomiting. Siewecke † has collected twelve similar cases in which the characteristic symptoms of cancer were absent throughout.

I recently had an opportunity to perform an autopsy on a man, twenty-nine years old, who, up to four weeks before his death, had been able to undergo a Playfair [Weir Mitchell] treatment for a supposed neurasthenia without disturbing his digestion in any way! Before that time an abdominal tumor could not be palpated; later a hæmorrhagic pleurisy was developed, and the patient died in coma. I found a general widely distributed "carcinomatous" condition. The stomach was imbedded in nodular masses, its walls doubled in thickness, its diameter about that of a transverse colon of medium size. The microscope showed that the mucosa was almost entirely infiltrated with a fibro-sarcomatous neoplasm; only in small areas were the short and long glandular tubules intact, but the epithelium was very granular and cloudy, and the contours of the cells were destroyed. Stomach digestion had undoubtedly been impossible long before, and the food probably passed through the stomach as if it were a prolongation of the œsophagus; the intestines had been able to carry on this severe labor of digestion up to a short time before death. Thus the case may be added to those already cited where the nutritive processes were kept up, although the digestive functions of the stomach

* Storer. Colloid Disease of the Entire Stomach, with very Few Symptoms. Boston Med. and Surgical Journal, October 10, 1872.

† Siewecke. Ueber Magenkrebs. Inaug. Diss. Berlin, 1868.

had been entirely lost, and the whole task had been assumed by the intestines.

In this category must also be placed the cases in which the disease is occult for a long time, or is only manifested by vague dyspeptic symptoms; but subsequent to or apparently because of a marked change in the metabolism, great worry, or a very different mode of life—i. e., a "Schweninger cure," or an exhausting course of treatment at a mineral spring—suddenly the entire group of symptoms of cancer of the stomach is rapidly developed. The patients imagine that they have discovered the cause of their ailment; while the truth is, that the change of the metabolism has simply weakened the organism's power of resistance against the neoplasm, or, in other words, has favored the growth of the carcinoma.

The differential diagnosis between ulcer and cancer of the stomach will be discussed at length in the next lecture. Here I shall simply state that hydrochloric acid and the ferments (pepsin and rennet) are always present in the former, but are absent in the great majority of cases of the latter. Experience has shown that an ulcer does not protect a patient against cancer, but it seems that if the latter already exists the former is never added. The following may serve to establish the diagnosis:

1. The appetite in cancer is, as a rule, more profoundly and permanently impaired. In ulcer it is lost only during the exacerbations, but is normal in the remissions and intermissions, although the fear of causing pain makes the patients eat little or hardly at all. As already stated, the condition of the tongue is very characteristic: in ulcer it is usually clean, or only coated at the base; in cancer it is furred in the great majority of cases.

2. The pain is generally more localized in ulcer, and is usually limited to the epigastric region and the left parasternal line. Corresponding to the frequency of the situation of ulcer on the posterior wall of the stomach (43 per cent), the pain very frequently radiates backward, the so-called lumbar pain (*Kreuzschmerz*); the pain is usually aggravated or caused by external influences—taking food, pressure from without, certain bodily movements and postures, and sometimes even by the simple act of

breathing. In cancer it is usually continuous, less intense, and not occurring in paroxysms. Yet the most manifold variations may occur in both.

3. In ulcer vomiting stands in an undeniable relation to the pain, and, like it, is irregular and changeable; as a rule, it occurs at an early stage of the disease, while in cancer it is usually absent during the first few months, but later becomes gradually more frequent. Ott very properly says that in cancer vomiting depends upon the site of the tumor; in ulcer, upon the intensity and duration of the pain. The presence of characteristic kinds of tissue in the vomit, its admixture with blood, and the vomiting of pure blood, have all been discussed under the symptoms. I shall merely add that hæmorrhage is relatively and absolutely more frequent in ulcer; its severity is also more marked in this lesion. On the other hand, the intervals between the hæmorrhages, or a relatively brief series of them, are much longer in ulcer, while in cancer, having once begun, they recur more frequently or permanently. If you are called to a patient with severe hæmorrhage from the mouth and anus, which has occurred suddenly, and has been so severe that there is danger of collapse from the profound anæmia, from these points alone you may make a diagnosis of ulcer with reasonable certainty.

The mistaking of the so-called essential or idiopathic anæmia for carcinoma, or, on the other hand, the failure to recognize a cancer, probably occurs less frequently with us in Germany than it does elsewhere. At least, in English literature I have found the reports of quite a number of such cases in which a careful examination of the blood and of the stomach-contents ought to have prevented such errors.

Finally, cancer must be distinguished from the severe forms of hysteria. At the first glance it would seem almost impossible to mistake these two conditions, and yet there undoubtedly occur cases in which an extemporaneous diagnosis is not to be made, and even prolonged observation may leave us in doubt. I do not like to acknowledge the possibility, yet it has happened more than once that hysterical women have for years swallowed portions of their hair; these hairs form coils in the stomach, and may readily simulate a

tumor.* But, even without these "complications," severe forms of hysteria may lead to such a marked disturbance of nutrition that, especially when occurring in elderly women, the suspicion of a cancer will always arise. But, as a rule, you will discover one or another characteristic symptom which will enable you to make a positive diagnosis.

Treatment.—The old proverb that no drug is potent against cancer is true even to-day, however depressing such an admission may be. From time to time a host of specifics has appeared, from cicuta and belladonna of the elder Vogel, Störck, and Hufeland, down to the condurango bark of Friedreich, of Heidelberg; they all owe their ephemeral popularity to a conscious or unconscious deception. At best, like condurango, they only relieve symptoms; they lessen the accompanying catarrh and increase the digestive activity of the organ, but a true curative action, in the strict sense of the word, does not belong to them. The recommendation of condurango in 1874 by Friedreich was based upon a solitary case, and, at that, one in which no autopsy was made! In this case it was said that after the prolonged use of the remedy a carcinoma was reduced to the size of a small tumor, and that the accompanying swelling of the lymphatic glands had disappeared. Like so many of our new remedies, it owes its reputation as a specific to the implicit faith of some half-civilized or wild Indians, and to the speculation of enterprising exporters. At first it was received with acclamation by the medical world, which is pervaded by a surprising *naïveté* and an ineradicable optimism whenever new specifics for incurable diseases are introduced. It was indiscriminately tried in every variety of cancer; the first flush of enthusiasm was soon followed by a disappointment which threatened to thrust the remedy back into oblivion. The one extreme is as bad as the other. For a long time it was praised and condemned without a thorough and methodical series of experiments having been conducted. Such an examination was first made on a few cases by Immermann; then Riess investigated it in a large number of cases from a similar standpoint: these re-

* Bussel. A Case in which the Cavity of the Stomach was occupied by an Enormous Mass of Human Hair. Medical Times and Gazette, June 26, 1869.

sults have recently been published.* Immermann's cases were not all pure examples of cancer of the stomach; upon his series he estimates the ratio of fatal cases treated with condurango to be 1 as against 1·3 without this remedy. Riess endeavored to limit the drug especially to patients with cancer of the stomach, and, after having observed 80 cases with this treatment and 116 without it, he claims that condurango has a specific action. It is readily taken by patients for a long time, and it is said that under its prolonged use palpable tumors disappeared, and the general condition progressively improved both subjectively and objectively. "In a large number of cases the impartial observer became positively impressed with the fact that life was considerably prolonged under treatment with condurango." The following table shows the result upon the mortality and the duration of the treatment:

	Average duration of treatment of all cases.	Deaths.	Average duration of treatment.	Discharged.	Average duration of treatment.
Cases with condurango (80).....	43·4 days	53 (= 66·3%)	39·5 days	27 (= 33·7%)	54·8 days
Cases without condurango (116).....	21·2 days	107 (= 92·2%)	22·0 days	9 (= 7·8%)	11·7 days

It is to be noted that the proportion of fatal cases with and without this treatment is 1 : 1·4 (according to Immermann, 1 : 1·3); thus, the results of Riess and Immermann are almost the same. This would have been very convincing had the diagnosis of gastric cancer been positively made in all the cases, and had the discharged patients been watched for a long period; but this substantial basis is wanting in these observations, and Riess himself betrays his own doubt, inasmuch as he is always very careful to speak only "of the group of symptoms of gastric cancer" (*von dem Symptomencomplex des Magenkrebses*). It is also to be regretted that this writer did not give more definite information as to the situation of the tumor, and that he did not verify his diagnoses by the aid of the newer methods. He also neglects to state whether the clinical diagnosis was always verified by autopsies. This is the more to be regretted, since

* L. Riess. Ueber den Werth der Condurangorinde bei dem Symptombilde des Magencarcinoms. Berl. klin. Wochenschr., 1887, No. 10.

in three cases of supposed cured or improved cancer which subsequently died of other causes, and which were examined *post mortem*, the diagnosis made during life was not free from doubt; for, from the brief notes of these three autopsies given by Riess, it would seem much more probable, if not indeed actually so, that the lesion was an old cicatrized ulcer.

Hence the publications thus far on the specific action of condurango are by no means convincing to me. You may object, and say that the involution of palpable tumors which, as Riess claims, may even be observed with a tape-measure, is a very significant occurrence. In answer to this, I claim that the improvement of the concomitant catarrh of the mucous membrane may lessen the hyperæmia and the size of the tumor. It is also a well-known fact, to which I have directed attention, that abdominal tumors always seem larger than they really are when palpated through the abdominal walls, and hence increase or diminution in size will be manifested on a larger scale. How often do we believe we have palpated a pyloric tumor about the size of a walnut or a hen's egg which, on autopsy proves to have been only an insignificant muscular hypertrophy of the cervix pylori! *

These remarks are not intended to question the beneficial influence of condurango on the general condition in gastric cancer, as I have frequently had the opportunity of convincing myself of this action. It is eminently proper that the remedy should be extensively used, since Riess's observations on this point are very important; yet, in spite of Orszewsky and Erichsen,† one should not expect to cure cancer of the stomach with it. The accompanying gastric catarrh is improved, and the same beneficial effects are obtained in genuine catarrhal diseases of the gastric mucous membrane; hence condurango may be considered an excellent stomachic

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* According to Retzius, I would thus designate that portion of the pyloric ring which in such cases projects into the duodenum, as the cervix uteri does into the vagina. Bemerkungen über das Antrum pylori beim Menschen. Müller's Archiv, 1857.

† Zur Casuistik der Condurangowirkung bei Carcinom. Petersburg. med. Wochenschrift, 1876, Nos. 2, 3. These writers claim to have observed a stimulation in the production of connective tissue, with a coincident destruction of the cellular elements of the cancer.

in all those cases in which a true catarrhal condition of the gastric mucosa exists—i. e., the secretion of a sero-mucous fluid, with a more or less abundant admixture of pus. Condurango is best administered in a maceration decoction, 25·0 to 200·0 [i. e., ℥ vj of a 1 : 8 decoction]—to last two days; and as the amount of hydrochloric acid in these cases is always lessened, it is well to add 0·3 to 0·5 per cent of this acid, and a carminative syrup like syr. zingiberis, or syr. fœniculi (Ph. Germ.), or syr. menthæ (Ph. Germ.).* Immermann has given directions for making a condurango wine. The alcoholic extraction increases the cost of the remedy without, so far as we know, extracting any special ingredients from the bark. For this reason, when it is indicated, I usually order the watery extract, and a good wine to be taken separately. [In the United States the preparation usually employed is the fluid extract, in doses of a drachm or more.] †

Thus, after all, the treatment must be restricted to the symptoms.

Vomiting ceases or is lessened by swallowing small pieces of ice with a few drops of chloroform, ice-cold carbonic water in teaspoonful doses, effervescing lemonade or champagne (one of my patients insisted on having "weiss Bier" for his vomiting, and bore it well), and morphine internally or hypodermically. Occasionally, temporary relief may be obtained by the use of suppositories with 10 to 25 milligrammes [gr. $\frac{1}{6}$ to $\frac{5}{12}$] of opium.

The action of ferric chloride, which was formerly so highly lauded in *hæmatemesis*, is very doubtful; it is also hard to understand how it can act when given in the dilution necessary to prevent corrosion. Nature has provided for the stoppage of hæmorrhage from the smaller vessels by means of thrombosis; the bleeding from larger vessels can not be influenced by ferric chloride. Much

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* [Syrup of fennel and of peppermint (Pharm. German.) are both 10-per-cent solutions.—Tr.]

† [Sufficient time has not yet elapsed to pass a correct judgment on the new specific against inoperable malignant neoplasms, *methylene blue*, which was proposed by Prof. von Mosetig-Moorhof (Wiener klin. Wochenschr., 1891, No. 6, p. 101; ib., No. 12, p. 24.) The general tendency, however, is unfavorable toward the claims of its specific action. For bibliography, see W. Meyer. Notes on the Effects of Aniline Dyes, etc. New York Med. Record, vol. xxxix, pp. 473–478.—Tr.]

better results are obtained by cold (eating cracked ice, and cold compresses to the abdomen) and ergot. I order a doubly purified extract of secale cornutum (Pharm. Germ.) in a 50-per-cent solution of glycerin and water; of this I inject two to three Pravaz syringefuls* in the epigastrium in the course of half an hour; we may also give 10 to 20 drops of this solution internally every hour.† We may use ergot freely, since it has been calculated that the poisonous effects of sclerotinic acid do not appear in human beings till about 10 grammes [℥ijss.] have been taken. Our knowledge of sclerotinic acid being still vague, it is better to use the extract of ergot. However, the effectiveness of the remedy must not be judged by the possible results in controlling the bleeding in cases of cancer, where the walls of the blood-vessels are degenerated and adherent to a more or less rigid tumor. Its action is much more pronounced in gastric ulcer (*q. v.*).

As mild *analgesics* we may try rubbing in chloroform liniment, hydropathic applications with chamomile infusion, warm poultices, affusions to the abdomen, etc. I have obtained no good results from cocaine in this disease; chloral has been more useful, yet at times the hypnotic effect predominated too much over its sedative action. The preparations of opium labor under the great disadvantage that they paralyze still further the already retarded intestinal peristalsis. This is especially true of opium, since it is well known that morphine or codeine affects the intestines much less. Yet, even here, we encounter idiosyncrasies, so that the use, for a few days, of very small doses of morphine, only 5 to 10 milligrammes [gr. $\frac{1}{12}$ to $\frac{1}{6}$], may cause obstinate constipation. Belladonna has for a long time enjoyed the reputation of being antagonistic to this action of opium, but, as a rule, it has been given in too small doses. We may add 20 to 50 milligrammes [gr. $\frac{1}{3}$ to $\frac{5}{6}$] of extract of belladonna to 10

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* [The capacity of the Pravaz hypodermic syringe is one gramme (15 minims). —Tr.]

† [For hypodermic use good fluid extracts of ergot, like Squibb's, Wyeth's, etc., diluted with one or two parts of water, answer every purpose. Sometimes the solution is not clear; if this is the case, it is unfit for use. The injections should be carefully made; yet, sometimes, in spite of all care, painful spots, or even small abscesses, are left. Cold applications of witch-hazel are very soothing if pain is present at the site of the injection.—Tr.]

milligrammes [gr. $\frac{1}{6}$] of morphine; for hypodermic use add $\frac{1}{10}$ part of sulphate of atropine. But all persons do not react alike to belladonna; hence, dilatation of the pupils, dryness of the tongue, and irritation in the throat may occur very early, and after very small doses. It is therefore advisable to warn patients of the possible effects of the drug. A patient with cancer of the large intestines and metastases in the liver and retroperitoneal glands once refused to take some pills because he read extract of belladonna on the prescription. He asserted that he was at once affected with a most annoying dryness in the throat and difficulty in swallowing. I thought that this was at least highly exaggerated, and ordered extract of belladonna, 0·1 grammes [gr. jss.], to be given without his knowledge in a suppository. The next day he complained that the suppository had produced the typical effects of belladonna, and he reproached me for having imposed on him.

Constipation should be relieved as long as possible by mild vegetable aperients. The various salines are to be avoided, since they needlessly weaken the patient by the loss of fluid, and may easily cause diarrhœa. Where the constipation is marked, we may use cathartic pills, like those mentioned under dilatation of the stomach (p. 154). Where fæces have accumulated in the large intestines enemata are indicated, either of lukewarm water alone, or with laxative agents, like glycerin injections which may be given up to 30 to 50 grammes [℥ j to ℥ j ℥ v], and glycerin suppositories; yet all these fail as soon as there is a general paresis of the gut and an accumulation of the fæces in the small intestines. For diarrhœa we may use opium in suppositories or in enemata. There is no indication for loading the stomach with the familiar astringents—calumba, hæmatoxylon, catechu, nitrate of silver, tannim, etc.—because the diarrhœal passages are due to such extensive anatomical lesions that the mild astringents and the anti-catarrhal remedies are absolutely useless.

In the section on dilatation of the stomach I have already discussed the treatment of accumulation and decomposition of the stomach-contents which follow the stenosing of the pylorus by a tumor.

A *diet* of starches and vegetables is more easily borne than one

of meat, since the diminution in the secretion of hydrochloric acid causes the digestion of albumen and meat to be incomplete. In most cases milk is also poorly borne on account of the absence of rennet, and not even the addition of soda or lime-water, which normally stimulate its secretion, will be of any service. It would be better to add a few drops of cognac to a tablespoonful of milk. Kefir and peptonized milk are relished. The other artificial food-products are also indicated, especially the meat-peptones in bouillon, soups, sauces, etc.; it is greatly to be regretted that the patients tire so soon of even the best of them (Kemmerich's or Koch's meat-peptones and Leube's beef solution); in my own experience I found that the only preparation which is relished for a longer period is the meat-peptone chocolate and peptone-beer [see Lecture VIII]. The otherwise very commendable soups of leguminous flour, Nestle's food, and the like, labor under the same disadvantage. All kinds of food should be cut up as fine as possible, or should be eaten in the form of paps.

For many patients such a diet of paps and finely divided food is a veritable torture. The muscles of mastication and the salivary glands feel an almost irresistible desire to be once more in action, and the palate longs for a hearty and delicious morsel. When this condition is reached—usually it is about the middle of the course of the disease—it is pardonable if the rules are somewhat relaxed and the patient allowed to satisfy his longings, unless, of course, such an allowance is positively injurious. This course is the more justifiable as the end of the disease is marked by complete anorexia. After all, we usually deal with people whose main desire has been a well-supplied table, and such a relaxation affords them the last pleasure of their lives!

There is, at least, one group of foods which must always be avoided, namely, those inclosed in tough envelopes, which not even cooking will soften, or which are permeated by bundles of dense connective tissue, enabling them to resist the action of the digestive juices for a long time. To this group must also be added the fermented liquors containing a large percentage of fermentable substances, and also the fats whose prolonged stay in the stomach causes them to decompose and thus cause trouble. There are other foods

which may be allowed, but which are very differently borne by individual patients. Here the personal experience of the patient is the best guide. Furthermore, the anxious sufferer may be placed in a dilemma by one physician allowing what another has forbidden. If we do not know what has already been recommended, it is well not to give a definite bill of fare, but to follow Trousseau's advice, to refer the patient to his own experience.

All of the above refers only to the first stage of the disease, when the so-called dyspeptic symptoms constitute the chief part of the clinical picture. Later, the choice of food becomes more and more restricted, till finally it is limited to thin broths (flour, rice, sago, and tapioca), with the addition of peptones, finely scraped white meat, jellies of rice and calves' feet, eggs (if they can be digested), bouillon, and the like. Bouillon is usually rejected very soon. The patient's strength is to be maintained by stimulating beverages like strong teas, good clarets, the so-called dessert wines (except port, which is too highly sweetened), and finally champagne.

Treatment at the mineral springs, or the home consumption of these waters, is naturally useless after the diagnosis has once been positively made. But the disease is easily and frequently mistaken in its early stages, and the patient on his own or his physician's advice goes to one of the celebrated spas like Carlsbad, Marienbad, Ems, Vichy, etc., to cure his "chronic stomach catarrh." Then later on we hear the familiar reproach against the doctor "who sent me to the wrong spring." This condition of things will be improved in the future when the chemical diagnostic aids will be more generally employed, and thus enable us to have at least a suspicion early in the disease, and to act accordingly. Many patients, without knowing what their true condition is, insist on going to some spring. "I then permit them to carefully take small quantities of the corresponding water at home," says Lebert, "and as they usually derive no benefit from it, they soon renounce the trip to the spring itself."

[**The Non-cancerous Tumors of the Stomach.**—Concerning these little need be said, for "they are comparatively rare and are usually unattended by [special] symptoms. Even should a tumor be discovered, there are no means of determining the nature of the tumor;

and, if symptoms are produced by the tumor, the case will probably be diagnosticated as one of cancer."*

These tumors may be benign or malignant—primary or secondary. They include papillomata, fibromata, lipomata, myomata, lymphomata, adenomata, sarcomata (see page 205), myo-sarcomata, and lympho-sarcomata. Cysts may also be found. Foreign bodies, especially balls of hair (see page 199) and gastroliths, may simulate tumors.]

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* [Welch. *Loc. cit.*, p. 578. In addition to cases reported there, see P. Albertoni. Rivista clinica e terapeutica. Naples, November'12, 1889.—Kunze, Arch. für klin. Chirurgie, Bd. xl, Heft 3.—Malvoz. Annales de la Société. méd. chir. Liége, August and September, 1889.—Tr.]

LECTURE VI.

ULCER OF THE STOMACH—ULCUS PEPTICUM SEU RODENS.

GENTLEMEN: The specimen which I here show you was removed from the following—in many respects—remarkable case:

The patient, aged thirty-five, was a married man, father of two healthy children, an architect by profession, whose work had of late fallen off, and who was subjected to much excitement and worry. From his youth he had shown a tendency to *embonpoint;* he was a hearty eater, and a still heartier drinker of Bavarian beer. He never had syphilis, and had always been in good health. For the past year he had now and then complained of pain in the abdomen, as a rule not localized, and only occasionally referred to the right side. At times he was somewhat irritable, and suffered from insomnia. In spite of good care he lost flesh constantly —about eighty-eight pounds during the past year; his weight was reduced from 204 to 116 pounds. This was so conspicuous as to cause him anxiety. His occasional attacks of abdominal pain were ascribed by his relatives to all manner of secret dietetic errors.

On examination with my colleague, Dr. G., no abnormalities either in the nervous system or in the organs of vegetative life could objectively be discovered, with the exception of slight pain on deep pressure in the præcordium, such as is present in all cases of gastric catarrh. Appetite good, tongue clean, bowels irregular, but easily regulated by a mild cathartic. There was frequent flatulence. His general condition was feeble; he was languid, and had lost all interest in his work. The urine was normal.

In view of the great loss of weight, we could not be satisfied with the idea that this was a case of simple catarrh of the digestive tract, which was the opinion of others, and we consequently concluded to observe the patient while under a strict diet. For this purpose he was admitted to the sanitarium, and placed upon a nourishing but somewhat restricted diet. During the first few days infusion of rhubarb was given, with a prompt result. Examination of the expressed stomach-contents, after a test-breakfast, revealed a *normal* quantity of hydrochloric acid, peptone, and achroodextrin—no granulose. On the whole he felt well, complaining only of transient lack of sleep and pain in the limbs, ascribed to the unaccustomed confinement to his room and to the fact that he was only permitted to be up two hours daily. In spite of this the loss of weight continued, amounting to half a pound during the first week and three quarters of a pound during the second. On the sixteenth day he insisted on going out

to attend to some business matter. This he did during the morning in company with his wife, and while gone he positively committed no error in diet. In the course of the afternoon he suddenly became very restless, rang the bell repeatedly, and always a number of times in succession, for the servant to get him this or that trifle. Suddenly, without any nausea, vomited about one litre [quart] of fresh, bright-red blood mixed with a little mucus. The indicated medication (ergot, morphine, cold local applications, and swallowing small pieces of ice) was at once exhibited, and he passed the night without any further attack. The next morning he had two fresh hæmorrhages, preceded by excitement, and in the course of the day seven bloody stools—at first dark-brown, fairly hard masses, then tarry evacuations, and finally nearly pure blood. He became intensely anæmic, so that the question of transfusion was considered, but the pulse rallied, and the patient passed a good night. On the following day he was in a comparatively good condition, so that he could see his wife and father. Nevertheless, I was called to see him the next night, because he had suddenly fallen into a comatose condition. He is said to have conversed at eleven o'clock, and to have assured the house-physician that he felt well. At two o'clock I found the patient fully unconscious, with faint conjunctival reflex, small, wiry pulse, retracted abdomen, cold skin, and well-marked Cheyne-Stokes respiration. He had several passages of bloody intestinal contents, and died at 5 A. M.

He received in all 2 grammes [gr. xxx] of the extract of ergot subcutaneously, and about 50 milligrammes [gr. $\frac{5}{6}$] of morphine and opium, partly hypodermically and partly in suppositories. Considering all that had taken place, no doubt could exist that the diagnosis was ulcer, with hæmorrhage. Its site, however, whether it was in the stomach or in the duodenum, remained questionable, as also the cause of the final catastrophe. Had there been a perforation, or did a complication arise in the form of cerebral apoplexy? The soporific condition and the type of respiration most frequently, if not exclusively, seen in injuries of the brain seemed to point to the latter, while, opposed to the former, was the absence of air in the abdomen, as well as the manifestly slight sensitiveness of the abdominal walls.

The autopsy gave the following results (Fig. 25):

Abdominal walls moderately tense and vaulted. On opening the abdominal cavity some air escaped. In the abdomen was a considerable quantity of fresh blood. The coils of intestine were somewhat flabby, the serosa moderately injected. In the center of the anterior wall of the stomach was found a rectangular perforation about the size of a bean, with blackish, bloody margins. The serous coat of the stomach was dotted with numerous small greenish points. There were five losses of substance in the stomach, varying in size and depth; the largest was situated midway between the pyloric and cardiac ends, the others in the lower third of the stomach. The large ulcer was almost rectangular in shape, 4·2 centimetres [$1\frac{7}{10}$ inch] in length by 2 centimetres [$\frac{4}{5}$ inch] in width. It extended to the serous coat, and toward the pylorus showed the above-mentioned perforation, which was divided in half by a thin, thread-like bridge of serous membrane. In the center of the base of the ulcer the

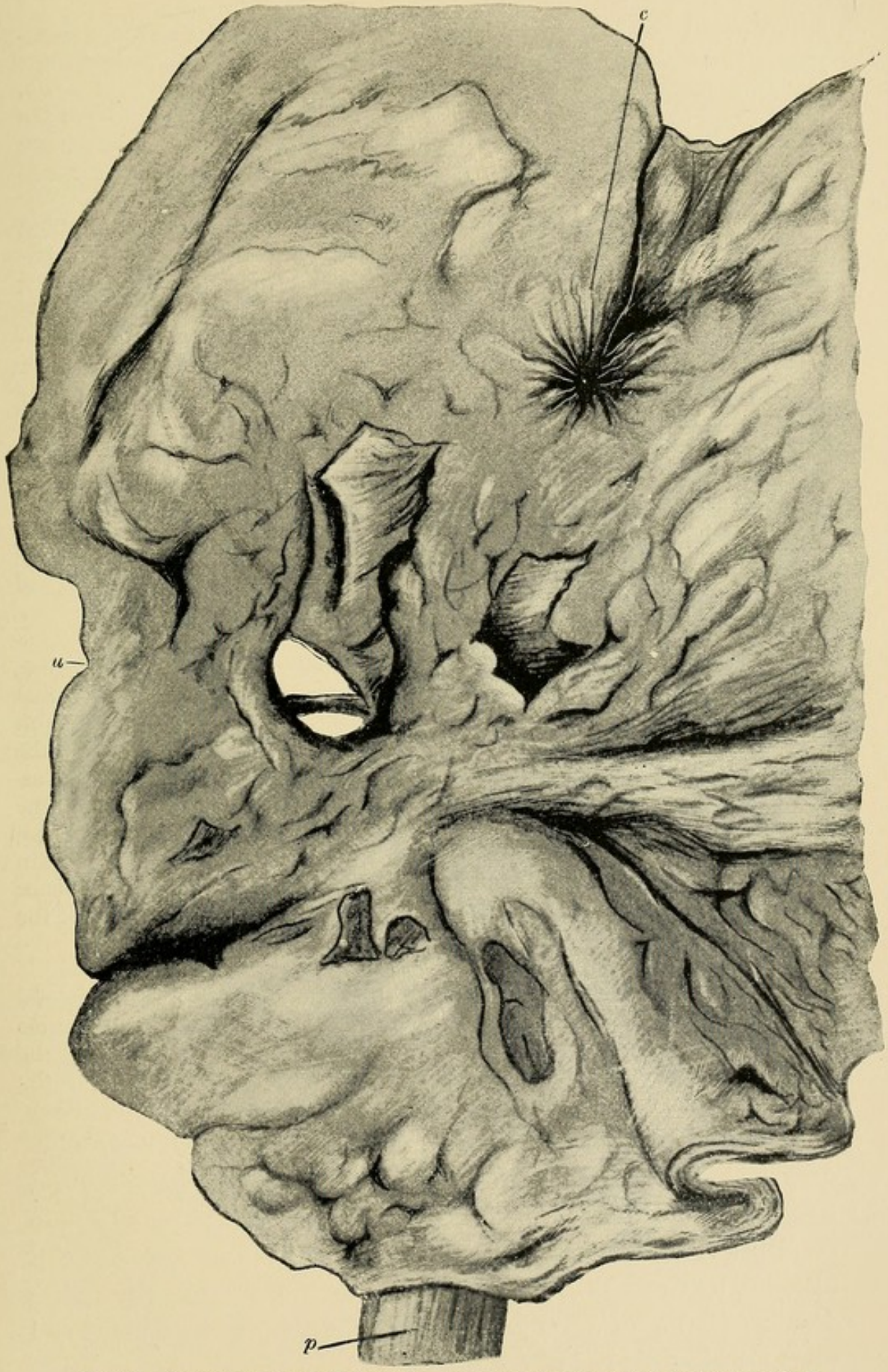


FIG. 25.—Perforating ulcer of stomach. *c*, cardia; *p*, pylorus; *u*, perforating ulcer.

serous coat was somewhat thicker, becoming thin again, and also transparent like tissue-paper, toward the cardiac end. At this situation there was a thrombosed and very tortuous vessel, about the diameter of a pin, from which the fatal hæmorrhage arose. The margins of the ulcer in the lower and middle portions were thickened, wall-like, and undermined; in the upper portion they ran gradually into the intact mucous membrane.

The other ulcers extended only to the muscular layer, or were limited to the mucous membrane. In one of these the remains of a small thrombosed vessel could be observed. The rest of the mucous membrane was in the usual condition, except that the small greenish points described above as appearing on the serous coat were also seen here. The microscope revealed a catarrhal condition in the fundus and pylorus, with marked cellular infiltration and cloudy glandular cells. The "green points" were not due to extravasations of blood, but were produced by the vessels of the submucosa, which were uncommonly enlarged and markedly tortuous, and especially by the veins, which were widely distended with blood. There was no amyloid degeneration. In the intestines were found large quantities of thin fluid blood. The remaining abdominal viscera were normal, but anæmic to a high degree.

This case presents several deviations from the common type of gastric ulcer, not only in regard to the course of the disease, or rather its latency, but also on account of the not very common form of the ulcer and the perforation, and finally in the uncommon manifestations to which the perforation itself gave rise. I will return to this later on.

I shall now describe the clinical picture of the so-called **round**, but better named **chronic eroding gastric ulcer**, in contradistinction to the acute ulcers produced by the action of corrosive poisons, which, as they do not belong here, will be discussed in speaking of toxic gastritis [see Lecture VII]. The name chronic round gastric ulcer is also not quite proper, inasmuch as it is occasionally acute or subacute, and as it is by no means always round, but frequently of various forms.

Etiology.—Investigators have zealously endeavored both clinically and experimentally to establish the causes of gastric ulcer. Synchronous with the commencement of the experimental era in medicine is the first careful and comprehensive description of this affection by Cruveilhier, who was the first to raise the gastric ulcer from a curiosity of the autopsy-table to the dignity of a definite and recognizable pathological condition.

Experiments on Animals.—Gastric ulcers—that is, circumscribed losses of tissue in the mucous membrane, extending to the submucous and muscular layers—may be produced in animals by various means, which in the end always amount to a local disturbance of nutrition in limited portions of the mucous membrane, lasting a certain time. There is either a shutting off of circumscribed vascular areas with consequent necrosis and sloughing of the tissues, the gastric juice meanwhile attacking the spots deprived of their normal nourishment exactly as, under favorable conditions, it causes softening (digestion) of the dead stomach, but to a greater degree. This is due to emboli artificially produced, ligation of small vessels, or to hæmorrhages which result from injury to certain portions of the central nervous system. Or, the ulcer may be referred to direct mechanical, chemical, or thermal lesions of the mucous membrane, the latter being at the same time accompanied by an alteration of the circulation in the parts subjected to irritation. But these losses of substance heal with exceptional rapidity, cicatrization advancing from the margins to the center with restoration of the mucous membrane. According to the investigations of Griffini and Vassale,* the mucous membrane of the fundus of the stomach is replaced by the formation of true peptic glands from the superficial epithelium which at first covers the wound, this in turn being formed from the glandular epithelium found in the glands situated in the margins of the wound. This replacement, too, is prompt and efficient, so that in the very late stages of the process it is difficult to find the situation of the injury, while after ten to fifteen days it has entirely healed, without leaving behind a trace of its presence. Thus, these are fundamentally acute defects of the mucous membrane which can not properly be called ulcers; for these, at least during some portion of their existence, must display the tendency to spread. For the production of chronic ulcers another force must come into play—namely, a disproportion must exist or be created between the secretion of the gastric glands and the nutritive blood, either synchronous with or previous to the appearance of the local lesion; it may be

* L. Griffini und G. Vassale. Ueber die Reproduction der Magenschleimhaut, Beiträge zur pathologischen Anatomie, etc., von Ziegler und Nauwerck, Bd. 3. Heft 5, S. 425.

either an increased acidity of the former or a deterioration of the latter, or both factors may be present at the same time. Ebstein,* making use of a discovery of Schiff, produced gastric hæmorrhages and corroding ulcers, and even perforation, by injury to the anterior corpora quadrigemina. We may well assume that an excessive production of acid secretion took place here, perhaps due to the cerebral irritation. Koch and Ewald,† by introducing a hyperacid, 0·5-per-cent, solution of hydrochloric acid, produced deep ulcers in the stomachs of animals in which gastric hæmorrhages had been caused by section of the spinal cord, according to Schiff's method. Quincke and Daettwyler ‡ made the animals anæmic by venesection. Silbermann # caused hæmoglobinæmia by means of substances which disintegrate the blood-corpuscles. Under such circumstances the losses of substance produced by the above-mentioned methods heal but gradually and tardily, or they may go on even to perforation, as occurred in one of Silbermann's experiments. Then only have the experiments on animals borne any analogy to the clinical picture of gastric ulcer. Tolma ‖ succeeded in producing softening of the stomach as well as typical gastric ulcers in rabbits and dogs by ligating the stomach above and below—that is, tying the œsophagus just above the cardia, and the duodenum between the pylorus and the mouth of the common bile-duct. The result of this was a stagnation and fermentation of the contents of the stomach, the quantity of the latter being more or less increased by the persistent secretion of the gastric juice. In this way the walls of the stomach were rendered so tense that sharply localized hæmorrhagic infarctions were produced, and from these typical gastric ulcers. Tolma also concludes that "a disturbance of nutrition must precede the ulceration, be it

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* W. Ebstein. Experimentelle Untersuchungen über das Zustandekommen der Blutextravasate in der Magenschleinhaut. Arch. für exper. Pathol., Bd. 2, S. 183.

† Ewald. Klinik, etc., I. Theil., 3. Aufl., S. 122. I must say that we did not carry on our experiments in the above sense, although they correspond entirely with them.

‡ H. Quincke und Daettwyler. Correspondenzbl. f. Schweizer Aerzte, 1875, S. 101.

O. Silbermann. Experimentelles und Kritisches zur Lehre vom Ulcus ventriculi rotund. Deutsche med. Wochenschr., 1886, No. 29, S. 497.

‖ Tolma. Untersuchungen über Ulcus ventriculi simplex, Gastromalacie und Ileus. Zeitschr. für klin. Med., Bd. xvii, S. 10.

either a simple anæmia or a retardation in the movement of the nutritive lymph; or, finally, more profound changes in the tissues themselves."

In man, too, if we confine ourselves to the typical ulcer of the stomach, and disregard the secondary ulceration of carcinoma or of phlegmonous gastritis, we have to record a twofold course of gastric ulcer. Constant reference is made to the fact that it is doubtlessly not uncommon for ulcers to occur—that is, in the sense of the defects of the mucous membrane described above—which never reach the point of manifesting themselves clinically, or which do not present the typical picture of ulcer of the stomach, but which give rise only to indefinite symptoms, which do not spread and which do not really cicatrize. To this category belong the hæmorrhagic erosions of Rokitansky, which were already regarded by him as the initial steps leading to true gastric ulcer.* Here I might also include the so-called follicular ulcers, which are due to the swelling and consecutive suppuration of the glandular follicles. The factors enumerated above often give rise to such processes. We need only think of the frequent occurrence of circumscribed hæmorrhages from the mucous membrane in chronic catarrh, especially in drinkers; of the irritations of the mucous membrane caused by too hot ingesta, and of the artificial lesions produced in this membrane by the introduction of sounds, to have a full quota of such factors. In proof of this—the transient hæmorrhages and follicular suppuration due to irritating ingesta—we possess a classical witness for all time in the Canadian experimented on by Beaumont.† Is it to be expected in the many cases in which sharp objects, such as splinters

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* C. v. Rokitansky. Lehrbuch der pathol. Anatomie, 3. Aufl.

† W. Beaumont. Experiments and Observations on the Gastric Juice and the Physiology of Digestion. Boston, 1833, p. 108. The passage in these excellent investigations, referred to, reads as follows: "There are sometimes found on the internal coat of the stomach (especially after irritation of the mucosa by food) eruptions, or deep red pimples: not numerous, but distributed here and there upon the villous membrane, rising above the surface of the mucous coat. These are at first sharp pointed and red, but frequently become filled with white purulent matter. At other times irregular circumscribed red patches, varying in size and extent from half an inch to one and a half inches, are found on the internal coat. These appear to be the effect of congestion in the minute blood-vessels of the stomach. There are also seen at times small aphthous crusts in connection with these red patches."

of bone, knife and dagger blades, etc., are accidentally or purposely swallowed, that they will always pass off without lesion to the wall of the stomach? And yet ulcers of the stomach are among the rarer results. One of the most remarkable examples of this kind and at the same time a most striking proof of what the stomach may be subjected to, is the following very curious case of the sailor, John Cumming, reported by Dr. Marcet:*

In the year 1799 an American sailor saw a juggler in Havre perform the trick of knife-swallowing. Returning to his vessel somewhat intoxicated, he was foolhardy enough to try to swallow his open pocket-knife, and, succeeding in this, he "ate" three more. Three passed off in the stool during the next few days, but one disappeared forever. One evening, six years later, he again swallowed portions of six knives, but this time not without unpleasant though very transient results, on account of which he was admitted to a hospital. He did this frequently, till he had swallowed about thirty-five knives. Finally, he was taken seriously ill, and he died in Guy's Hospital, in London, in 1809. In the stomach some thirty pieces of blades, in parts markedly corroded, together with handles, were found; two blades in the colon and rectum, which were placed transversely and had perforated the intestinal wall (and that without causing peritonitis!), but no recent or old ulcers of the stomach, or any remains of them.

It is inconceivable that the man's repeated onslaughts on the mucous membrane of his stomach should have passed off without producing any lesion at all; yet he nevertheless acquired no gastric ulcer. Moreover, it is also recorded that to the end he always enjoyed good health, and that he had a very good appetite.

If, therefore, gastric ulcer always resulted from the injuries above mentioned, it would appear much more frequently than is observed; in fact, it would be the rule, and its absence the exception. Let us take, for instance, the frequently mentioned occurrence of ulcer in cooks. It is true that their employment affords them ample opportunity to swallow hot morsels. But, not to speak of cooks, how many persons eat their food hastily, and as hot as possible, without acquiring gastric ulcer; and how small is the percentage of cooks who suffer with ulcer in comparison to the entire number of the members of this honorable craft! On the other hand, we actually know of cases in which ulcers were due to traumatisms.

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* Marcet. Med.-Chirurg. Transactions, vol. xii, p. 72.

Thus Vanni * reports the case of a woman, thirty-two years of age, in whom all the symptoms of a typical gastric ulcer developed immediately after a blow in the epigastrium. The same author has collected fourteen reported cases of round ulcer of traumatic origin. In this category we may also include the cases described by Tolma,† in which hæmorrhages of the stomach and ulceration resulted from severe general convulsions.

Changes in the Blood.—Evidently here, as well as above, there must be a second factor in order to render possible the chronic development of the supposed injury and its sequelæ—a factor which, to a certain extent, forms the basis on which the ulcer can κατ' ἐξοχὴν develop. And it is only by means of such a permanent or transient "predisposition" that the much-discussed question, why some ulcers heal and others progress, can be solved. There is no lack of analogies for such a condition. I need only bring forward the example of the tubercle bacilli which is now so familiar to all. Here, too, there is the exciting poison, the bacillus, to which numberless persons are exposed on countless occasions. However, to become tuberculous, the predisposition is requisite, which fortunately is not the possession of everybody. In man this predisposition to gastric ulcer resides also in the disproportion existing between the composition of the gastric juice and the blood, as we have already recognized it as necessary for the artificial production of chronic ulcer of the stomach in animals. It is not the alkalinity of the blood which prevents the auto-digestion of the gastric mucous membrane and the subsequent development of a round ulcer, as stated by Pavy ‡ in his explanation at that time, which, deceptive by its simplicity, was therefore almost universally accepted; for the old teaching that the alkaline condition of the deeper layers of the gastric mucous membrane prevents its digestion by the gastric juice under normal conditions is untenable. Disregarding the fact that this does not explain why the upper layers of the mucosa (which, as is well known, have an acid reaction) are not digested, Edinger

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* Vanni. Sull' ulcera dello stomaco d' origine traumatico. Lo Sperimentale. Juglio, 1889.

† *Loc. cit.*

‡ Pavy. On Gastric Erosion. Guy's Hosp. Reports, xiv, 1868.

has endeavored to prove that the deeper layers are also acid.* And even if we are unwilling to ascribe much weight to these experiments, as I have proved in the place cited below, it is nevertheless true that the alkaline reaction, as such, does not suffice here—alkali albuminates are also digested—because the blood may be made neutral by means of acid, as Samuelson † has shown, and yet not lead to autodigestion of the stomach.

This investigator gives still more important reasons, and refers especially to the contradiction that the acid formed in the glands is not neutralized when it enters the cavity of the stomach, but that this is supposed to occur when the reverse takes place—i. e., when the acid is brought in contact with the mucous membrane. Therefore, either no free alkali exists in the neighborhood of the acid, or it can no more neutralize the excreted than it can the penetrating acid. Furthermore, Sehrwald ‡ has shown that in a living animal the diffusion of an alkali through the wall of the stomach into an acid solution which had been poured into its cavity proceeds far differently than in a stomach removed from the body, taking place much more energetically in the latter than in the former case. This is a remarkable phenomenon, which can only be explained by the influence of the living cell on the course of the physical process. Further, how is it that an ulcer heals in spite of the damage done to the protecting network of vessels? Why, for instance, does not the pancreas digest itself? This problem still lies before us, for our knowledge of the zymogens # can not solve it, and we are no nearer the solution even after recognizing "the vital energy of the cells" or Hunter's "living principle."

We must cling to the fact that normal gastric juice and normal blood do not cause the formation of an ulcer from the factors already discussed, nor do they further its course or prevent its healing. The disproportion between the acidity of the gastric juice and the

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* Edinger. Ueber die Reaction der lebenden Magenschleimhaut. Pflüger's Archiv., Bd. xxix, S. 247. See Ewald. Klinik, etc., I. Theil, 3. Aufl., S. 121.

† Samuelson. Die Selbstverdauung des Magens. Preyer's Sammlung physiol. Abhandl., 1879. II. Reihe, Heft 6.

‡ E. Sehrwald. Was verhindert die Selbstverdauung das lebenden Magens? Münchener med. Wochenschr., 1888, No. 44 u. 45.

Ewald. Klinik, etc. I. Theil, 3. Aufl., S. 95.

composition of the blood is always necessary to produce such a result.

Leube * has already stated that "in chronic gastric ulcer we must assume the coincident appearance of two causes of corrosion, anæmia and an occasional abnormal acidity of the gastric juice"; but, as Pavy did in his time, he discusses the question at great length whether diminished alkalinity or increased acidity can alone cause an ulcer. According to my conception, however, these factors are merely adjuvants, *and we must deal not so much with the alkalinity of the blood, but rather with its altered composition and the resulting insufficient nourishment of the cells.*

Cohnheim,† who was a firm believer in the theory of alkalinity, thought that tumors in the stomach were not digested by the gastric juice because they were very vascular, and hence were correspondingly strongly alkaline. We know, however, that in malignant tumors the digestive power of the secretion is markedly diminished, and that, on the other hand, many tumors, in spite of being richly supplied with blood-vessels, ulcerate (that is, undergo digestion); and it is owing to this, and from these same vessels, that hæmorrhages occur. Just here, where one would suppose that the greatest possibility existed for the neutralization of the gastric juice, its corrosive action comes into play and thereby disproves Cohnheim's argument, which at first sight seems very plausible.

Modern Views.—The exact grounds for the view proposed above have, it is true, been arrived at only by the more recent investigations. We have known for a long time that corroding gastric ulcers arise from anomalies in the composition of the blood. Suppression of the menses, chlorosis, anæmia after parturition, are seen too frequently in connection with gastric ulcer to admit of any doubt as to their etiological relations. Indeed, Miquel ‡ reports cases in which menstruation at first ceased and then returned again; but a reappearance of the gastralgia with increased severity was noticed at every menstrual epoch. Crisp,# in his time, collected fourteen cases

* O. Leube. Die Krankheiten des Magens, 2. Aufl., 1878, S. 98.
† Cohnheim. Allgemeine Pathologie.
‡ Miquel. Hannover. Zeitschr. f. prakt. Heilkunde.
# Crisp. On Perforation of the Stomach. Lancet, August 5, 1843.

of perforating gastric ulcer in women, in thirteen of which there was coexisting irregularity or absence of menstruation. On the other hand, W. Fox,* supported by the observation of a case of poisoning by hydrochloric acid with perforating ulcer, had already expressed his suspicion that the cause of the formation of an ulcer might be "excessive secretion or excessive acidity of the gastric juice, especially when the stomach was empty." But the exact proof that the ulcers are in many cases associated with *hyperacidity* of the gastric juice was first brought forward by the investigations of von den Velden, Riegel, Ewald, Jaworsky, Boas, and others. The primary cause of the ulcer may then be one of the above-mentioned accidents. These include traumatic or thermal irritations, violent emesis, hæmorrhages due to congested conditions, hyperæmia and stasis in circumscribed vascular areas of the mucous membrane, hæmorrhagic infarctions, spasm of the vessels, and atheromatous, amyloid, or aneurismal degeneration. But such injuries are, undoubtedly, of frequent occurrence in the stomach without being followed by ulcer. If, however, a growing ulcer develops, it is due to the existence of one or another of the anomalies mentioned. Repair begins only when the latter has been removed; then a reactive inflammation of the base of the ulcer and of the surrounding tissues sets in, and its subsequent cicatrization becomes possible.

Here, too, lies the natural explanation of the well-known tendency of gastric ulcers to relapse. According to my conception, relapses always follow in those cases in which the underlying affection is transiently relieved by therapeutic measures, but which returns to the old condition as soon as the effect of the medication wears off. This also corresponds with the well-known fact that the greatest contingent of relapsing gastric ulcers is drawn from those of a nervous or chlorotic nature, whose cure requires a long time, and in whom the tendency to relapse is well marked.

Perhaps the objection may be raised that many diseases in which there is alteration of the composition of the blood predispose to gastric hæmorrhage without the occurrence of typical gastric ulcers.

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* W. Fox. Chronic Ulcer of the Stomach. Reynolds's System of Med., vol. ii, p. 930.

Thus, for instance, in cirrhosis of the liver hæmorrhages from the gastric mucous membrane due to obstruction in the portal circulation are not uncommon, yet the occurrence of gastric ulcers is only a simple coincidence. My answer is, that these processes reduce the acidity of the secretion by means of the consecutive hyperæmic and catarrhal condition of the mucosa. Consequently, the requisite disproportion between the blood and the gastric juice does not exist, even though both components, taken absolutely, are found to be altered. *As predisposing factors, however, we must recognize hyperacidity of the gastric juice, as well as a change in the composition of the blood in the presence of the normal acidity.* For, in spite of the view of Riegel and his pupils, repeatedly quoted in many recent publications, that hyperacid gastric juice is always secreted in cases of ulcer, I must assert that, *although frequent, this is by no means always the case.* Riegel * says: "That this hyperacidity is a constant phenomenon in ulcer can now be regarded as positive, inasmuch as the results of 382 analyses in all of the forty-two cases treated by us during the past year showed the hyperacidity to be equally constant." On the other hand, Gerhardt † formulated his experience in a paper read after the publication of the first edition of this book, to the effect that among twenty-four patients with gastric ulcer at his clinic who were examined at the proper time, in seventeen the color-tests showed hydrochloric acid, while in seven they did not. Still more significant are the statements made by Rosenheim ‡ in the discussion following the reading of Gerhardt's paper: On examining the stomach-contents with the method of Cahn and Mering # in eight patients with undoubted ulcer, only

* F. Riegel. Beiträge zur Diagnostik der Magenkrankheiten. Zeitschr. für klin. Med, Bd. 12, S. 434.

† C. Gerhardt. Ueber Zeichen und Behandlung des einfachen chronischen Magengeschwürs. Deutsche med. Wochenschr., 1888, No. 18.

‡ Idem. No. 22.

[The method of Cahn and von Mering is based upon the successive removal of the organic acids from the stomach-contents, the fatty acids being removed by distillation and the lactic acid by extracting with large quantities of ether; should the residue have an acid reaction, it can only be due to an inorganic acid—i. e., HCl. The acidity is tested at the different stages, and the amount of the acids in question is thus calculated. The method is not accurate, for it has not been shown that the residue is really free HCl, but only that an acid residue is obtained, which may be either free or combined HCl or both. The latter is the accepted view. See Cahn

twice did he find hyperacidity (over 0·33 per cent of hydrochloric acid), in four the acidity was within the normal bounds (0·24–0·33 per cent), and in two there was a diminution to 0·18 per cent in one and 0·16 per cent in the other. Even if, according to von Pfungen's * investigations, this method by no means shows only the free hydrochloric acid but the total acidity which is due to free acid and acid salts and which is influenced in a variable and moreover uncontrollable way by the ingesta, the fact nevertheless remains that a constant hyperacidity does not exist with ulcer.

One case to the contrary will suffice to overthrow the apodictic proposition mentioned above. I have reported an undoubted case of this kind at the beginning of this lecture, and could quote others from my case-books. Disregarding the observations quoted above, we may also see exactly the same in the estimations of acid in cases of gastric ulcer made by Cahn and von Mering, and by Ritter and Hirsch.† The latter, in eight different experiments made on five patients, only twice found a degree of acidity which was slightly above normal; moreover, they established the fact that hyperacidity of the stomach-contents, due to hydrochloric acid, occurs in quite healthy people, or at any rate in those in whom no stomach trouble is manifest—an observation which I also have had many opportunities of verifying.

However, these cases are always exceptional. Nevertheless, they are too important and too firmly established to be set aside; consequently Riegel's proposition should read, "In cases of ulcer the gastric juice always contains hydrochloric acid, and usually an excess of it." I need not enlarge on the importance of this fact in diagnosis, and especially in differential diagnosis. Riegel maintains that, both in consequence of this hyperacidity and by means of it, an ulcer may develop. "On account of the hyperacidity an erosion

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und von Mering. Ueber die Säuren des gesunden und kranken Magens. Deutsch. Arch. f. klin. Med., Bd. 39, S. 233. Honigmann und von Noorden. Ueber des Verhalten der Salzsäure, etc. Zeitschr. f. klin. Med., Bd. 13, S. 87. Boas, *loc. cit.*, 2. Aufl., S. 139.—Tr.]

* R. von Pfungen. Beiträge zur Bestimmung der Salzsäure im Magensaft. Wiener klin. Wochenschr., 1889, No. 7 u. ff.

† Ritter und Hirsch. Ueber die Säuren des Magensaftes und deren Beziehung zum Magengeschwür bei Chlorose und Anämie. Zeitschr. für klin. Med., Bd. 13, S. 446.

or injury of the mucous membrane, unimportant in itself and tending to rapid repair, attains a greater significance; its healing is retarded and the ulcer spreads."* A second possibility, and one equally justified, is this, that the hyperacidity, and with it the typical ulcer, is only developed in predisposed individuals with great irritability of the nerves of secretion, as the result of some damage, etc., to the mucous membrane. In other words, as Ritter and Hirsch also say, the hyperacidity may just as well be the result as the cause (or, as I should say, the primary predisposing factor) of the ulcer.

The idea that the secretion of hyperacid gastric juice is essential for the formation of a round ulcer is by no means new, but, like all the questions with which the pathology of the stomach has recently been concerned, was expressed long ago, even if it was not investigated by means of exact methods. It is closely connected with the question of softening of the stomach—gastromalacia—which, unless it be a post-mortem phenomenon, is nothing but a large gastric ulcer running an acute course. Even Rokitansky and Camerer believed that an hyperacid gastric juice was secreted in these cases as the result of a paralysis of the vagi. Günsburg† directly postulated that the existence of a perforating gastric ulcer depended upon the production of an hyperacid secretion. He says, "The (ulcerative) destruction of the gastric mucous membrane depends upon a quantitative irregularity in the secretion of free acid." His chief evidence was the fact that in perforating ulcer he found the mucus of the stomach markedly acid, instead of its having the usual alkaline reaction; he erred in referring this hyperacidity to lactic acid, in accordance with the view then held as to the nature of the acid of the gastric juice. However, it can nevertheless be seen that here, as well as everywhere else, we stand on the shoulders of our predecessors, and that the numerous public and private claims for priority made in such profusion, on closer investigation shrink to very modest proportions.

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* F. Riegel. Zur Lehre vom Ulcus ventriculi rotundum. Deutsche med. Wochenschr., 1886, No. 52, S. 931.

† Fr. Günsburg. Zur Kritik des Magengeschwürs, insbesondere des perforirenden. Arch. f. physiol. Heilkunde, xi. Jahrg., 1852, S. 516.

The remarkable coincidence of *burns* of the skin with ulcers of the stomach and duodenum in young subjects, first observed by Curling* and later by Dupuytren, Cooper, Erichsen, Wilks, and others, will be no more than mentioned in this place, inasmuch as, for the present, we possess no knowledge of a possible interdependence of the two processes. In 125 cases of severe burns Holmes† found the duodenum ulcerated in 16, and other portions of the intestine in two. The earliest period of its appearance was from four to six days after the burn. Ulcers in the stomach, of which Rokiansky, Low, Wilks,‡ and Pitt# report cases, seem to be much rarer.

And, finally, *micro-organisms* have also been brought forward as the cause of gastric ulcer. Letulle‖ found numerous streptococci in the veins of the submucosa and of the uterus in a case of recent ulcer of the stomach, which appeared during the course of puerperal septicæmia. Pure cultures of these injected into guinea-pigs also caused ulcerations in the stomachs of the animals, which threatened to perforate the walls of the artificially distended organ. Letulle obtained the same result in four cases with the staphylococcus pyogenes aureus cultivated from various abscesses, and in one case with the microbes of dysentery discovered by Chantemasse and Vidal; in this case they were derived from a man who had returned from Cochin-China with chronic dysentery, and was attacked with a gastric ulcer. It was claimed that the process was either embolism or direct invasion of the mucous membrane, leading to necrotic spots and the digestion of circumscribed areas. For the present the simple recording of these statements will suffice.

So much concerning the presumable cause of ulcers of the stomach. I have spoken of these views first because at present they are

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* Curling. On Acute Ulceration of the Duodenum. Med.-chirurg. Transact., vol. xxv, p. 260.

† Holmes. Syst. of Surgery, vol. i, p. 733.

‡ Wilks. Cases of Death from Burns and Scalds. Case 77, quoted by Falk. Ueber einige Allgemeinerscheinungen nach umfangreichen Hautverbrennungen. Virchow's Arch., 1871, Bd. 53, S. 27.

Pitt. Stomach with Numerous Superficial Erosions following after an Extensive Burn. Transact. Pathol. Soc. London, 1887, pp. 38, 140.

‖ M. Letulle. Origine infectieuse de certains ulcères simples de l'estomac ou du duodénum. Compt. rend., tom. 106. No. 25.

the center of interest, and because they are naturally of great importance in prognosis and therapy. Let us now review the clinical facts.

I shall first give you a few statistics, which, as they are compiled from the records of autopsies, naturally refer only to the typical perforating or cicatrizing ulcers:

Occurrence.—The frequency of ulcer of the stomach seems to vary in different localities. Lebert, it is true, holds that on the average this is between 4 and 5 per cent [of the total mortality] for Europe, and supports this statement by his own statistics as well as those of Brinton and Jaksch; yet these averages are subject to considerable variations. Disregarding the fact that the figure estimated by Lebert for Jaksch's statistics at 5·8 per cent is incorrect, and should be 3·2 per cent, we find that Berthold gives 2·7 per cent for Berlin, and Nolte 1·23 per cent for Munich, while, on the other hand, Griess gives 8·3 per cent for Kiel; in Jena, it is said to be 10 per cent; according to Starck, it is 13 per cent in Copenhagen.* Inasmuch as these results are deduced from large numbers, it is to be supposed that the unimportant errors have become fairly well averaged, and that a certain regional difference is exhibited. There is truly nothing surprising in this, for the causes of ulcer of the stomach are in part referable to direct irritation of the gastric mucous membrane, and this factor changes with the mode of life and the food-supply in the various places. It has frequently been shown that an insufficient diet may cause gastric ulcer, as demonstrated, for instance, by Gerhardt's experiences in the *Thüringer Wald*. Sohlern,† proceeding the opposite way, has lately called attention to the fact that in certain districts of Germany, the Rhön Mountains and the Bavarian Alps, and further in the greater part of Russia (the so-called *Grossrussland*), gastric ulcer is a rarity, and that, strange to say, the inhabitants of these regions exist almost exclusively on a vegetable diet. Nevertheless, this class of people, espe-

* [As Welch properly says, such statistics are based upon the result of autopsies in which all cicatrices are included as healed ulcers. The ratio of cicatrices to open ulcers has been placed at 3 to 1.—Tr.]

† Von Sohlern. Der Einfluss der Ernährung auf die Entstehung des Magengeschwürs. Berl. klin. Wochenschr., 1889, No. 14.

cially in Russia and Bavaria, is in general well nourished and powerful. Now, as it is well known that much more potassium is added to the blood on a vegetable diet, nearly a third more than on a mixed diet, so this permanently increased addition necessarily brings with it an increase in the amount of this metal in the blood; while, according to other investigations, the red blood-cells are to be regarded as the chief carriers of potassium. Sohlern claims that this increased amount would represent the cause of the relative immunity of the above-mentioned classes from ulcer of the stomach, quite in accordance with the rare occurrence of this disease in vegetarians, whose blood, as is well known, is rich in potassium phosphate. On the other hand, diseases accompanied by an impoverishment or change in the red blood-cells, such as chlorosis, anæmia, etc., might tend to the development of ulcer because they produce blood which is poor in potassium.

For the present, as Sohlern himself says, these very interesting considerations lack the support of a series of examinations of blood made for the purpose; but even without these the significance of the facts advanced can not be denied.

Statistics show great unanimity regarding the remainder of the accessible factors—*sex*, *age*, *site of the ulcer*, and *frequency of perforation*. It is universally found that females are more frequently affected than males, the average proportion being as two to one. Further, on consideration of all the factors involved, it is without doubt that it most commonly occurs between the ages of twenty and forty, while the greatest mortality is found between forty and sixty years. These facts are in no way altered by Grünfeldt* having found scars of gastric ulcers 92 times (20 per cent) in 450 autopsies on old people, or by Chiari's† case of a recent perforation in a man seventy-one years old, or Sedgwick's‡ similar case in which the man was eighty-two years old, nor by the fact that, according to Henoch,# ulcers of the stomach are fairly frequent in children, and

* Grünfeldt. Hospitaltid, 2. R. ix, p. 765, quoted in Virchow-Hirsch's Jahrb., 1878.

† Chiari. Fall von Perforation eines Magengeschwürs. Anzeiger der k. k. Gesellsch. d. Aerzte zu Wien, 1880, S. 161.

‡ Sedgwick. On Perforating Ulcer of the Stomach. Dublin Hosp. Gaz., 1855.

Henoch. Vorlesungen über Kinderkrankheiten. Berl., 1883, 2. Aufl., S. 61.

even in the new-born. The latter, at all events, have nothing in common with typical gastric ulcer, inasmuch as they are probably caused by intra-uterine poisons, or by those connected with parturition, and since they do not last beyond earliest infancy. At any rate, on reference to the mortality tables, we find that childhood, till the tenth or fifteenth year, is practically entirely exempt. On the other hand, I think it very probable that ulcers of the stomach occur at this age, but that, owing to the more active regenerative and plastic powers of the tissues in childhood, the tendency to recovery is greater than at a more advanced age. I have observed at least two cases which I could only regard as gastric ulcer, and in which nothing but hæmorrhage was needed to complete the typical picture. Unquestionably, however, they are of much rarer occurrence than in later years, because the injurious factors are by far less common in childhood.

Whether occupation plays any *rôle* in the causation of round ulcer, as is frequently accepted, appears more than doubtful to me, according to what I have said at the beginning of this lecture. Nevertheless, I will again mention the well-known fact of its frequent occurrence in female servants, and especially in cooks. In English literature insufficient food is more often given among the causes, and we also find a parallel drawn between it and the occurrence of ulcers of the cornea in cachectic and much enfeebled patients.

Pathological Anatomy.—A large number of the ulcers undoubtedly arises from direct lesions to the vessels and their result, hæmorrhagic infarction, whether it be that the primary cause lies in the obstruction of the smallest arterial twigs which run up between the glands of the mucous membrane from the submucosa, or whether it be that atheromatous, amyloid, or aneurismal degeneration of the vascular walls, cerebral injuries, or even the simple processes of the stoppage of the circulation, predispose to the rupture of the vessels. These processes—i. e., the formation of hæmorrhagic infarctions—are excellently described by Hauser,* with whom I can almost entirely agree, as the result of experiments made by

* G. Hauser. Das chronische Magengeschwür. Leipzig, 1883.

me, in part with Dr. George Meyer, which I shall fully describe elsewhere.

But these causes are not alone sufficient, because numerous cases occur, especially in youthful individuals, in which no indication either of disease of the vessels or of the other enumerated factors exists. Here we must assume that the ulcers are developed from the follicular hæmorrhages and the hæmorrhagic erosions of Rokitansky, which in a small way represent the same thing that hæmorrhagic infarctions do on a large scale, namely, the withdrawal of the normal nourishment from small areas of the mucous membrane. Carswell, in his atlas,* pictures an exquisite example of follicular hæmorrhages with punctate hæmorrhages in the mouths of the crypts partly surrounded by a round zone of extravasated blood. In a stomach, the mucous membrane of which was suffused with blood, and which I treated very soon after death according to Heidenhain's method (placing small pieces of tissue immediately in absolute alcohol which must be frequently changed, and staining with hæmatoxylin and bichromate of potassium), I found the ducts of the glands packed full of red blood-cells to beyond the neck—i. e., down into the fundal portions. These could only have had their origin in a hæmorrhage on the surface of the mucous membrane, which in its turn could only have come from the fine capillary network (Henle) situated close beneath the free surface of the mucous membrane. Such hæmorrhages may be due to a very unimportant stoppage of the circulation, or to a traumatism, etc. They develop into hæmorrhagic erosions, small streak-like or rounded losses of substance from the size of a millet-seed to that of a pea, on which at times a blackish-brown extravasation of blood is found, together with the simultaneous loosening of the mucous membrane. Their number is very variable, being sometimes enormous, especially near the pylorus, so that the stomach appears as if sown with them. From the erosion the typical chronic ulcer is developed. According to Förster's † conception, this is the usual course of formation of the ulcus rotundum, while we now know that this takes place only

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* [Carswell. *Loc. cit.*]

† Förster. Lehrbuch der speciellen pathol. Anatomie. Leipzig, 1854.

in a limited number of cases in which hæmorrhagic infarction can not be made to explain its appearance.

But whether the causation of the ulcer be due to one or the other, it can nevertheless never be regarded as an "ulcer," viewing it from the standpoint of pathological anatomy; it is rather a "progressive necrosis of tissue," in which the characteristic feature of an ulcer, "the proliferation of young cellular elements which always spreads deeper into the tissues, and continually throws more elements to the surface,"* is entirely lacking. The ulcer does not grow by an active process in the tissues with subsequent necrosis, but by a passive one. The participation becomes active only on the appearance of the cellular infiltration which leads to cicatrization.

In microscopic sections through the margin of a recent ulcer the ducts of the glands are seen to descend trough-like [*muldenförmig*], and as though cut off toward the base of the ulcer. They are simply eaten away or digested as far as the tissues could offer no resistance to the digestive power of the gastric juice. It is only in older ulcers that a reactive inflammation sets in at the periphery, leading to the formation of a callous margin. Here the trabeculæ between the remaining ducts are thickened and in part placed obliquely, a condition which would appear to be analogous to a discovery of Witosowski's, which will be mentioned directly [page 238]. As much of the glandular epithelium as is present in the fundal portions of the remaining ducts has undergone a remarkable change. In the place of the peptic cells we find cuboidal or cylindrical epithelium; they are shrunken so that they are separated both from the membrana propria and from one another; their nuclei can not be recognized by staining, and their contents are of a broken-down, light, glassy appearance, which reminds one most of hyaline degeneration. Single ducts have undergone cystic degeneration. The submucosa is decidedly broader and thicker, with an abundant infiltration of small cells, and with a rich vascular network; the bands of muscular fibers of the muscularis in some portions are separated by connective tissue which is partly fibrillar, partly torn apart in

* Virchow. Cellularpathologie, 4. Aufl., S. 537.

meshes, and in other portions they have been entirely replaced by it. We see, therefore, that the necrotic process is surrounded in its entire extent, both at the margin and the base, by a zone which is the seat of irritative processes, which subsequently lead on to true cicatrization. This always causes the firm attachment of the base of the ulcer to the underlying tissue, and the inversion of the mucous membrane at the edge into the substance of the ulcer.

Witosowski * claims that the ducts of the glands situated at the margin of the ulcer become bent so that their mouths are turned toward the ulcer, and thus pour their secretion directly into it. He holds that a corroding ulcer, which always develops at the bottom of the furrows produced by the folds of mucous membrane, can only be formed by these means or by a simultaneous process of proliferation proceeding from the submucosa. The former is for the most part true, and can be explained by the impeded circulation of the parts. I have never seen the latter, and I can not regard the singular theory which Witosowski has founded upon it as being open to discussion. At all events, in old ulcers the ducts of the glands are directed toward the crater of the ulcer, as has already been stated by Hauser, and as I can fully corroborate, but it is only because the elasticity of the muscular coat causes it to retract and draw away under the mucosa; however, from the very nature of things, a secretion from these ducts is no longer possible. In the interstices we always find a profuse small-celled infiltration, but there is nothing specially characteristic of ulcer in this, as it is found in all processes leading to inflammatory irritation of the mucous membrane, from a mild catarrh to an acute phlegmonous gastritis. A common result of the ulcer, however, is an accompanying irritable condition of the surrounding portions of the mucous membrane. And, finally, it is to be noted that a number of originally separate ulcers may coalesce to form one large one.

The views just unfolded are of the highest importance in the practical treatment, because it must necessarily follow that ulcer of

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* Witosowski. Ueber das Verhältniss der productiv entzündlichen Processe zu den Ulcerösen im Magen. Virchow's Arch., Bd. 94, S. 542.

the stomach can be attacked from two sides, directly and indirectly, by means of local and of general treatment.

The gross anatomy of gastric ulcer and its consequences I can dispose of in a few words. Its form, like a funnel or crater, is well known; the margin is at first sharply defined, and only becomes thickened and wall-like later on. There is not a medical student who does not know Rokitansky's classical comparison that an ulcer looks "as though cut out with a punch," although this can only be applied to old perforating ulcers; while among the others are found linear, oval, insular, or step-like forms. For the most part the base of the ulcer is smooth, or with only a few inequalities, but occasionally it is covered with small blood-clots or with tenacious greenish or brownish mucus.

The size varies considerably, being usually that of a 10-pfennig piece [5-cent nickel] to a mark [silver quarter-dollar]. Generally the ulcer observed by Cruveilhier, 16 centimetres [$6\frac{2}{3}$ inches] in length, and 8·5 centimetres [$3\frac{2}{3}$ inches] in width, is referred to as a prodigy; but I have found a case described by Habershon in which the process involved nearly the entire surface from the pylorus to the cardia.

The site is preferably at the pylorus and the greater curvature, corresponding to the most dependent portion of the stomach where the gastric juice collects in the erect posture; hence Nolte gives the following scale of frequency: At the greater curvature 22, at the pylorus 13, anterior wall 3, posterior wall 2, cardia 1.*

In the majority of cases only one ulcer is present; more, up to three or over, are rare. However, Lange saw so many of them in one case, that "he had to give up the attempt to count them all." †

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* [Welch, as the result of the analysis of 793 cases, gives the following:

Lesser curvature	288	(36·3 per cent)
Posterior wall	235	(29·6 ")
Pylorus	95	(12· ")
Anterior wall	69	(8·7 ")
Cardia	50	(6·3 ")
Fundus	29	(3·7 ")
Greater curvature	27	(3·4 ")

Pepper's System of Medicine, vol. ii, p. 503.—Tr.]

† Lange. Deutsche Klinik, 1860, S. 90. "In addition to this (i. e., the perforating ulcer) there was not only an immense number of scars of various sizes and

Finally, if in the course of the process the base of the ulcer becomes thickened and like a plate, and the margins indurated and wall-like, and if its site be such that the spot is appreciable on palpation, it can, on this account, convey the impression of an ulcerating malignant neoplasm, as I shall discuss more particularly later on. If, however, the ulcer is situated either in the region of the pylorus or of the cardia, the cicatrization may cause stenosis of these openings with its clinical sequelæ.

The results of the necrotic process are of special interest. We must distinguish between—

1. *Cicatrization.* Here there exists a marked distinction from the ulcers artificially produced in animals; for, while these heal with restitution of the normal mucous membrane, as Cohnheim states, and as I, too, have found, in man a fibrous, centrally depressed scar is formed, with the well-known tendency to contraction. This leads to radiating scars and to distortion of the gastric wall, especially if a fixed point has been established by previous adhesions to the neighboring organs. Girdle-like constrictions of the viscus occur, giving it the form of an hour-glass or a gourd. In this way, if the scar is situated in the lesser curvature, the pylorus and cardia may be drawn together to such a degree that a lead-pencil can scarcely be passed between them, as is seen in the specimen (dried in superheated air) which I here show you. Thus, also, very peculiar cicatricial bands or bridges may be formed, which lead to the formation of a complete sac, of which Cruveilhier * gives an excellent drawing in his large work.

2. *Progressive necrosis and corrosion.* If cicatrization does not occur, the necrotic process continues as long as any gastric juice is secreted, finally causing its own cessation by means of the ensuing complications. These are :

(*a*) Corrosion of the vessels. Vessels of larger or smaller caliber are opened according to the site of the ulcer and to its extension

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depths all over the walls of the stomach, but also such a quantity of uncicatrized ulcers, some extending only into the mucosa, others penetrating even into the muscularis, some flat, some in the shape of holes, and others funnel-like, that I had to give up the attempt to count them all."

* *Loc. cit.*, 20. Livrais, Pl. 6.

into the tissues. The slight tendency to thrombosis is a characteristic feature, which is probably connected with the digestive action of the gastric secretion. Among the larger vessels most frequently affected are the gastric, splenic, and pancreatic arteries.

(*b*) Adhesions to neighboring organs and perforation. If the necrosis extends to the serosa, it leads either to a reactive inflammation and adhesion to surrounding organs, and consequent spread of the process to them; or, where circumstances will not permit this, to a direct perforation into the abdominal cavity. There may also be secondary perforations into the pleural or pericardial cavities through the corresponding interposed tissues. According to the site of the ulcer, all the neighboring organs, liver, gall-bladder,* pancreas, spleen, diaphragm, heart, lungs, and intestines are subject to this possibility. At times it may produce adhesions among organs situated near one another in the abdominal cavity—such a case being described by Budd.

Finally, *tubercular* and *syphilitic* ulcers must be mentioned.

Tubercular Ulcers.—Thus far these have only been found in connection with tubercular lesions in other organs. They are characterized by their thickened, infiltrated, wall-like margins; the base is for the most part yellowish and granular. They are pale, and, as seen in Eppinger's† cases, they thus present a sharp contrast to their dark-colored surroundings. In the margins and base tubercular nodules with their characteristic giant-cells are found. There may be one or more ulcers, involving only the mucosa and submucosa, or extending down to the muscularis. In a few cases (Litten‡) the serous coat over the base of the ulcer is strewn with miliary tubercles. In Litten's case the ulcer was fairly large—4·2×3·3 centimetres [1·7×1·3 inch). The edges were sharp and indurated, and in parts swollen and infiltrated with blood. The rest of the digestive tract was free from tubercular ulcerations, but they were found in the larynx, bronchi, and lungs. A similar case is reported

* Habershon. Lancet, June 2, 1883, p. 951.

† Eppinger. Ueber Tuberculose des Magens und Œsophagus. Prager med. Wochenschr., 1881, No. 51 u. 52.

‡ M. Litten. Ulcus ventriculi tuberculosum. Virchow's Archiv, Bd. 67, S. 615.

by Talamon-Balzer,* another by Gilles-Sabourin,† and Eppinger‡ has described two others. [An excellent description of tubercular ulcer of the stomach will be found in a paper by Musser,# in which he describes a case, a negro forty-four years of age, with pulmony phthisis and vague gastric symptoms; on autopsy, an ulcer, $1\frac{1}{2} \times 3\frac{1}{2}$ inches, was found in the stomach; the ulcer was evidently tubercular, and contained cheesy matter, as well as miliary tubercles in the base and in the submucosa in the vicinity. *Tubercle bacilli were found in the cheesy masses;* they were also found in some other cases which he mentions in his quite complete bibliography. Most of the cases have been observed in children.—Tr.] However, all these do not belong to the type of the corresponding ulcer; they are rather true areas of tubercular softening as they occur everywhere with central cheesy degeneration of the tubercle tissue. At all events, there is a combination with the corrosive action of the gastric juice on the necrotic tissue elements.

The **syphilitic ulcer** is not marked by characteristic anatomical features. In the majority of the few cases thoroughly observed, the question whether the ulcer was a primary lesion or a broken-down gumma is not broached.‖

Symptoms.—As is well known, some gastric ulcers, healing by cicatrization, run their course during life without presenting any symptoms whatever, or only a few which are not at all characteristic; they are then only found accidentally after death. Their occurrence had already been established by Williams, Abercrombie, and Chambers, and naturally they do not come under clinical observation.

The various ulcers of the stomach may be arranged, according to their symptoms, into the following groups:

1. Cases in which the symptoms due to irritation predominate,

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* Talamon-Balzer. Phthisie locale; ulcérations tuberculeuses de l'estomac et de l'intestin. Bull. Soc. anatom., 1878, p. 374.

† Ibid. ‡ *Loc. cit.*

[J. H. Musser. Tubercular Ulcer of the Stomach. Philadelphia Hospital Reports, 1890, vol. i, pp. 117–124.—Also, Barlow. Transactions of Patholog. Society of London, 1887, vol. xxxviii.—Tr.]

‖ Galliard. Syphilis gastrique et ulcère simple de l'estomac. Arch. génér. de méd., 1886, pp. 66 *et seq.*

and which result in hæmorrhagic erosions, or in corrosion and exposure of a larger or smaller portion of the mucous membrane without the development of further complications.

2. Cases with these symptoms of irritation, together with hæmorrhages.

3. Cases with symptoms of irritation and perforation, resulting in recovery or death.

4. Cases which remain latent until death occurs by hæmorrhage or perforation.

The fact that the symptoms of the first three groups may be combined in various ways explains why the clinical picture is so changeable; and if, in addition, the results of cicatrization are also included, it becomes even more complicated. The first stages manifest themselves by those conditions of discomfort which we find at the commencement of so many diseases of the stomach, such as vague sensations of pressure, transient drawing pains, and the accompanying disturbances of the appetite. However, the tongue is usually clean, or only moderately coated at the base. On strict inquiry we find that the patients eat very little, and usually keep a fairly strict diet, not on account of lack of appetite, but owing to the dread of having pain after a full meal. For this *gastralgia* forms a marked feature of the picture, even early in the disease. The accompanying catarrhal gastritis is but rarely sufficiently marked to cause true anorexia, foul taste, belching, bad odor from the mouth, and heavily coated tongue.

Only in the rare cases in which a girdle-like ulcer or a cicatrix interferes with the peristalsis of the stomach and causes dilatation, is there marked decomposition of the stomach-contents and belching of foul gases. Sluggishness of the bowels is the rule; diarrhœa, or a condition in which the two alternate, the exception. The intestinal functions are rarely found to be normal and undisturbed.

Chronic ulcer runs its course without fever, and, should an increased temperature be present in conditions of exhaustion toward the end of life, or in certain forms of ulcer running an acute course, they are due to inflammatory processes, such as gastritis, peritonitis, or pneumonic infiltrations.

Recent cases are not usually accompanied by disturbances of nutrition; they may even be absent after the ulcer has existed for some time. Most patients, however, eventually emaciate on account of their scanty diet, and frequently lose weight so rapidly as to cause apprehension, so that losses of 20 kilogrammes [44 pounds] and more in a few months are not uncommon. This depends partly on the previous condition, and occurs more frequently in the strong and stout than it does in lean persons.

Gradually the pains become localized to a definite spot corresponding to the site of the ulcer, and as this is commonly situated in the lower half of the stomach, and as the painful spot can not be localized with exactness, it is usual to have it referred to the infrasternal depression. The boring, sharply localized pain, frequently darting from before backward, is characteristic. Some patients complain only of pain in the back, others of "stitches in the side," owing to which the disease may be mistaken for intercostal neuralgia. As a rule, pressure increases it; women can not lace, and men can not pull the band of their trousers tight. In rare cases, on the other hand, pressure eases the pain. It appears in attacks most frequently on mechanical or thermal irritation of the exposed surface of the ulcer. Of course, this is primarily and most frequently the case after eating, the food either causing direct irritation on its introduction, or stretching the wall of the stomach by its weight, or the surface of the ulcer is distorted and its nerves irritated by the contractions accompanying digestion. But this is not the only cause. I have repeatedly seen severe gastralgia in patients with ulcer of the stomach, after a drink which was too cold, or a spoonful of soup or tea, etc., which was too hot; in these cases, consequently, the pain could not be attributed to the above-mentioned factors, but only to thermal irritation. Moreover, according to my experience, ingesta which are too hot are less often the cause than those which are too cold, perhaps because the mouth and throat act as guards to the stomach in the former case, and because the mucous membrane of the stomach is more tolerant of high degrees of temperature than it is of low, and also because smaller quantities of the former are taken than of the latter. The state of the ingesta is also certainly not without influence on the reaction of the mucous

membrane. A remarkable example of this is recorded by Dunglison :*

Numerous cases of severe acute gastritis occurred among the workmen in Virginia who, becoming overheated under the hot sun, quenched their thirst with large quantities of cold spring-water ; these attacks were rapidly followed by death. On substituting small pieces of ice instead of the water, this disease practically disappeared.

To be sure, there are many patients who never have trouble after eating, but instead the attacks of gastralgia appear when the stomach is empty, and even in the night. Here the cause may be the secretion of hyperacid gastric juice, which is still to be spoken of. On the other hand, gastralgia may be caused by the distention of the walls of the stomach by gases, or by irritation of the nerve-fibers due to the progressing process of ulceration, while the attacks of gastralgia caused by colds and excitement, and the increased pain before the menstrual epoch and its cessation on the appearance of the menses, may be regarded as reflex in character. A peculiar symptom occasionally seen is the cutaneous hyperæsthesia and anæsthesia observed by Traube † and referred by him to a central "irradiation." The causes of the gastralgias lead to the fact that they usually appear suddenly and with great intensity at once, and as rapidly subside, so that a nearly normal condition is very soon established ; paroxysms which gradually increase in intensity are less frequently observed.

Vomiting usually occurs soon after eating. It is due to the irritation caused by the food, and not to an accumulation of ingesta, as is the case in dilatation of the stomach. The food is brought up only slightly changed and mixed with some mucus, as in the morning vomiting of drunkards. Fermentation-fungi and other foreign cellular elements, with the exception of the occasional admixture of blood, are absent, or (for example, sarcinæ) are very rare.

Hæmoptysis.—When the blood comes from small vessels, the quantity is usually small; if recent, it appears only as fine bloody streaks in the vomit; but if the gastric juice has had an opportunity to act for a longer time upon the blood while it was accumulating,

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* Quoted by Copeland, Dictionary of Pract. Med., article Indigestion.

† Traube. Deutsche Klinik, 1861, S. 63.

then it is changed to reddish-brown, granular masses. Small quantities of blood may easily escape observation when no vomiting occurs and the blood is carried into the intestines; here it is altered to such an extent that nothing is noticeable by simple inspection of the fæces. Under such circumstances the blood in the stool can only be demonstrated by a microscopic, spectroscopic, or chemical examination. In this way the cause of an obscure anæmia may be discovered. In fact, this is possible much more frequently than is generally assumed; consequently, repeated examination of the fæces should not be omitted after gastralgic attacks, or indeed in any obscure case of gastric or intestinal diseases.

Profuse hæmorrhages presuppose the erosion of a larger vessel; the blood acts as an emetic on the stomach, so that it empties itself of its contents. Many patients have a distinct and positive premonition in the form of flashes of heat, epigastric pulsation, fullness in the region of the stomach, and great and apparently groundless restlessness, as in the case described at the beginning of this lecture. The time during which the blood remains in the stomach varies, and with this, consequently, the appearance of the vomited masses. In some cases we find bright-red clots, in others dark brownish-red masses, while in the great minority of cases it presents the appearance of coffee-grounds. Part of the blood passes into the intestines. This is the rule in the smaller hæmorrhages which do not lead to vomiting; the blood mingles with the rest of the intestinal contents and is not recognizable in the fæces, or is overlooked. In the case of larger hæmorrhages, or if the ulcer is situated in the duodenum, the evacuations consist of tarry, very offensive masses. The presence of blood in the vomit can, as a rule, be readily established with the naked eye; it can always be easily discovered with the microscope or spectroscope, or by means of Heller's blood-test. We must not forget that confusion may arise if the patient has partaken of red wine, cacao, colored medicines, cinnamon, or real coffee-grounds; but a glance through the microscope will readily settle this question.

The estimation that hæmatemesis occurs in 50 per cent of the cases is rather too high than too low. Brinton gives 29 per cent; Witte, of Copenhagen, found it 100 times in 339 cases; and Ger-

hardt saw it in 47 per cent of his cases: * so we may assume that considerably more than half the patients do not have hæmatemesis.

It scarcely needs to be mentioned that we must guard against confusion with hæmorrhage from the œsophagus, gums, or after the extraction of a tooth, or that we must not forget that, as I have already stated, hæmorrhage may occur in the initial stages of cirrhosis of the liver, in disturbances of the circulation, in aneurism, etc. In the first of the above, however, it may sometimes be very difficult, for profuse hæmorrhages may occasionally take place from varicose venous plexuses in the œsophagus, occurring in the aged or in the phlebectasiæ, which form part of the collateral circulation developed in cirrhosis of the liver, and which have repeatedly given rise to fatal hæmorrhages. Ulcer of the œsophagus may also lead to hæmatemesis. The bloody masses in hæmorrhage from gastric ulcer contain no specific tissue elements, and the blood-corpuscles are present in such excess that the cellular elements of the gastric mucous membrane appear only sparingly, or not at all.

The diagnosis of admixture of blood with the fæces is at times more difficult, for here the blood-cells are nearly always so changed in their passage through the intestine that they lose their characteristic form. Although this is not usual in larger hæmorrhages, it is in smaller, especially if preparations of mercury or sulphur [or iron] have been prescribed, which of themselves impart a dark color to the stools.

When larger hæmorrhages have occurred, the danger of their recurrence hangs over the patient's head like the sword of Damocles, and in a twofold manner: First of all, repeated hæmorrhages occur in the course of the day, even several times during the same day, or at short intervals, say, during a week. Then we must assume that there are recurrences from the same vessel which was first opened. Secondly, after a pause of months, or even years, fresh hæmatemesis appears. Its return may be due to a tendency of the individual to this kind of hæmorrhage. In order to form any idea at all why in certain persons extensive ulcers which must necessarily have involved large vessels in their growth run their

* C. Gerhardt. *Loc. cit.*

course without hæmorrhage, and others are marked by such profuse hæmorrhage, we must, in my opinion, assume a certain predisposition to a deficiency in the fibrinoplastic power of the blood, and with this an insufficient or ineffectual formation of thrombi. It occasionally appears, too, as if the thrombi after being formed were very loosely attached and could be quite easily displaced, as soon as the heart's action exceeded its normal strength. Thus I have twice seen a hæmorrhage recur after a long period of quiescence, caused by the patients, who, thinking themselves well, had indulged in strong alcoholic beverages, although only in small quantities.

Small hæmorrhages have no influence on the condition of the patient, except psychically; larger hæmorrhages, especially if recurring at short intervals, lead to a high degree of anæmia and its consequences. Waxy pallor of the skin, small, rapid pulse, slight febrile movements, complete anorexia, ringing in the ears and vertigo, transient mild delirium, and even complete loss of consciousness may occur. Subsultus tendinum and convulsions in the extremities have even been observed. In spite of this, as a rule, the patients rally comparatively rapidly, and under appropriate treatment soon tend to regain their lost powers. Nevertheless, I have seen a number of cases in which the patients finally died with the symptoms of progressive pernicious anæmia, the number of the red blood-corpuscles sinking to two millions per cubic centimetre (the normal being five millions) and the quantity of hæmoglobin to 25 to 30 per cent.

Immediately fatal cases of gastric hæmorrhage from the vessels of the stomach are comparatively rare. In most the cause has been perforation of the ulcer (see page 249), and the involvement of the splenic or pancreatic artery, the portal vein or the left heart. Cruveilhier pictures a case in which the stomach was distended with fluid, brownish-red blood. Budd saw a case in which not only the stomach but also the entire intestinal tract was full of blood, and in which the patient had bled to death into his own body. A case reported by Finny is interesting:*

* Finny. Ulcer of the Stomach opening in the Left Ventricle of the Heart. Brit. Med. Jour., 1886, i, p. 1102.

A young man, nineteen years of age, in whom phthisis had been suspected, and who for some time had had hectic fever, died suddenly. There were no symptoms of stomach trouble. Vomiting did not occur, not even immediately before death. The stomach and intestines down to the anus were found full of fluid blood. The stomach, diaphragm, pericardium, and myocardium had all become adherent to one another. A small cannular communication led into the left ventricle ; otherwise its muscle was normal, and was found to have undergone granular degeneration only in the neighborhood of the perforation. The ulcer in the stomach was situated on the anterior wall, and measured one inch and a quarter in length by three quarters of an inch in width.

A small aneurism of the gastric artery was the cause of death in a case reported by Powell.* The ulcer was situated near the cardia on the lesser curvature, and in the center was a ruptured aneurism of the size of a pea, the profuse hæmorrhage from which caused the death of the patient in a few minutes.

Referring to the fourth group mentioned above [page 243], we see that hæmorrhages may occur without any previous indication of a gastric ulcer, and in fact these have frequently been observed. I wish to again recall to your memory the case described at the commencement of this lecture as belonging in this category. However, in this patient vague symptoms of a grave illness preceded the fatal hæmorrhage, while in other cases it has killed apparently healthy persons with alarming and unexpected suddenness. In this connection a case of hæmorrhage from the intestines described by Poisson† is of diagnostic interest; the bleeding appeared during convalescence from an attack of typhoid, and might have occasioned its being mistaken for a typhoid hæmorrhage.

A severe complication of this disease is produced by the *perforation of the ulcer and the involvement of the neighboring organs.* When the digestive process has reached the serous layer of the gastric wall, and has involved one of the neighboring solid organs (among which I here include the coils of intestine), it manifests itself occasionally by a localized sensation of pain, referable to the position of the affected viscus. Most frequently, however, it runs its course without any outward manifestation, so that only when disturbances of function appear in the organs involved do we recog-

* Powell. Transact. Pathol. Soc. [London], vol. xxix, p. 133.

† Poisson. Bull. de la Soc. anat. de Paris, Febr., 1855.

nize the fact that they are similarly affected. Or hæmorrhages may occur from the larger vascular trunks, especially in the pancreas and spleen, which are naturally in no way to be distinguished from those already considered.

I do not consider it essential to give a detailed account of the intercurrent affections possible here, and which I have already referred to above, although the literature of the past fifty years is full of reports which exhaust all such complications. We can readily conceive of the occurrences in question on calling to mind the topography of the stomach and its relations to the surrounding organs. The most interesting is the perforation through the diaphragm [sometimes giving rise to diaphragmatic hernia] and pericardium into the left heart,* with pneumo-pericarditis, or into the mediastinum, with cutaneous emphysema and collection of inflammable gases. West† describes a case in which the ulcer extended to the portal vein, and caused death from pylephlebitis. Perforation into the pleura‡ can be diagnosticated if it causes pneumothorax and suppurative pleuritis, or if it leads to direct communication with the lungs, and the coughing up of particles of food, which not only may, but actually has occurred.

I have already spoken of perforation into the colon and the resulting lienteric diarrhœa, in discussing perforation due to cancerous ulceration. Perforation into the abdominal cavity may develop variously. In fortunate cases there is a preceding adhesive inflammation between the stomach and the neighboring intestinal wall and omentum, thus forming a cavity representing a sac inclosed in a sac, which prevents the escape of the gastric contents into the abdominal cavity. Then signs of irritation of the peritonæum appear; circumscribed pain and distention of the upper part of the abdomen, together with fever, and sometimes frequent vomiting. If the adhesions are more extensive they may result, as in the case

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* [Oser has described a case in which, although the left ventricle was eroded, the patient survived two days. The opening was closed during the systole and only open during the diastole; the patient thus gradually bled to death. Additional cases are quoted by Welch (Pepper's System of Med., vol. ii, p. 508).—Tr.]

† S. West. Pathol. Transact., p. 147. London, 1890.

‡ [In a case reported by Müller, lumbricoid worms were found in the pleural cavity. Memorabilien, xvii, October, 1872. Quoted by Welch, *loc. cit.*—Tr.]

of Budd, which I have already mentioned, in complete interference with the functions of the intestine, thus leading to permanent obstruction, progressive marasmus, and death.

Perforation into the peritoneal cavity is by far the most frequent, however, either with or without previous adhesions and formation of abscess. It may follow slowly and gradually, or, rather, the escape of the gastric contents may be slow. In such cases sacculated abscesses may form, which remain encapsulated, or burst later on, and cause general peritonitis. As a rule, though, the perforation occurs quite suddenly, without any warning or symptoms referable to it. The patients suddenly experience severe pain in the abdomen, causing them to collapse to a certain extent. This appears without cause, or after a preceding traumatism, such as an accidental blow, or after leaning on the edge of a table or window-sill, after riding, after a hearty meal, or after vomiting. In a short time the clinical picture of peritonitis due to perforation is developed: distention of the abdomen, severe pain even on the slightest touch, vomiting, singultus, facies Hippocratica, small pulse, and finally death. Yet, as in the case recorded at the commencement of this lecture, the perforation may occur without the appearance of any of these signs. Inasmuch as the patient had practically taken no food for three days previously, the stomach in this case was empty both of food and air[?], and consequently the perforation of the ulcer was accompanied only by the symptoms of profound shock—unconsciousness, Cheyne-Stokes respiration, extremely small pulse, cold skin, etc.—while the abdomen was neither markedly distended nor very painful.*

Such perforations may also be caused by convulsive contractions of the stomach after vomiting, induced either by drugs or by the introduction of the finger into the throat, as many patients are fond of doing in order to produce vomiting or belching, or after the introduction of the stomach-tube. Faber† describes a case of perforation after vomiting brought on by the patient. According

* Even unconscious individuals react still to severe painful sensations.

† Faber. Emphysem des Mediastinums und der äusseren Haut in Folge einer Perforation eines Magengeschwürs. Württemb. med. Correspondenzbl., 1885, No. 40.

to Bouilleaud,* the act of defecation, completed in the usual manner, may give rise to perforation.

In the practice of one of my colleagues I have myself recently observed a case of perforation of an ulcer which had caused stenosis of the pylorus; the opening was the size of a cherry-pit. This occurred during the evening, after lavage of the stomach, which had at one time been recommended by me on account of the marked dilatation of the stomach and accumulation of its contents. Immediately afterward the emaciated and miserable patient complained of severe abdominal pain and distention, and died in collapse that very night. At the autopsy which I held I found the condition described above, and I here show you the specimen. We found air and blackish-brown stomach-contents in the abdominal cavity. The stomach is enormously dilated, and the pylorus is so narrow that a pencil can scarcely be passed through it. Immediately above this lies the ulcer. It is about the size of a 2-mark [50-cent] piece, with wall-like and thickened (carcinomatous) edges, and in the center is seen the circular perforation with very smooth, sharp contour, which is not at all ragged or torn, and which in no way suggests a recent wound. Inasmuch as my colleague used a soft rubber tube, taking all necessary precautions, a direct lesion caused by it may be excluded. My explanation of the case is rather that a slight adhesion had taken place and was broken up by the marked traction on the gastric or abdominal walls which always accompanies the washing out of the stomach.

I need scarcely mention that this experience has only strengthened my repeatedly expressed view of the necessity for caution in the use of the sound, etc.

Cases which recover from such perforations are among the greatest rarities.† We really can not speak of recovery in the true sense of the word, for the adhesions of the intestines, which are produced in the most favorable cases, lead to chronic illness, and death occurs in a comparatively short time from progressive disturbance of nutrition. Sudden perforations have repeatedly caused suspicion of poisoning, and have led to erroneous accusations.

[" Gastro-cutaneous fistulæ are a rare result of the perforation of

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* Bouilleaud. Arch. de méd., i., p. 534.

† [Such a case has recently been published by Hall. Case of Perforating Gastric Ulcer, Peritonitis, Recovery. Brit. Med. Jour., January 9, 1892. The writer found only six reported cases of recovery after peritonitis from perforating gastric ulcer. Three recovered completely; three died in the course of subsequent attacks; autopsies verified the diagnoses. The treatment was expectant—i. e., opium and rectal alimentation. The good result was attributed to the fact that the perforation occurred four hours after eating, when the stomach was empty. —Tr.]

gastric ulcer.* The external opening is most frequently in the umbilical region, but it may be in the epigastric or in the left hypochondriac region or between the ribs."]

The form of the cicatrization is of great importance. It is very apparent that cicatricial contraction may lead to the severest disturbances of the functions of the stomach, of which one, dilatation following cicatricial stenosis of the pylorus, has already been discussed. In these cases a well-marked and characteristic clinical picture is developed. In other cases the cicatricial contraction leads to traction on the nerves in the gastric wall, to deformities of the viscus, to the shutting out of larger portions of the muscular coat, or to adhesions with the neighboring organs; the result is gastralgias, or disturbances of function, which manifest themselves as "dyspepsias" of various kinds. As a rule the primary cause of these "dyspepsias" is very difficult to discover; a cure is usually or nearly always impossible. It is not uncommon for such patients to be regarded as "nervous dyspeptics." If saccular dilatations form, and if it happen that for some reason lavage is used later on, the remarkable phenomenon may appear that the stomach apparently can not be emptied. The water, to be sure, comes away almost clear after a time, but it suddenly becomes turbid again; this may be repeated several times.† In such cases we either have the condition described, or an insufficiency of the pylorus, permitting regurgitation of the contents of the duodenum into the stomach.

Syphilis and Ulcer.—As early as 1838 Andral inquired why syphilitic manifestations could not break out on the mucous membrane of the stomach as well as on that of the mouth. Since that time the question has been frequently discussed, and a number of more or less convincing observations have been published by Goldstein, Hiller, Virchow, Leudet, Lanceraux, Fauvel, Klebs, and Cornil. Only two

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* ["Of the 25 cases of gastro-cutaneous fistulæ collected by Murchison, 18 were the result of disease. In 12 of these cases the probable cause was simple gastric ulcer (Med.-Chir. Transact., London, 1858, vol. xli, p. 11). Middeldorpf says that among the internal causes of the 47 cases of external gastric fistulæ which he tabulated, simple ulcer of the stomach played an important *rôle* (Wiener med. Wochenschr., 1860). Welch, *loc. cit.*, vol. ii, p. 508.—Tr.]

† G. Scherf—Beiträge zur Lehre von der Magendilatation; Inaug. Dissert., Göttingen, 1879—also observed this.

cases of the simultaneous appearance of gumma and ulcer have been observed. Other observers (Frerichs, Drozda, Murchison, Chvostek) found scars in the stomach coincidently with general syphilis. Among 100 cases of ulcer, Engel found previous syphilis in 10 per cent, Lang found it in 20 per cent, while Julien* justly expresses himself with great reserve on this subject. It must always remain questionable in two diseases, as common as those under discussion, whether we are dealing with cause and effect, or with an accidental coincidence, especially since we are by no means able in every case to avoid confounding it with an ulcerating gumma. Here the result of specific treatment can alone be conclusive. A number of such cases have been reported, for instance by Hiller† and by Galliard,‡ although the latter, who has published the latest monograph on the subject, admits that they can not be positively proved. At any rate, syphilitic ulcers do not show specific symptoms. Nevertheless, it is advisable to use specific treatment in cases showing the signs of gastric ulcer together with the existence of syphilis.

Tuberculosis and Ulcer.—As is well known, tubercular ulcerations of the intestinal canal are common, but they do not occur very frequently with ulcer of the stomach; this may be because the germicidal action of the gastric juice prevents the proliferation of the bacilli which may be introduced in swallowed sputum, or in the blood. The occurrence of single tubercular ulcers of the stomach without further implication of the digestive tract is very rare. (See p. 241.) There are only a few, and in part, disputable cases on record collected by Marfan,# in a study of the gastric disturbances in phthisis pulmonalis. Tubercular ulcers of the stomach present no specific symptoms. Sudden death from hæmatemesis due to the involvement of vessels has also been observed in these cases. [Musser‖ claims that this is the rule.]

Diagnosis.—When all the classical symptoms are present the diagnosis of chronic gastric ulcer is easy and scarcely to be mistaken;

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* Julien. Traité des maladies vénériennes. Paris, 1886, p. 880.

† Hiller. Monatschr. f. prakt. Heilkunde, 1883.

‡ Galliard, *loc. cit.*

B. Marfan. Troubles et lésions gastriques dans la phthisie pulmonaire. Paris, 1887.

‖ [*Loc. cit.*]

while if this be not the case it can only be made approximately, or not at all. Where it deviates from its typical course there are practically two other diseases of the stomach, the symptoms of which resemble those of gastric ulcer—i. e., gastralgia or gastrodynia, occurring as the expression of nervous disturbance, and carcinoma. A good survey of the symptoms of the diseases in question may be obtained by arranging them in parallel columns, as Walshe has done in his celebrated treatise on cancer.*

Nervous Gastralgia.	Gastric Ulcer.	Gastric Cancer.
Tongue variable, often pale, with indented edges.	Tongue dry and red, with a white stripe down the middle; or smooth and moist, or lightly coated.	Tongue pale and furred.
Frequent *belching* of odorless gas.	Belching rare; or sour regurgitation with heartburn.	Frequent fetid belching.
No change of the *taste* in the mouth. Frequent dryness in the mouth; may have salivation.	Taste unchanged.	Pasty, insipid taste.
Appetite irregular and capricious.	Appetite good between the attacks. Thirst.	Appetite diminished or entirely absent. Repugnance to meat shown early in the disease.
Variable *sensations* in the stomach, at times hot and at others cold.	Burning in the stomach. Circumscribed boring pains, frequently radiating to the back.	Feeling of oppression, drawing, and pain of variable character. Later, pain in the shoulder.
Pain entirely irregular and not dependent upon eating; frequently eased by this or by pressure on the stomach. *Puncta dolorosa* over the intestinal plexus.	Pains rare when the stomach is empty; chiefly after eating, or after movements or positions which cause traction on the stomach. Increased by pressure.	Continuous dull pain, at times becoming paroxysmal. Frequently produced or increased by pressure.
Chemistry of digestion not essentially altered.	Digestion of starch foods frequently retarded. Digestion of meat normal or even too rapid. Hyperacidity the rule.	Digestion insufficient; as a rule, deficiency of free hydrochloric acid. Formation of organic products of decomposition.
Epigastric pulsation.	.....	Epigastric pulsation only seen with marked emaciation.

* [The Nature and Treatment of Cancer. London, 1846, p. 289.]

Nervous Gastralgia.	Gastric Ulcer.	Gastric Cancer.
Vomiting variable: sometimes only mucus, sometimes more or less digested stomach-contents; seldom with bile.	Vomiting usually immediately or within a short time after eating; frequently the first symptom of the disease. Very rarely, hyperacid vomiting from an empty stomach.	Violent and frequent vomiting, often periodic, at times from an empty stomach. Mucous; if acid, it is owing to organic acids. Always appears first in the course of other dyspeptic troubles. Consists of slightly digested food and occasionally cancer-cells.
No *hæmatemesis*, excepting in unusual accidental complications.	Vomiting of clear blood or coffee-ground masses. As a rule, frequently repeated within a short time. At times very profuse, with intense anæmia and collapse. Comparatively rapid recovery. Bloody stools.	Blood more often decomposed than recent. Quantity usually small. When once commenced, frequently recurs and without specially long intervals.
Obstinate *constipation* always present to a greater or lesser degree. Normal stool very rare. At times watery, mucous evacuations, the so-called pseudo-diarrhœa.	Stool variable. Diarrhœa due to intestinal irritation not uncommon. Lienteric diarrhœa after perforation into the colon.	Obstinate constipation almost constant. Lienteric diarrhœa after perforation into the colon.
No *fever*.	Slight febrile movement, but only in the presence of adhesive inflammation caused by perforation of the ulcer; or in connection with larger hæmorrhages.	Fever rare. When present, only seen toward the end of life.
Complexion pale, rarely fresh. Cutaneous circulation normal.	Complexion commonly fresh, only anæmic after severe losses of blood. Frequently the visible mucous membranes and even the cheeks are slightly cyanotic. Another group of patients is chlorotic.	Complexion pale and yellowish. Skin dry and relaxed. Marked cachexia.
Occurs at all ages. Commoner in women than in men. Frequently in combination with hysterical symptoms.	Most frequent in middle-aged patients. Rare in children. Spirits variable, frequently much depressed.	Most frequent between forty and sixty years. Spirits depressed and despondent, but remarkably less despairing than in severe cases of ulcer.
No *tumor* can be palpated unless in the rare and exceptional cases in	Round, egg-shaped tumor to the right of the midline, if the ulcer is situ-	Tumor variable in size and form: knobbed or smooth; can readily be palpated;

Nervous Gastralgia.	Gastric Ulcer.	Gastric Cancer.
which foreign bodies, such as hair, etc., are introduced.	ated at the pylorus and is followed by hypertrophy. In old ulcers with a firm base and thickened border—or in circumscribed encapsulated perforations, or in case of adhesions with the head of the pancreas, the left lobe of the liver or the spleen—a tumor may at times be palpated. Position not changed by respiratory movements.	usually can be moved without resistance; at times its position changes with respiration. Secondary glandular enlargements. Metastases.
[*Hydrochloric acid* present and usually increased in amount.]	Hydrochloric acid present and increased in amount.	In the majority of cases no hydrochloric acid.
No symptoms of *perforation.*	Perforation into the neighboring organs, with its characteristic signs appearing even after an apparently short duration of the disease, or without so much as a premonition.	Perforation or implication of surrounding organs only after the disease has existed for some time.*

I hope that this table may be of service in establishing a differential diagnosis. However, sharp as the distinction between the three pictures may appear on paper, we find often enough in practice that just the most important symptoms are absent, or so combined with one another, or so vaguely manifested, that an exact diagnosis can not possibly be made. This applies especially to the early stages of the ulcerative process. Up to the present time it was well-nigh impossible to differentiate these conditions from the many forms of dyspepsia, as long as they presented only more or less marked general disturbances of nutrition, as long as no typical gastralgic attacks occurred, and especially as long as every trace of hæmatemesis was absent. I regard the demonstration of increased acidity as a marked advance toward the recognition of this condition, and it enables us to make an early diagnosis. It is just in these cases that I consider it especially valuable, although we must not forget that we undoubtedly find exceptions to this rule. I have

* [See also E. Kollmar, Zur Differentialdiagnose zwischen Magengeschwür und Magenkrebs. Berl. klin. Wochenschr., Bd. xxviii, S. 119, 146.—Tr.]

already given you an example of such an exception in the history of the case on page 217, and another may not be amiss at this place.

I here present to you the patient in question, a man, forty-one years of age, who has suffered from repeated gastric hæmorrhages, and whose history and examination permit no doubt in the diagnosis of ulcer of the stomach. He came here about three weeks ago to take the Leube-Ziemssen rest-cure. The contents of his stomach have been examined three times, with the following results: 70 per cent on March 8, 58 per cent on March 20, and 66 per cent on March 25, 1887. Here I show you the filtrate five hours after a light dinner; on titration to-day, April 1, 1887, the acidity is 63 per cent.* I have purposely selected this form of test-meal in order that you may see that no difference exists between the test-breakfast and test-dinner. No lactic or fatty acids are present. Even regarding the value of 70, which was first found, as lying on the boundary-line of hyperacidity, the others are far below it, and we therefore see, as I have said above, that hyperacidity is not an absolute attribute of ulcer of the stomach, and that a negative result is accordingly not decisive in establishing a diagnosis. I do not mean by this to belittle the value of positive results, for establishing which Riegel deserves great credit; nevertheless, the simultaneous presence of the three classical symptoms—typical gastralgia, hæmatemesis, and bloody stools, together with absence of tumor and cachexia—still remains the most positive means of making diagnosis. Yet I have seen cases of undoubted gastric ulcer with great loss of strength; and, on the other hand, cases of cancer of the stomach in which the strength and general condition were unusually good. At times we can only make the diagnosis, as Leube also says, by the success or failure of specific treatment for ulcer. A special difficulty in diagnosis may be caused by the above-mentioned tumor-like cicatrization, and where neighboring organs have been drawn into the base of the ulcer, which has become adherent to them and perforated over them. In the latter case the head of the pancreas and the left lobe of the liver are specially in-

* The patient again presented himself on November 1st, and had then 46 per cent acidity.

volved, less frequently the spleen. There is also a lymphatic gland in the ligamentum gastrocolicum, and especially a chain of glands situated near by, which under certain circumstances become sympathetically swollen and sensitive on pressure, and which may be detected on palpation as small tumors of the size of a hazel-nut at the lower edge of the stomach. These have repeatedly caused me great trouble in diagnosis. In all these cases, the fact that the tumor remains unaltered, the maintenance of strength, and the presence of hydrochloric acid, speak for the diagnosis of ulcer and against cancer. Further, as may be assumed from what I have already told you concerning the duration of these processes, a course lasting more than three years, and the absence of typical cancerous cachexia, point toward the presence of the former affection.

While discussing cancer of the stomach I have already spoken of the transformation of an ulcer into a cancer. Inasmuch as we know that hyperacidity is the rule in the majority of cases of gastric ulcer, we ought not to be surprised to find a persistence of the secretion of hydrochloric acid, sometimes even up to the normal amount, in certain cases of cancer which have developed in this way. It is therefore of importance from a diagnostic standpoint to consider tumors, especially those situated at the pylorus, which are accompanied by the typical symptoms of the cancerous cachexia, but in which hydrochloric acid is present in abundance, as being cancers which have developed from ulcers. I have repeatedly seen such cases. In one of them a tumor at the pylorus reached the size of an apple within a year. At first the patient presented only the symptoms of an ulcer with hyperacidity of 104 per cent; this hyperacidity persisted in spite of the development of the tumor and the presence of well-marked signs of stenosis. Gastro-enterostomy was performed; at the operation inspection of the tumor showed that it was undoubtedly a cancer. The patient, a man, twenty-seven years of age, is now [January, 1892] in good condition, although the tumor has reached the size of a fist. Dietrich * has estimated the frequency of such cancers to be 5 per cent of all gastric carcinomas; Rosenheim † places it even higher, 8 per cent.

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* *Loc. cit.*

† Berl. klin. Wochenschr., 1889, No. 47.

After all that has been said, the important question must present itself to you, whether it is really justifiable and necessary to introduce the stomach-tube in cases of gastric ulcer, a question upon the answer to which most important results may at times depend. You know that only a short time ago this was always answered with a decided negative, and that some clinicians, Leube for instance, even yet take this wise precaution, but that very recently we have become less anxious in the use of the tube. It can not be denied that the danger of causing damage in introducing the soft tube is much lessened after previously cocainizing the throat; but it is not entirely eliminated. And if you reflect how easy it is, even in practiced patients, for movements of gagging or of vomiting to occur in the course of the manipulations, and if you will recall Faber's and my own cases cited above, you will agree with me that examination by means of the tube must be undertaken with the greatest caution, and that it should only be used in those doubtful cases of short duration in which no hæmatemisis has occurred, and in which the probability of a deep ulcer is slight. So, too, Germain Sée,* one of the leading clinicians in Paris, rejects lavage of the stomach and the introduction of the tube in cases of gastric ulcer, and cites cases of Cornillon and Daguet, in which lavage was followed by fatal hæmorrhages. For the sake of scientific purposes we may risk the possible dangers in the clinic or in a hospital where the necessary means are at hand in case of emergency; but in private practice and in dispensary work I must caution against it most decidedly, otherwise I fear one may at some time find himself in an exceedingly uncomfortable position. It may happen to any one of us that in introducing the tube we may cause hæmorrhage, and we may even be so unfortunate as to cause the perforation of an unsuspected ulcer, or of one giving but vague symptoms. This might easily have happened to me in the case reported at the commencement of this lecture, just as it did in the one quoted later on, without giving rise to any justifiable reproach. But this danger must always be borne in mind. It is, of course, greatly lessened by

* G. Sée. Hyperchlorhydrie et atonie de l'estomac. Bull. de l'Acad. de méd., 1 mai, 1888.

cocainizing the throat before introducing the tube in doubtful cases, and by using the utmost caution in aspirating with the bulb or the stomach-pump; it is equalized and more than equalized by the great advantages peculiar to our methods of examination. But, nevertheless, I refrain from introducing the tube in all cases of ulcer *in which the diagnosis can be made in another way;* and I desist so much the more, since in *these* cases the examination of the stomach-contents *does not establish the diagnosis*, and since it does not aid us in the treatment. On the other hand, I have frequently observed that severe hæmorrhages which could not be controlled in any other way have been checked by repeated washing out of the stomach with ice-cold water.

Among the facts necessary to establish the diagnosis, the recognition of hæmatemesis or of melæna may present some difficulty, to which I have already referred (*vide* page 247 *et seq.*). Let me here mention an apparently secondary matter, but which to-day plays an important *rôle* in the examination of the alvine discharges. I refer to the use of water-closets. Many patients, unless confined to bed, are unable to describe their dejecta, beyond speaking of the vague impression that they are formed or otherwise, or that the quantity is large or normal or small, because they never see their stools. Therefore we can never be positive of a possible bloody evacuation, as well as of many other facts. A striking example of this is the following case quoted from my case-book:

A man, thirty-eight years old, had suffered for five years with stomach disturbances which at first manifested themselves only in a feeling of fullness in the stomach after eating, occasional belching, and constipation. Strict diet and medication, together with the use of Carlsbad (Mühlbrunnen) water, only gave slight relief. True cardialgia never present. One day, a year ago, he had abdominal pains and diarrhœa while at his office, necessitating his using the closet several times during the day. Toward evening he suddenly fainted, and was carried home half dead. He remained in bed five weeks, and recovered slowly. Was quite well the following summer, complaining only of slight gastric oppression. Now, for about eight weeks, he has had great difficulty, especially marked regurgitation and repeated vomiting some time after eating, chiefly during the night between ten and twelve and two and three o'clock. Relief after vomiting. He claims that there never was any blood in the vomit or fæces. Constipated. Feeling of fatigue marked.

With the exception of slight sensitiveness on pressure nothing could

be discovered either in the epigastrium, or to the right of this in the parasternal line under the free border of the ribs. The acidity after the test-breakfast was 84—i. e., hyperacidity was present.

There can be no doubt that this is a case of gastric or duodenal ulcer, and that the apparent "diarrhœa" was the resulting profuse hæmorrhage leading to fainting, while the other conditions causing hæmorrhage from the bowels, such as tuberculosis, ulcers, diseases of the portal vein and of the liver, etc., can be excluded. Later on the patient remembered that he had seen blood on the closet-paper. How often, however, may such hæmorrhages occur without coming to the knowledge of the patient or of the physician! Only a short time ago I had another case of this kind in which a man, suffering with gastralgia, after a short sojourn in Carlsbad, had two severe attacks of syncope, which, now that symptoms of a duodenal ulcer have become more plainly developed, can only be referred to severe internal intestinal hæmorrhage.

Considerable difficulty may arise in making a differential diagnosis between *hepatic colic* and *gastralgia* due to an ulcer at the pylorus or in the duodenum. Naturally, not in the typical cases of either disease! Just as positively as the complete list of symptoms given above shows the presence of an ulcer, we may establish a diagnosis of hepatic colic if we find constantly recurring pain in the right hypochondrium independent of the ingestion of food, possibly mild febrile movements, jaundice, swelling of and pain over the liver, together with a gall-bladder which may be palpated, possibly with gall-stones, and the presence of the latter in the stool. But very many cases occur in which the symptoms are so shifted about that we can scarcely avoid mistaking one for the other. If in cases of hepatic colic jaundice may frequently be absent or very slight, so, on the other hand, we not uncommonly find cases of gastralgia with slight icterus, due perhaps to the convulsive contraction of the abdominal viscera forcing the bile into the blood, or perhaps because a very transient sympathetic spasm of the hepatic duct has caused a stagnation of the bile. Frequently, too, the patients refer the pain in hepatic colic more toward the mid-line, especially the case in women, in whom lacing has altered the topography of the liver. Should the pylorus be displaced somewhat toward the right, or

should the ulcer lie in the horizontal portion of the duodenum, a local differentiation would be wholly out of the question. Thus we may remain in doubt for a long time, or indeed never decide whether we have to deal with hepatic colic or with gastralgia. Here, again, the presence of hyperacidity of the gastric contents offers us a valuable diagnostic aid. Results in which the acidity amounts to more than 80—i. e., 0·3 per cent of hydrochloric acid—may be regarded as denoting this.

Not only is the diagnosis of the existence of an ulcer to be established, but its *site* as well. This assertion has frequently been made, only lately even by Gerhardt. Can this be done? According to my conviction and experience, it is only in those cases in which the circumstances are unusually favorable, that an ulcer situated at the pylorus or in the duodenum, or perhaps on the greater curvature, may be made out. On the other hand, proceeding by exclusion, we may surmise that the site of the ulcer is elsewhere. In contrast to this, ulcer of the pylorus can be recognized by a sharply localized pain a little to the right of the middle line. But the element of time as a factor in the causation of the pain now leaves us in the lurch, and I find the assertion that ulcers in the cardiac portion of the stomach are accompanied by pain immediately after eating, while those at the pylorus only cause pain later, to be neither sufficiently proved clinically nor warranted under the circumstances. We really can not conceive, or at least we have no grounds for so doing, that the ingesta are retained at the cardia and only reach the pylorus after an appreciable interval. Attempts have also been made to locate the site of the ulcer by the position which some patients assume in order to ease the pain. If the pain is lessened when the patient lies on the left side, the ulcer is said to be situated on the lesser curvature, and *vice versa*. This, too, may be considered a doubtful and unreliable symptom—the more so, since the majority of patients have no such experience. If the site of the ulcer in the stomach were discovered, it would perhaps be of practical significance in predicting the possible resulting conditions. According to Gerhardt,* "sensitiveness on pressure and a tumor"

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* *Loc. cit.*

point "more toward the site being on the anterior wall, pain in the back and hæmorrhage more to its being on the posterior wall. Ulcers in the regions of the fundus or the pylorus may often be distinguished by the location of the pain and by its increase in the lateral posture. Ulcer of the fundus adherent to the spleen may lead to chills, owing to splenitis, as I (Gerhardt) have seen in three cases." It need not be specially mentioned that dilatation of the stomach points to the site of the ulcer being at the pylorus or in the duodenum, and that contraction shows that it is at the cardia. However, if you consider how vague a symptom sensitiveness on pressure is; how rare the occurrence of a tumor caused by an ulcer is in comparison with the total number of cases; how little we are able to establish the condition of contraction during life; and if you will recall the case of perforation of a necrotic carcinoma of the lesser curvature accompanied by chills, cited on page 181; and, finally, if you know that frequently numerous ulcers are situated in different places—you will be able to appreciate the unreliability of these signs. I can not agree with this statement of Gerhardt, "If the diagnosis is to be positive it must also indicate the site of the ulcer"; in most cases I am content and well satisfied if I can feel sure of the diagnosis of ulcer, at times so difficult to be made.

All that has been said concerning the site of the ulcer in the stomach refers also to its position in the *duodenum*. In at least 90 per cent of the cases it is impossible to decide positively whether we are dealing with a gastric or a duodenal ulcer. For the duodenum, and especially its horizontal portion, may for this purpose be really regarded as only a continuation or a portion of the stomach; and the ulcerative process is accompanied by the same phenomena in this case as it is in the other. Those factors which indicate an ulcer at the pylorus also speak for the duodenal ulcer, and the more so since the latter at times extends directly from the pylorus into the duodenum. A duodenal ulcer is probably present if the pain does not develop until some time after the ingestion of food, if the position, together with sensitiveness on pressure, is situated decidedly to the right of the parasternal line, and if possibly there are profuse bloody stools without any hæmatemesis. The fact that duodenal ulcers often appear after extensive cutaneous burns may

in such cases be of service in diagnosis. A point of support, but no more, is offered by the rarer occurrence of ulcer of the duodenum. Thus Willigk reports only 6 duodenal ulcers to 225 in the stomach, and Trier places the figures at 28 to 261. Yet even in this small percentage a number of cases are included in which ulcers existed in the stomach and duodenum at the same time. Gastralgia is said to be less common because, as Budd believes, the duodenum is not subjected to as much traction and change of position as the stomach. Moreover, the very uncommon appearance of jaundice can be of no more aid in diagnosis than the circumstance that, on the whole, intestinal hæmorrhages are more frequent here than hæmatemesis, for we find that ulcer of the stomach also leads to the former, and that duodenal ulcer is also accompanied by the latter.

Prognosis.—Till within a short time it was customary and proper to give a doubtful prognosis in cases of gastric ulcer, when the diagnosis could only be made by the established symptoms. But now, since we are able to recognize its early stages, and to differentiate it from other dyspepsias, since the principles of treatment have become apparent to us, and we are in the position to apply them at the commencement of the process, the prognosis has become essentially better so far as the early stages of the ulcer are concerned. We may now, if the patients subject themselves to a rational course of treatment—i. e., the rest-cure—at the proper time, give them well-grounded prospects of recovery; and even in cases of classical ulcer we may hope for cure or for decided improvement. It is to be regretted that during the earliest stages, which are not very troublesome subjectively, very few patients are either willing or in the position to subject themselves to a course of treatment which is always exacting. However, if we succeed in permanently remedying the anomalies in the composition of the blood or the secretion of gastric juice, we lessen the danger of relapses, which otherwise always threaten us, and only too often appear. But the consequences of traction by the cicatrices, especially after the healing of extensive ulcers, always remain to be feared, as well as the accompanying permanent impairment of the general health which can not be remedied. In such cases, therefore, the prognosis must always be made with great care. But that it is nevertheless not a poor one

can be deduced from the well-known fact that the scars of gastric ulcers are found about twice as often as the ulcers themselves. In hæmorrhage, if this is not immediately fatal, the prognosis is on the whole favorable. As a rule we are able to control the bleeding by means of appropriate treatment, and even to remedy extreme anæmia in a relatively short time.*

Treatment.—I know but one form of treatment which holds out prospects of success, and which, if applied in the early stages, can show any favorable results. This is the rest-cure introduced into Germany by von Ziemssen † and Leube, ‡ by which the stomach is protected from all irritating factors, as a broken bone is immobilized in plaster, with of course the difference, that, while this is absolute in the latter instance, it can only be approximately attained in the former. The principle of this treatment, long since recommended in England by Wilson Fox and Balthazar Forster,# consists of rest in bed and rectal alimentation, with such nourishment as will cause the stomach the least trouble. As adjuvants we have moist heat in the form of external applications, which quiet the pain [except when there is bleeding] and at the same time diminish the irritation; and, internally, in the form of a *Trinkcur*, hot Carlsbad water or a solution of Carlsbad salts.

I could quote a large number of cases either cured with surprising rapidity and safety by this method, or at least freed for a long time from all difficulties, but the following will suffice:

In October, 1888, I was called in consultation to see Mrs. Tr., aged thirty-seven, a widow who supported her children by working on the machine as seamstress. Typical history of ulcer, hæmatemesis, gastralgia. Severe pain after each meal, and also at times during the night and morning on an empty stomach. Dieted strictly and lost much flesh. Appeared pale and miserable. Pain on pressure in the epigastrium. No tumor. Abdominal walls soft, strong muscular contraction occurring only on making pressure at the spot mentioned. No wandering kidney. Urine negative.

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* [Oser claims that in straightforward cases the prognosis is better than in chronic catarrhal gastritis.—Tr.]

† Ziemssen. Ueber die Behandlung des Magengeschwürs. Volkmann's Samml., klin. Vorträge, No. 15.

‡ Leube. Magenkrankheiten, S. 117.

Loc. cit., p. 944.

Patient treated till the middle of January, 1889, with internal medication—nitrate of silver, bismuth with ext. hyoscyam. and morphine, tinct. opii, etc.—but without success. At last, on January 14th, she applied for admittance at the Augusta Hospital. The typical ulcer-cure was instituted, and the patient was treated in the manner soon to be described. Her troubles were rapidly lessened, and then ceased entirely. The sensitiveness at the pit of the stomach—a point on which I always lay great stress—disappeared, and on the 20th of February, that is, after six weeks, the patient was discharged cured. Inasmuch as she was very foolish regarding her diet, and during her convalescence took more than was allowed her, and as this propensity was responsible for a renewed attack of gastralgia at about the middle of the treatment, we can really say that she gave us still stronger proof of her recovery. She has also remained free from relapses up to the present time.

However, I dare not conceal the fact that such a prompt cure does not always result, and that I have also had cases which as long as they were taking the "cure" felt very well, but as soon as they returned to their daily life, even if with all precautions, suffered from fresh attacks and the return of the old difficulties. Nevertheless, these have always been in the minority.

Leube emphasizes the fact that the composition of the Carlsbad salt is both neutralizing and, owing to the sodium chloride which it contains, stimulating in its action; but as we know that the acidity is increased in the majority of cases, the latter property may be regarded more as a disadvantage. Depression rather than stimulation is indicated. Neither can I ascribe very much importance to the neutralization or diminution of the acidity if this be done but once, and then in a stomach containing no food, which, unless there is continuous secretion (hypersecretion), is therefore empty. The essential indications seem rather to be the reduction of the hypersecretion by means of neutral salts, as already surmised by Pemberton, and directly proved by Jaworski,* and in the sedative action of large quantities of warm water;† and, finally, in the laxative effects of the neutral salts. If the action of the waters of the simple alkaline springs has been found to be less effective than that

* Jaworski. Ueber Wirkung, therapeutischer Werthe und Gebrauch des neuen Carlsbader Quellsalzes. Wiener med. Wochenschr., 6–16, 1886.

† [Oser cautions against giving too large amounts of water or anything producing large quantities of gas, on account of the danger of distending the walls of the stomach, and thus opening the ulcer. However, this seems to be theoretical rather than practical.—Tr.]

of the alkaline saline, it is probably due to the failure of supplying the laxative effects by other means.

Where this laxative action is absent, as is frequently the case in the Carlsbad waters, we must produce it by the addition of Glauber's salt, or better by means of vegetable cathartics, preferably rhubarb or senna in watery infusion. Moreover, it is not necessary for us to adhere too narrow-mindedly to one standard; our watchword is necessity. It is immaterial whether we relieve the pain by hot fomentations, or, if these be ineffectual, by subcutaneous injections of morphine; whether we give the patient a solution of Sprudel salt or the natural Carlsbad spring-water, or that of an effervescing soda spring, such as Ems, or Vichy, or Neuenahr, and supply the laxative action missing in these waters by means of other aperients. We give 300 to 500 c. c. [f ℥ x to Oj] of Carlsbad water. It is immaterial from which spring it comes, because there are no essential differences in their chemical composition, while the differences of temperature existing in the waters of the individual hot springs may be disregarded, for they are always taken only as hot as the patient can bear them; in other words, at about the same temperature. Of the salt about 15 grammes [one tablespoonful] are dissolved in one half litre [one pint] of [hot] water. This is taken as at the "cure"—i. e., small swallows at proper intervals.

For the first three days I give the patients absolutely no food, and allow them only a nutritive enema three times daily. Then feeding by the mouth is commenced with small quantities of milk-* and flour-soups; later on I give leguminous soups, then leguminous vegetables and potatoes in the form of a *purée*, to which small quantities of meat-broth are added later. Only in the third week is a quantitatively and qualitatively ampler diet permitted, but always with the view of sparing the stomach as much as possible. We must of course individualize, for the patients undoubtedly lose flesh on this diet. But they recover rapidly, the gastralgic attacks remain absent, and now is the

* Cruveilhier was the first to recommend the milk diet. Flour-soups cooked with milk are preferable to pure milk, because the casein coagulates more flocculently than it does in pure milk.

time to meet the second indication, to improve the general condition.*

For this purpose we use the iron preparations, either alone or in combination with arsenic. The former are indicated in cases of pure chlorosis or anæmia, the latter if we have to deal with an enfeebled nervous system and we wish to exert an indirect action upon it by direct stimulation of metabolism. The scruples formerly existing against the use of iron in cases of gastric ulcer were caused by the experience that this drug is often poorly borne as long as an active process is going on; but they are not justified as soon as recovery has commenced and is well under way. I can at least fully concur in the experiences which Te Gempt† has published on this subject. He uses Drees's liquor ferri albumin., which, as is well known, is a preparation made by treating albumen with chloride of iron, and which is very expensive.‡ Inasmuch as all we care for is to introduce the proper proportions of albumen and iron into the stomach, so as to produce an absorbable peptonate of iron, and inasmuch as we know that the power of forming peptones is not extinguished in ulcer of the stomach, I prescribe this medicament in a simpler and less expensive manner. I order three times daily a teaspoonful of a 2 to 3 per cent solution of ferri sesquichlor. (Ph. Ger.) [ferri chloridum, U. S. P.] to be added to a wineglassful of egg-water (one part of white of egg to two parts of water) and taken through a glass tube in order to spare the teeth. The advantages of the chloride of iron, as one of the mildest and most easily assimilable preparations of iron, have been extolled by many; with these I also wish to join. However, it is well known that every one has a favorite iron preparation, and if you have more confidence in any other and get good results with it, do not discontinue its use; for success does not depend upon the prepara-

* [Da Costa reports three cases of gastric ulcer which he treated successfully with ice-cream *ad libitum*. The ice-cream must contain no corn-starch or other substances employed for thickening purposes, and it must not be over twenty-four hours old. Medical News (Philadelphia), August 8, 1891 p. 155.—Tr.]

† Te Gempt. Ueber Behandlung des runden Magengeschwürs mit Eisenalbuminat. Berl. klin. Wochenschr., 1886, S. 240.

‡ [Dietterich's peptonate of iron and Pizalla's albuminate of iron are more common in this country.—Tr.]

tion, but upon its assimilation, and especially upon its action on the blood. I formerly gave arsenic in the form of Fowler's solution, together with tinct. ferri chlor. According to Liebreich's brilliant investigations, arsenious acid appears to be more effective, and I prescribe it in pills containing 2 milligrammes [gr. $\frac{1}{30}$] of arsenious acid and 2 centigrammes [gr. $\frac{1}{3}$] of ferri sesquichlor. [Ph. Ger.]. It is advisable to employ increasing doses, and to give the drugs after meals. This regimen must be continued for months, during which the use of arsenic is to be discontinued for three to five days every three weeks. The combined use of arsenic and iron may thus be continued for a long time, if we employ the caution of giving the arsenic in increasing and then diminishing doses, say from 3 to 10 pills! a day. The diet may gradually become more generous, but must nevertheless be strictly regulated for months; and those patients who tend to excesses must be made to adhere rigidly to a written bill of fare and a certain allowance of food.

This treatment brilliantly confirms the remark of Leube, that "the treatment of gastric ulcer remains a thankful task to the physician because the cures form by far the greater majority of the therapeutic results, if we include those cases in which the patients are freed from all difficulties for a long time, and have relapses only later on";* and also, "I am convinced that the more strictly the dietetic directions are carried out at the bedside, the more will the unpleasant medicinal treatment of ulcer of the stomach dwindle away."

However, the latter is nevertheless indispensable: first, because there are very many patients who are unwilling or unable to subject themselves to such a "cure"; secondly, because there are many cases which present urgent symptomatic indications which must be met immediately.

Bismuth has enjoyed a very great reputation ever since it was first recommended by Odier, of Geneva, although we have never been sure of its mode of action, as is shown by the great variations in its dosage, from 0·1 gramme [gr. jss.] up to 15 grammes [℥ ss.]. Given by Odier "*entérieurement comme antispasmodique*," it was

* Leube. Magenkrankheiten, S. 113.

used later, for instance by the English school, for the purpose of remedying an "undue secretion." In our day the remarkable supposition is frequently advanced that the comparatively diminutive amount of the preparation introduced into the stomach selects the surface of the ulcer on which to deposit itself and form a protective covering. Since we give it chiefly in doses of 0·5 gramme [gr. vijss.] together with 5 to 10 milligrammes [gr. $\frac{1}{12}$ to $\frac{1}{6}$] of morphine, it can not be said how much of the possible action is to be ascribed to the latter. To me the French method appears to be the most rational, in which large doses, 10 to 15 grammes [℥ ijss. to ℥ ss.], are given suspended in water. However, on account of the expense, this is a line of treatment not applicable to all.

But bismuth has been given with "success" by so many excellent practitioners, especially in cases of gastralgia—Budd recommends it just "in gastralgia with increased secretion of the gastric acid"—that all possibilities of illusion seem to be excluded. Nevertheless, the question whether it possesses a specific action, or whether it can not be just as well replaced by some other preparation of a poorly soluble alkaline salt—e. g., bicarbonate of calcium—must still remain undecided.

What I have said of bismuth will almost apply to nitrate of silver. Here, too, we are entirely in the dark as to its mode of action, for, as Leube has said, we can scarcely believe in a direct local action of the small doses—0·01 gramme [gr. $\frac{1}{6}$]—of nitrate of silver, and it is no more possible that any effective combination with an acid can be formed by it. Notwithstanding this, we also have weighty evidence (I will only mention Gerhardt) in favor of the effectiveness of the drug. In a few cases I have obtained decided but also only transient relief of the difficulties with a solution of 0·2 [gr. iij] argent. nitrat. in 150 [f ℥ v] of water, taken every two hours; while in other cases I had to discontinue the drug after it had been used a few times, because increased discomfort in the stomach, nausea, anorexia, coated tongue, and also constipation appeared. On the other hand, in several cases under my care I had to discard it because just the reverse occurred—namely, watery evacuations always followed almost immediately after taking it.

In my opinion, the dietetic principles given above are also the

most serviceable in the treatment of ambulatory cases, and we must endeavor to carry them out, at least as far as the diet is concerned, as fully as possible. Here we must give special consideration to milk, the neutralizing action of which on acids is well known, and which, moreover, has only lately been firmly established by the experiments of Leo and von Pfungen. It is to be regretted that so many show a repugnance to milk in all forms, and no matter what may be added to it, whether soda or lime water, brandy or coffee, etc. Frequently, in such cases, peptonized milk, made pleasant to the taste with sweet cream, can be taken. Moreover, I try to blunt the hyperacid gastric juice by the hourly exhibition of small doses of an alkali combined with rhubarb and cane or milk sugar. The rhubarb acts mildly on the bowels, while the sugar has a decided anodyne action, on account of which it has frequently been recommended. I have seen fairly good results from the following powder:

℞ Magnesiæ ustæ,
Sodii carbonatis,
Potass. carbonatis..... ....āā 5·0 [ʒ j gr. xv]
Pulv. rad. rhei..... 10·0 [ʒ ijss.]
Sacch. lactis..... 25·0 [ʒ vj gr. xv]

M. Sig.: A large pinch, dry on the tongue, every hour.

Morphine, either by the mouth or subcutaneously, stands first for the relief of severe gastralgia. Solutions of chloroform (1 : 120, ʒ ss. every two hours) have at times an excellent effect, not only on the temporary pain, but altogether on the course of the process. Among the remaining anodynes I have frequently used lupulin, ext. cannabis indic., ext. hyoscyam., and belladonna experimentally, but I have always been obliged to return to morphine. Formerly leeches were frequently applied over the affected site; blisters and even the cautery were used. Ice-bags will suffice, or ice-cold or warm applications, or Leiter's coil, which, where circumstances allow it, is the cleanest and most comfortable way of applying cold.

Nothing is more serviceable in vomiting than a carefully regulated diet. We may allow the patients to drink large quantities of warm water several times during the day, and also give them pieces

of ice with chloroform. But, as the vomiting usually ceases with the gastralgia, it is met by the treatment of the latter.

Special care is required in *hæmatemesis*, not only, as is self-evident, when it is profuse, but also when the hæmorrhages are smaller. The first indication under all circumstances is absolute physical and mental rest, and the avoidance of all internal and external irritation to the stomach. Even in the smaller hæmorrhages, since they frequently are precursors of larger ones, the patients, if circumstances will permit, ought to subject themselves to this regimen for several days, and the entire plan of treatment should be carried out. We may give small pieces of ice, or tablespoonfuls of ice-cold tea or ice-cold fluid peptone solutions. [For the use of washing out of the stomach with ice-cold water in otherwise uncontrollable hæmorrhage, see page 261.] In the cases in which it is not known whether the patients take milk well, I do not give it, but instead I prescribe for the first day a solution of grape sugar, which is replaced by some bouillon made of meat-peptones taken very cold, or cold thin gruels made of barley or oatmeal. Where it is possible, I order nutritive enemata, which must be given with care. Several times during the day I inject one or two syringefuls * of the following into the region of the stomach:

℞ Ext. secalis cornuti [Ph. Ger.]..... 2·5 [gr. xxxvij]
Glycerini,
Aquæ.....āā 5·0 [f ʒ j ♏ xv]. M.

[See page 212.] However, I must add that in some persons ergotin causes very unpleasant symptoms of oppression and dizziness. In case the patients are much excited, morphine may be added to this injection. As a rule, the hæmorrhages, unless they come from too large a vessel, are controlled by this. Formerly, remedies which have the reputation of being styptics, like acetate of lead, chloride of iron, and oil of turpentine, were given internally; but we do not use them now, since we have a much more effective and rational remedy in ergot. Bearing in mind that hydrastis canadensis and hamamelis virginica have been useful in metrorrhagia, I have made quite a number of trials with the fluid extracts

* [Pravaz syringe—holds one gramme.—Tr.]

of these drugs in bleeding from the stomach; but, since I have never seen any palpable benefits from them, I have returned to the use of ergotin, morphine, and ice.

Should symptoms of collapse appear, we may give hypodermic injections of camphor and ether (1 : 6), or enemata of wine or wine and egg or peptone, and also hot applications to the extremities. In threatened death from hæmorrhage, with very small pulse, anæmic murmurs heard over the heart, and cerebral anæmia, we proceed to transfusion of blood or infusion of salt solution. The advantages of these two methods have been extensively discussed, but they have not yet been finally decided, although lately there is an increase in the number of cases successfully treated by salt infusion*.

Peritonitis due to perforation demands the exhibition of large doses of opium, best given in suppositories or enemata, and also the use of ice-cold applications to the abdomen. If doubt exists whether the stomach be full, an attempt may be made to empty it by means of the stomach-tube, after the patient has, as far as possible, been rendered incapable of reaction by means of a large dose of morphine, or by the local application of cocaine. But under all circumstances we must prevent all attempts at gagging and choking, since these may lead to the enlargement of the perforation. At times this treatment has succeeded in keeping the peritonitis localized and causing adhesions.†

Finally, let me mention the fact that operative treatment has also been directed to gastric ulcer, and that it has been successfully excised by Kleef, for instance. Inasmuch as the uncertainty of an exact localization of the ulcer in the stomach must always remain the chief difficulty in this procedure, the future alone can show how much dependence, beyond a mere fortunate coincidence, may be placed upon it.‡

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* For instance, Michaelis, Heftige Magenblutung nach einer Magenausspülung (wahrscheineich bei Ulcus). Erfolgreiche Kochsalztransfusion. Berl. klin. Wochenschr., 1884, No. 25.

† Such cases, which were verified by the subsequent perforation of a second ulcer and post-mortem examination, have been reported, for instance, by Hughes, Hilton, and Ray, Guy's Hosp. Rep., vol. iv, and by Bennett, Clinical Medicine, p. 487.—[See Hall, *loc. cit.*, on page 252.—Tr.]

‡ [See W. Nissen. Zur Frage der Indicationen der operativen Behandlung des

And now, finally, my views of the *treatment at the mineral springs.*

For years the hot Glauber salt springs, especially those in Carlsbad, have enjoyed the established and undeniable reputation that the treatment of ulcer there is crowned by excellent results. We can not assert, as we can in other affections and concerning other places, that these results would have appeared in spite of Carlsbad; nevertheless, it is my opinion that the same or perhaps more rapid effects would have been obtained in these cases had they taken the rest-cure at home, and if after its completion they had sojourned in an invigorating climate under a tonic regimen. For the adjuncts of the medicinal springs—pure air, diversion, and beautiful scenery—which are frequently so effectual, are not requisite in the treatment of gastric ulcer. Rest and effective local treatment are the things needed, and these can be had much better at home than anywhere else. There is always time, after the disturbances of the digestive apparatus have been quelled, for the patients to seek general strengthening and invigoration by a stay at Franzensbad, Elster, Rippoldsau, Pyrmont, etc., in the mountains or at the seashore, but always with the proviso that they are able to procure suitable food, preferably by having the family cook its own meals. In this regard the places along the Baltic are to be recommended, as all opportunities for keeping one's own house are there offered. But very many patients much prefer to go to the baths or springs than to lie in bed at home, and many too can devote only from four to six weeks to the treatment; for these Carlsbad is the best place, if for no other reason than that opportunities for dietetic errors are practically excluded there. After Carlsbad, Neuenahr, Ems, Franzensbad, and Homburg can be recommended.

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runden Magengeschwürs. St. Petersburg. med. Wochenschr., 1890, lxiv, S. 516. Also Simon and Barling. Perforation of Gastric Ulcer and its Treatment by Abdominal Section.—Brit. Med. Jour., January 9, 1892.—Tr.]

APPENDIX.

The Vomiting of Blood.—In addition to hæmatemesis in ulcer and cancer of the stomach, the two diseases which undoubtedly most often give rise thereto, I will also discuss the rarer causes of gastric hæmorrhages.

The symptoms are fully given on pages 245 *et seq.*, so that I must only add two phenomena which have not yet been mentioned. These are œdema of the extremities, which appears chiefly at night after the patient has been on his feet all day; and amaurosis, appearing immediately or a short time after the hæmorrhage, which, according to Fries,* is found in 65·5 per cent of all such cases of hæmorrhage of the intestinal tract. Nevertheless, its intrinsic connection with hæmatemesis has not yet been made clear.

But as "vomiting of blood" is applied not only to gastric but also to pulmonary hæmorrhages, we may consider the differences between them—i. e., between *hæmatemesis* and *hæmoptysis*. We must remember that in hæmoptysis the blood is mixed with a great deal of air, and consequently tends to be bright red in color, and is ejected by coughing, and also that the history points to some chronic pulmonary affection. In many cases the patients have a distinct sensation as to whether the blood comes from the lungs or from the stomach; in the former the hæmorrhage is preceded by inclination to cough, due to irritation, tickling in the throat, and a sensation of warmth in the chest, while in gastric hæmorrhages nausea and a tendency to vomit precede the attack. This holds true also of pharyngeal hæmorrhages, which may possibly come into play here; but these, as a rule, are not so profuse, their source can usually be easily discovered, and the attack generally occurs under circumstances which do not permit their being mistaken. However, gastric hæmorrhages may begin very violently, coughing being caused by the aspiration of blood into the respiratory tract, which is expelled not only through the mouth but also through the nose. Thus a pulmonary hæmorrhage may be simulated, and even suffocation

* S. Fries. Beiträge zur Kenntniss der Amblyopie und Amaurose nach Blut verlusten. Inaug. Diss., Tübingen, 1876.

produced by blood accumulating and clotting in the throat during syncope. According to Henoch,* a differential sign, regardless of the proof of possible pulmonary disease, is the acidity of the serum in gastric hæmorrhages, and its alkalinity in bleeding from the lungs. I have had no experience with this, but for obvious reasons I do not consider it applicable in cases of larger hæmorrhages rapidly followed by vomiting. Of far greater significance in the differential diagnosis is the behavior of the patients after the occurrence of the attack. In hæmoptysis the patients cough for some time and the sputa are coin-shaped and brownish or brownish-red in color; in a recent attack we first observe bright-red and then dark blood. There is no sputum after hæmatemesis, but, as a rule, we find bloody stools (i. e., so-called melæna), which in doubtful cases indicate the occurrence of gastric hæmorrhage. On the other hand, we naturally dare not forget that many gastric hæmorrhages occur without bleeding from the intestine, and also, that occasionally blood which has been coughed up is swallowed and voided in the stools.

The causes, then, which lead to hæmatemesis, disregarding ulcer and carcinoma, are:

1. *Conditions of congestion in the venous vascular system.* Thus Dr. Yellowly † reports a case of hæmorrhage into the stomach in a man who was hanged (at all events, there was no hæmatemesis). Similar occurrences are said to take place in epileptic attacks. Cases of hæmatemesis with cardiac lesions have been described by Carswell and Budd.‡ H. Jones # has reported a case in acute yellow atrophy of the liver, and another in cirrhosis of the liver with compression of the portal vein. Debove ‖ has published an exhaustive essay upon the relation between hæmatemesis and diseases of the liver. Here especial attention must be paid to the hæmorrhage from dilated œsophageal veins. In hepatic cirrhosis these vessels, which form a part of the collateral circulation for the blood in the portal

* Henoch. Klinik der Unterleibskrankheiten, S. 432.

† Med.-chirurg. Transactions, 1853.

‡ *Loc. cit.*, p. 53.

H. Jones. Cases of Hæmatemesis, with Remarks. Med. Times and Gazette, 1855, vol. ii, pp. 182, 410.

‖ Debove. Des hémorrhagies gastro-intestinales profuses dans la cirrhose du foie et dans les autres affections hépatiques. Journ. Soc. anatom., 1890, No. 43.

vein, are liable not alone to well-marked varicosities but also to ruptures which may cause profuse and at times even immediately fatal hæmorrhages. These conditions have been very thoroughly studied by Blume, of Copenhagen, and Saundby and Wilson,* of Birmingham. Vomiting of blood is also said to occur in intermittent fever, but in the cases described the existence of an ulcer is not excluded.

2. *Active hyperæmia.* An example of this is found in the frequently quoted case of Watson,† concerning a woman who, ever since her fourteenth year, had gastric hæmorrhage instead of menstruating, which, after her marriage, only ceased during pregnancy and lactation, and then became vicarious as before. The following case, which came under my observation, must also be considered among the active hyperæmias. The patient was a married lady of an excellent family, who again became pregnant after having already borne two children, the younger of which was one year old. One evening, in order to bring about a miscarriage, she drank a hot decoction consisting of a bottle of claret, chamomile flowers, juniper berries, and some powerful aromatics, and also took a vaginal injection of soap-water. During the night, while nursing the baby, she suddenly fainted and vomited large quantities of fresh blood. This was followed by rectal tenesmus and the evacuation of bloody masses. The hæmatemesis recurred twice during the next three days. Although she was greatly prostrated, she made an excellent recovery under appropriate treatment. Strange to say, she did not abort! Here, too, the hæmorrhages in severe chronic glandular gastritis are to be included, which probably may be regarded as analogous to the bleeding in chronic catarrh of the nose and pharynx. Usually they are so slight that they do not cause vomiting of blood. Finally, we may also include the rarer hæmatemesis in hysterical subjects, in cholera, yellow fever, scurvy, and purpura hæmorrhagica, so far as the hæmorrhage is not dependent upon direct lesions to the vessels, or upon changes in their walls.

3. *Direct traumatisms.* Hafner‡ reports the case of a boy who half an hour after a fall from a considerable height on hard ground,

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* Wilson. Brit. Med. Journ., 1890.

† Cited by Budd, *loc. cit.*, p. 364.

‡ Cited by Henoch, S. 434.

without apparent external injury, repeatedly vomited blood, and had bloody stools. The swallowing of pointed objects, and even severe vomiting itself, without any further injury, may lead to gastric hæmorrhage.

4. *Alterations in the walls of the blood-vessels.* As yet nothing is known concerning the formation of varices or of atheromatous or amyloid degeneration of the gastric vessels, which might lead to hæmorrhages. As already stated, varicose veins occur in the œsophagus in old persons, and also, as stated by Letulle,* in confirmed drunkards. Bleeding from these vessels may give rise to false hæmorrhages from the stomach. I have found two cases reported by Gallard † as examples of the only disease which can be classed under this heading, in which small miliary aneurisms were the cause of rapidly fatal and very profuse gastric hæmorrhage. Both patients were men, twenty-five and fifty-one years old respectively. Atheroma, or other diseases of the general vascular system, were said not to be present. An additional case was recently reported by Welch: ‡ in a man, fifty years of age, he found a ruptured miliary aneurism on a branch of the gastric artery; it was situated in the submucosa, midway between the pylorus and cardia. I might, perhaps, include here the cases already mentioned as occurring in scurvy, purpura hæmorrhagica, yellow fever, and also in progressive pernicious anæmia, malaria, and the exanthematous fevers; although we have as yet no knowledge of demonstrable alteration in the vascular walls referable to these processes. However, where a positive and extensive change in the vessels exists, as for instance in the atheroma of old persons, it does not, according to my experience, lead to gastric hæmorrhage.

It is apparent that the recognition of the cause of the hæmorrhage necessitates different lines of treatment, and that it can not be an indifferent matter, either for the prognosis or the treatment, whether the hæmatemesis be due to a congestion, or an active hy-

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* Latulle. Varices veineuses de l'œsophage dans l'alcoolisme. Jour. des société. Scient., 1890.

† Gallard. Altérations peu connues de la muqueuse de l'estomac. Gaz. d. hôpit., 1884, p. 196.

‡ Welch. Johns Hopkins Hospital Bulletin No. 1.

peræmia, or a destructive process acting on the mucous membrane. In the former it will hardly ever be necessary for us to resort to energetic antiphlogistic measures, which, at most, could only be indicated by the presence of a very hard pulse with high tension, and signs of general plethora, for mild aperient measures will suffice; nor on the other hand would we apply all the styptics at our command, by means of which we treat the gastric hæmorrhages due to destructive processes (*vide* p. 273). Applications of cold water over the epigastrium, possibly one or two leeches applied there, swallowing small pieces of ice, Haller's acid elixir,* alum-whey, Rochelle salts, or small doses of rhubarb with sulphate of soda, dissolved in water, usually suffice; but, in order to avoid relapses, they must be combined with a carefully regulated diet.

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* [*Hallersches Sauer*, mistura sulfurica acida (Ph. Germ.), consists of a mixture of 1 part of sulphuric acid (sp. gr. 1·84) and 3 parts of alcohol.—Tr.]

LECTURE VII.

INFLAMMATION OF THE COATS OF THE STOMACH — GASTRITIS GLANDULARIS ACUTA, IDIOPATHICA ET SYMPATHETICA—GASTRITIS PHLEGMONOSA PURULENTA—GASTRITIS TOXICA.

GENTLEMEN: The following remarks should naturally have been placed at the commencement of this series of lectures, for inflammation of the gastric mucous membrane is almost constantly associated with all the affections—at least all the organic affections—of the stomach; therefore its discussion should form the basis for all further remarks. However, the desire to incorporate into this chapter the very latest experiences on this subject, which has very recently been the field of numerous investigations, has induced me to place the acute and chronic inflammations of the mucous membrane of the stomach after the disorders already discussed.

I shall preface the following pages with a few statements of a general nature.

The Mutual Relations of the Stomach, Liver, and Intestines.—In his lectures on general pathology Cohnheim very properly says that it is a characteristic feature of diseases of the stomach that one and the same factor tends to disturb the phenomena of digestion in so many different ways. In fact, the absorption, secretion, and movements of the stomach have such a close and interchangeable connection that under all circumstances injury to the one also involves the others. Every alteration of the secretion (e. g., following an acute gastritis) changes the normal course of those functions known to-day by the designation of the *chemismus*. But unalterably connected with every disturbance of the chemismus we find also changes in absorption and peristalsis. For, should the secretion of acid and pepsin be insufficient, there is not only a retardation in the formation of absorbable nitrogenous substances, but also the degree

of acidity necessary for efficient peristalsis and the transfer of the chyme into the intestines is attained either very late or not at all. The ingesta stagnate and undergo abnormal decomposition, the products of which not only further irritate the gastric mucosa, but also alter the conditions of absorption and exert a paralyzing influence upon the muscularis, either by their absorption into the vessels or by the mechanical distention of the organ with gases. Furthermore, deficient muscular action has a depressing effect on the intensity of absorption; insufficient absorption leads to stagnation in the venous system, and this in turn to impairment of the secretion. Thus a vicious circle is formed, and one can easily appreciate that there is no difference at which end of the chain you begin; for unless the deficiency of one function is compensated by the increased action of the others all the resulting phenomena will also be developed, whether the first change was in the secretion, motion, or absorption. If we succeed in breaking this endless chain of deleterious influences at one place, we effect a cure of the remaining functions—that is, provided the primary cause no longer acts. This gives a partial explanation of the fact that so many cases of what had been to the present time designated catarrh were cured by the most varied modes of treatment.

But the question arises, May not such a regulation take place without our aid and without therapeutic interference? Cohnheim believed that this does not occur in the great majority of cases, and he regarded this as a characteristic peculiarity of the diseases of the stomach in which, for instance, much to their disadvantage, they differ from cardiac affections. On the other hand, I believe that such regulation frequently occurs, and that it is only by such a compensation that the manifold direct and indirect disturbances to which this viscus is constantly subjected are equalized. Only on the disappearance of this compensation do we encounter what has been collectively designated dyspepsia. Careful consideration will show that the heart and stomach are under the same laws as regards compensation; there is only this difference, that in the heart it is of long, frequently very long duration, while in the stomach it is only transitory. The heart passes from the condition of compensation to that of absolute insufficiency; while the stomach, on the

other hand, may return to the normal. In the heart this compensation occurs but once, and its existence can be objectively demonstrated, while in the stomach it is merely transitory and can only be recognized *ex eventu*. But if the heart muscle is diseased, or if severe organic lesions are present in the walls of the stomach, then neither in the one case nor in the other can there be any more thoughts of compensation. Nevertheless, even very marked disturbances of individual functions of the stomach may be compensated by the increased work of another. How else could we explain the fact that persons with a complete absence of hydrochloric-acid secretion may live for years without marked dyspeptic difficulties? Of this condition I have observed a large number of cases. The explanation of this condition, which at first glance appears so anomalous, is to be found only in the increased peristalsis of the stomach by which the ingesta are transferred to the intestines before they can decompose or before any other disturbance may occur. Here, doubtlessly, a vicarious compensation comes into play.

But it will not suffice to simply call special attention to the individual manifestations of the stomach's functions, however obvious and positive the fact may be. *A thorough comprehension of the morbid processes of the stomach and of the manifestations of the disturbance of gastric digestion is not to be obtained without a consideration of the relations existing between the stomach, the intestines, and the liver.* For every disease of the stomach affects the intestines and liver, and, *vice versa*, every disorder of the latter is reflected upon the former. Whether it be that the stomach-contents are rendered abnormally acid from the presence of inorganic or organic acids, or because they contain much undigested food mixed with mucus, such chyme will act on the intestines as an irritating foreign body until the specific intestinal secretions, bile, pancreatic juice, and the succus entericus succeed in quelling this disturbance—i. e., by establishing normal digestion and absorption in these crude masses. Furthermore, the upper portion of the duodenum is especially involved, and hence the functions of the liver are disturbed in a twofold way: first, purely mechanically by swelling the orifice of the common bile-duct (this simply causes a retardation in the flow of bile, but no true jaundice); secondly, by contaminating the

blood in the portal vein with the products of incomplete digestion, which slows the hepatic circulation and in turn retards the secretion of bile. Lauder Brunton * has shown that the rapidity of the circulation in the excised liver depends very markedly upon the composition of the blood injected into its vessels. Retardation of the hepatic circulation necessitates a slowing of the biliary secretion, and, since the bile is antifermentative and digests fats, the intestinal digestion is doubly affected.

A similar course of events occurs when the liver or intestine is the viscus primarily involved, with the exception that the subsequent course of the process, so far as the stomach is concerned, is somewhat different. It is not so much the fact that the intestines are full and offer a certain resistance to the expulsion of the chyme, or even force the intestinal contents back into the stomach; it is not the reaction which each retarded peristaltic wave in the intestines exerts on the peristalsis of the stomach; but it is rather the obstruction which is caused in the entire portal circulation, producing a venous stasis in all the radicles of this extensive venous system, the injurious effects of which are manifested even in the stomach. A venous congestion of this viscus is the result, which, as we have already seen, sympathetically affects all its functions by the slowing of the secretion which is associated therewith. Thus, to a certain extent, in every case of dyspepsia, there are two endless circles—the smaller in the stomach, the larger in that viscus and also the intestines and liver—in other words, the entire portal system.

But the disturbance of the hepatic circulation has still another significance. The function of the liver is not alone to secrete bile, but, being interposed between the portal system and the right side of the heart, it also forms a kind of trap which arrests all toxic substances absorbed from the intestines; these it either retains and only gradually gives up in small quantities to the circulating blood, or it decomposes these substances or returns them to the intestines by means of the bile. We know that this peculiarity of the liver ac-

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* T. Lauder Brunton. On Disorders of Digestion, their Consequences and Treatment. London, 1886, p. 25.

counts for the comparatively harmless action of snake-poison or curare when taken by the mouth. We also know that this is true of nicotine, and must also assume it in reference to the toxic properties of peptone.* For if this feature of the latter's action is not generally manifested, as is actually the case, it is because the peptone has been reconverted into albumen while still in the intestinal wall, or because it enters the general circulation in such minute quantities or so slowly that it remains innocuous, having been stored up in the liver or converted into other products. Many facts, especially the presence of peptone in the portal blood, indicate the occurrence of such a draining action of the liver, which fails as soon as the functions of the viscus are disturbed. A somewhat similar function is also true of the products of intestinal digestion—i. e., those substances generated by the intestinal putrefaction which possess alkaloidal properties. Under normal conditions these have no effect on the general system; this may be due to a selective action of the intestinal epithelium which prevents their absorption, or they may be filtered out by the liver as described above, or the quantity absorbed may be too minute to have any toxic effect.

All this may be changed, even after an excessive meal, when the amount of peptone absorbed is suddenly increased. Apathy, dullness, and a slight drowsiness are the result, which we attempt to counteract by the use of stimulants (coffee, strong *liqueurs*, etc.). Such products are formed in much larger quantities as soon as, from any cause whatsoever, the intestinal digestion has become inadequate. Then either the normal impermeability becomes impaired or the action of the liver is inadequate, or both may be combined; so that, whatever may be the final cause, the toxic substances are taken up into the blood and give rise to more or less severe symptoms of poisoning. In the mild cases, which happily form the majority, there are only mild cerebral symptoms—fatigue, languor, mental dullness, and headache—especially in the occiput. In severer cases the cardiac action is sympthetically affected; palpitation, or an intermittent or irregular pulse, and, finally, even marked symptoms of poisoning may appear, possibly as the result of the simul-

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* *Vide* Ewald. Klinik, etc., 1. Theil, 3. Auflage, S. 102.

taneous absorption of the gases of putrefaction, a good example of which is the well-known case reported by Senator.*

It thus becomes evident that only in very few cases can we speak of disturbances of the digestion of the stomach which are limited to that viscus, and then only in those cases in which the gastric disorder runs so rapid a course that there is no time for the development of the general and mutual functional disturbances just described. This occurs only in a comparatively few cases of so-called acute gastritis; in all the others there is ample time, even though we designate them acute.

Acute (and chronic) inflammations of the gastric mucous membrane are generally described as acute (or chronic) catarrh of the stomach, and in this way an entirely erroneous conception of the existing process is created. According to our present view, every catarrh is nothing but an inflammatory process, which we call "catarrh" if it essentially involves an epithelial and subepithelial coat with relatively few glandular elements; in this case the latter are especially muciparous glands. The structure of the gastric mucosa—better designated the glandular layer of the stomach, or the tunica glandularis—is such that it is out of the question to call it a mucous membrane in the ordinary meaning of this term; it is rather an aggregation of numerous tubular glands placed alongside of one another, with excretory ducts and epithelial cells. The structure is thus a glandular parenchyma with its attributes, interstitial connective tissue and excretory ducts; it is simply a peculiar feature of the inner layer of the stomach that the protoplasm of the epithelium of these excretory ducts possesses, to a remarkable degree, the property of becoming converted into mucus; in other words, it is a mucinogenous substance in the same way that the epithelium of the true glandular tubules is filled with a pepsinogenous material.

Therefore, such being the structure of the gastric "mucous membrane," every inflammatory process which involves it necessarily also attacks the gastric glands, unless it is limited to the excretory ducts. The latter is opposed to the results of clinical observation;

* Senator. Berl. klin. Wochenschr., 1868, No. 24. Emminghaus, ibid., 1872, S 477.

Beaumont's investigation on his patient, Alexis St. Martin, showed that every "catarrh," even the mildest, was accompanied by a disturbance of the secretion of gastric juice, consequently by an affection of the glands themselves. Thus the inflammation is not catarrhal but parenchymatous and interstitial; it has nothing in common with a catarrh except the "flow" (the secretion of a more or less abundant but always alkaline transudate into the cavity of the stomach); but which it far exceeds, owing to the accompanying disturbance of the specific secretion. In this respect I fully agree with the views expressed by F. A. Hoffmann,* and especially that, being misled by the term "catarrh," we are generally too prone to underestimate the importance of these processes, particularly when they are chronic, and that by thinking, for example, of a chronic pharyngeal catarrh we lose all proper standards of comparison. Consequently, if in the following pages, from the force of habit, I should speak of an acute or chronic gastric catarrh, I shall nevertheless always have in mind a *gastritis*, or, better, a *gastroadenitis*, which pursues an acute, subacute, or chronic course.

According to the etiology, we can distinguish the following varieties of acute gastritis: *gastritis glandularis acuta simplex* (acute gastric catarrh), *sympathica*, *toxica*, *phlegmonosa*, *idiopathica*, and *metastatica*.

Simple Acute Gastritis; Occurrence and Etiology.—This lesion is so common, and its causes are of such every-day occurrence, that it forms one of the most familiar diseases with which we are acquainted. Every acute gastritis is really a toxic gastritis in the sense of a local irritation such as is produced by toxic (i. e., locally irritating and corroding) substances. In this same way every overloading of the stomach may be said to act "toxically," since every excess is followed by a number of symptoms of irritation which finally cause an acute inflammation. Naturally, our conception of too much is only relative, and quantities of food which, under normal conditions, are disposed of without any delay, may, under abnormal circumstances,

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* F. A. Hoffmann. Vorlesungen über allgemeine Therapie. Leipzig, 1885, S. 169 *et seq.*

have an injurious effect. A convalescent gets an acute gastric catarrh after eating a beefsteak which he could easily digest when he is healthy. A man who has almost starved to death must return to his usual diet very cautiously and gradually. Three of the fifteen shipwrecked sailors of the Medusa died because they ate too ravenously after their rescue.

Many persons have a kind of predisposition to gastric catarrh, just as others are afflicted with a predilection toward catarrhs of the nose and throat; such people are made ill both by the quantity and quality of certain articles of food which have no effect on a healthy stomach. In some this predisposition is decidedly hereditary. Although none of the text-books with the exception of Lebert mentions this circumstance, yet I have no reason to doubt it, since too many patients have assured me, either spontaneously or after questioning, that the father or mother had suffered from a weak stomach, or that their brothers or sisters were equally predisposed. Hoffmann * says, "Every one has the stomach which he deserves"; nevertheless, great injustice might be done thereby to a large number of persons who, without being dyspeptics, suffer from weak stomachs. For it is well known that there are some patients (even though their number is small) who take the greatest possible care of their stomachs year after year, but are nevertheless unable to prevent an attack of acute or chronic catarrh which could in no way have been surmised beforehand.

Irritation may be caused both by the quality of the food as well as its quantity. Spoiled articles of food and drink may even cause inflammation of the mucous membrane of the stomach, probably on account of the inflammatory and fermentative action of the microbes which have been introduced with them; thus we might speak of a bacillary infection, if by this we understand quite generally that the disturbances are to be referred to the action of the micro-organisms, and not, of course, to a direct invasion of them. Furthermore, it has frequently struck me that, in the various cases in which I have had the opportunity of examining pieces of human mucous membrane while still warm from the body, I have never found so much

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* F. A. Hoffmann, *loc. cit.*

as a trace of bacteria in the tissues, although they are so abundant in the contents of the stomach. Yet I must confess that I have studied this point superficially rather than with great attention to details. Meanwhile, although in the examination of six cases of gastritis membranacea diphtheritica Smirnow * found large numbers of micrococci and bacilli in the membranes lying upon the gastric mucosa, yet he could not detect them in the lumen of the glands or in the tissues. But as the abnormal products of decomposition which irritate the mucous membrane of the stomach are always due to organized ferments, it is my belief that acute gastritis can in this sense be positively referred to the action of micro-organisms. It depends only upon the number introduced into the stomach, and upon the question whether the antifermentative gastric juice at the individual's disposal is able to limit or stop the decomposition. Therefore, since we always introduce a certain number of microbes with our food, a disproportion must exist between the two factors above mentioned, the foreign intruders and the normal production of acid. To this disproportion I should also like to refer the influence which psychical factors and nervous disturbances exert upon the development of acute gastric catarrh. Under such circumstances weak gastric juice is secreted, the motor and expulsive powers of the stomach are enfeebled; hence any causes of fermentation which may have been introduced are allowed to grow more rapidly and abundantly. But, surely, there is at no time a lack of causes of fermentation: we are constantly introducing them in our food and drink, and certainly one of the chief functions of the stomach is to disinfect the ingesta by means of the gastric juice, and thus prevent abnormal fermentations. Where this is done insufficiently or not at all, we get decomposition and the resulting symptoms of irritation.

Nevertheless, I do not think we ought to ascribe too much importance to this antifermentative function. First, the cases of vicarious intestinal digestion, which have already been spoken of quite frequently, in which the gastric juice is permanently insufficient or at least without any hydrochloric acid, and in which digestion goes on

* G. Smirnow. Ueber Gastritis membranacea und diphtheritica. Virchow's Archiv, Bd. 113, S. 333.

very well, prove that the requisite disinfection may be accomplished by the intestines, or that its absence causes no appreciable damage. Secondly, it has been shown that there is only a limited and by no means extensive decomposition in acute gastritis, even though, as it seems, free hydrochloric acid is regularly absent.

Among the products of fermentation the first to attract our attention is lactic acid. The fact that it is normally present in the beginning of the digestion of bread speaks against its having any peculiar irritating qualities, and rather stamps its appearance at this time as physiological; should it persist, as we shall see that it may under certain circumstances, and be present in large quantities in the later periods of digestion, it is then to be regarded not as a causal factor, but rather as a result. Furthermore, it is well known that we can give lactic acid medicinally [as in diarrhœa, diabetes, etc.] and in beverages (kefir and kumyss), not only without harm but with benefit to the stomach. Furthermore, I have had the opportunity of examining the stomach-contents in several cases of acute gastritis, immediately after the beginning of the attack. One case concerns me personally. I was suddenly taken sick during the night without having committed any dietetic error and while leading a very quiet life. I had to vomit very frequently; at first I raised large quantities of offensive stomach-contents, but later only biliary mucous masses. The filtrate of the former contained no free HCl and only traces of lactic acid, while (to judge from the reaction) large quantities of fatty acids were present. I examined the substances which were first vomited in three other cases by inmates of my infirmary, where acute gastric catarrh is of frequent occurrence after holidays or visiting days. The patients were between the ages of fifty and seventy years, and their digestion was otherwise good. At no time did the filtrate of the vomited food contain any free HCl, although the reaction was faintly acid (owing to acid salts); no lactic acid was present in the ethereal extract [*vide* page 34]. A slow digestive action was obtained after adding enough HCl to give a feeble acid reaction. Fatty acids could be detected only in very small quantities in spite of the intense rancid odor. I wish to lay particular stress upon the fact that these examinations were made immediately at the beginning of the gastritis.

Later on we will find only mucus and a few fragments of food, or, if the test-breakfast has been given, the pieces of the roll will be found undigested, a larger or smaller amount of lactic acid but no HCl. Therefore, according to these observations, there must be other substances than lactic acid which can produce the irritation necessary to cause gastritis. It is at present a matter of conjecture whether it be the fatty acids or some products of decomposition as yet unknown to us. However, I can not believe, as for example Leube does, that the mechanical irritation produced by undue retention of ingesta will alone suffice to give rise to gastritis. It is true that we commonly speak of "overloading" the stomach; but ought an organ which is normally adapted to tolerate burdens of the most varied kind, and for unequal periods of time, be really irritated by the prolonged pressure of food?

Among the chemical irritants I also include those which are toxic in the true sense of this word—i. e., concentrated or diluted acids or alkalies, and metals like copper, antimony, iodine, arsenic, phosphorus, etc. Finally, I must also mention thermal irritation; ingesta which are too cold seem to do more harm than those which are too hot. Although a draught of cold water or beer is often charged with being the cause of a gastric catarrh, we scarcely ever hear of any blame being attached to ice-cream, which is at least equally cold, possibly because it is not taken in such quantities or is not so hastily swallowed. I have already (page 245) referred to some cases illustrating this point.

Pathology.—All clinicians and pathologists complain that our knowledge of the changes in the mucous membrane in acute gastric catarrh is so limited, because not alone is it rare to encounter a stomach with acute gastritis at the autopsy-table, but also because this viscus is always removed from the body many hours after death, and hence the post mortem changes which manifest themselves so early and so destructively can not be excluded. Consequently we must refer to the experiments made on animals, especially those of Ebstein,* Lösch,† and Grütz-

* Ebstein. Ueber die Veränderungen welche die Magenschleimhaut durch Einverleibung von Alkohol und Phosphor erleidet. Virchow's Archiv, Bd. 55, S. 469.

† Lösch. Ueber die nach Einwirkung abnormer Reize auf die Magenschleim-

ner,* and for the human stomach to the studies of Edinger† and Kupffer,‡ although the latter do not specially take up the question of acute gastritis, but rather discuss the relations of the principal and parietal cells.# Here the results of the investigations of Virchow, Klebs, Menassein,‖ and more recently Marfan and Stintzig^ may be included. Recently Sachs◊ has also published a number of remarkable and very interesting contributions on this subject. In my opinion, these complaints are not entirely justified, for in very many cases of acute diseases on which autopsies are made there exists an acute inflammation of the gastric mucosa as an accompaniment of the ante-mortem disturbances—high fever, anæmia—even if few or no evidences of it can be detected macroscopically. But the post-mortem changes can be reduced to a minimum by washing out the stomach immediately after death and then filling it with alcohol.

According to my experience, a human stomach with an entirely normal mucous membrane is among the greatest rarities, at least after the fortieth year, and is found only in persons who have met with a sudden death. I possess the stomachs of two persons, both of whom were instantly killed; one by the entrance of a piece of meat into the larynx, and the other by injuries received from machinery. I was able to remove the first stomach immediately after death, and the second a short time after, and placed both in absolute alcohol. Both specimens present an exquisite picture of the normal gastric

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haut auftretende pathologisch-anatomischen Veränderungen. Allgemeine Wiener med. Zeitung, 1881, No. 50.

* P. Grützner. Neue Untersuchungen über Bildung und Ausscheidung des Pepsins im Magen. Breslau, 1875.

† Edinger. Zur Kenntniss der Drüsenzellen des Magens, besonders beim Menschen. M. Schultze's Archiv, Bd. 17, S. 209.

‡ C. Kupffer. Epithel und Drüsen des mensch. Magens. München, 1883.

Ewald. Klinik, etc. I. Theil, 3te Auflage, S. 72, etc.

‖ R. Virchow. Der Zustand des Magens dei Phosphorvergiftung. Virchow's Archiv. Bd. 31, S. 399; Klebs. Handbuch d. patholog. Anatomie, 1868, S. 174; Menassein, Chem. Beiträge zur Fieberlehre. Virch. Arch., Bd. 55, S. 452; Uffelmann. Beobachtungen an einem Gastrotomirten. Deutsch. Arch. für klin. Med., Bd. 26, S. 441.

^ Marfan. Troubles et lésions gastriques dans la phthisie pulmonaire. Paris, 1887; Stintzig, Münchener med., Wochenschr., 1890.

◊ A. Sachs. Zur Kenntniss der Magenschleimhaut in krankhaften Zuständen. Arch. für experiment. Pathologie, Bd. 22, Heft 3, and Bd. 24, Hefte 1, 2.

mucous membrane with distinct differentiation between the parietal and principal cells. On comparing sections from other stomachs with these I find that they all show more or less marked changes, the most conspicuous of which is an infiltration of the interstitial connective tissue with numerous round cells, which have also wandered to the free surface of the mucosa. Should the gastric functions have suffered during the last days of life, or if the symptoms of an inflammatory condition have appeared, as is generally the case, then in most portions of the fundus no difference between the parietal and principal cells can be detected, and instead we find that all the cells have alike become granular and cloudy, that in part they have become separated from the membrana propria of the glands and have diminished in size. Here and there we may find cysts which contain either the remains of epithelial cells or simply only a lining membrane. The mucous cells are especially abundant in the pyloric region, and extend down deeply into the ducts of the glands.

On the whole, this description agrees with that given by the authors mentioned above, and the condition which I have pictured indicates, first, that an active inflammatory irritation must exist which expresses itself in an abundant cellular proliferation; secondly, that there is a condition of continuous activity of the glandular cells which does not permit the secretion to collect in them, and hence does give the customary appearance of the cells of the glands in the condition of rest. At least this is the view of the authors mentioned, so far as they embrace Heidenhain's views.

I think I ought to say here that this condition of the cells, which is ascribed to continuous activity, may be produced equally well by a complete cessation of their function. For either the secretion is formed in the cell, and is so rapidly removed that none can collect there, or there is absolutely none produced. In either case the resulting picture in the cell will be the same.

I will gladly concede an increased cellular activity in the early stages of acute gastritis as a result of inflammatory irritation, but this does not necessarily mean that the product is improved in quality; on the contrary, the stomach may pour forth a secretion which is continuous, but is very deficient in active constituents. Let me say now, to anticipate a little, that in the later stages in acute and

chronic inflammation this does not apply. For, not alone, according to a universal pathological law, do chronic inflammations paralyze the specific function of the involved viscus, but we also know directly that in chronic catarrhs, especially those which are accompanied by a profuse secretion of mucus, the secretion is markedly impoverished in its specific ingredients, and consists of pure mucus. Sachs, in the work already quoted, lays great stress on the karyokinetic figures which may be seen partly in the leucocytes in the interglandular tissue, partly in the superficial epithelial cells, and partly in the cells of the "mucous glands of the stomach," and which afford additional proof of the active cell prolifefation which occurs in these processes. I have repeatedly seen indications of this karyokinesis, but never such distinct pictures as are drawn by Sachs. So far as our present knowledge goes, they do not seem to have any special pathognomonic significance.

Macroscopically the mucous membrane appears entirely or partially swollen and reddened, and marked here and there with small suggillations. Even to this day Beaumont's Canadian [St. Martin] remains the classical witness for the appearance of the gastric wall in such a condition; "its surface was marked with numerous white spots and vesicles like coagulated lymph, between which were very dark-red spots," while food could be found in the hollow of the pylorus unchanged and surrounded by a capsule of yellow mucus, as long as four hours after ingestion.

Symptoms.—Authors, especially the French, have taken great pains to establish various forms of acute inflammation of the stomach. Thus Lebert distinguishes between an acute gastric irritation due to overloading, indigestion, and an acute painless catarrh with disturbance of a more functional nature; the latter he subdivides into the afebrile and the infectious febrile varieties; and finally he describes an acute inflammatory catarrh. On closer inspection it will be seen that these are only artificial subdivisions, and that it is more in accordance with Nature to recognize only two great groups, *the afebrile* and *the febrile catarrh.* The latter is simply an exaggeration of the former, but it may occasionally follow so rapid a course that an acute febrile gastritis with high fever may be at once developed.

Immediately after a manifest indiscretion of diet, etc., nausea suddenly appears, together with a feeling of fullness, tension and swelling of the epigastrium, tenderness on pressure over this region, thirst, anorexia, and even disgust for food; accompanying these, or at the onset, are the general symptoms of giddiness, headache, flashes before the eyes, and prostration. In addition we find the tongue coated; at the beginning especially the organ is often completely covered with a thick, tenacious white fur, which may be colored by food or drugs, and which retains the impressions of the teeth; as the disease advances it tends to clear up at the tip and edges. At times herpes labialis develops. There is diffuse pain on pressure over the region of the stomach, and painful spasms may also appear. The pulse is small and rapid, the secretion of saliva is increased, the œsophagus contracts painfully; spasmodic yawning is also sometimes observed. The face becomes pale, the eyes are expressionless, the extremities cold, and a quite specific odor is exhaled from the skin. Now nausea and vomiting set in; the latter, even if it occurs some time after a meal, consists of the ingesta only slightly changed, and inclosed in thick masses of mucus; the vomit has a flat or very penetrating odor, and an exceedingly bitter taste. However, this is not due to bile, as the common expression "as bitter as gall" would lead us to suppose, but to the acrid taste of the peptones, together with the fatty acids, such as we find in every artificial digestion—e. g., peptonizing milk. Fresh bile is not bitter; it is tasteless. I have repeatedly proved this in cases in which the introduction of the stomach-tube, and the efforts at bearing down having caused a regurgitation from the duodenum, pure bile (chemically tested) has been brought up. Lauder Brunton has made the same observations. The vomiting tends to be repeated many times, and finally only mucus and bile are raised. At first it occurs easily, but later becomes very painful, depending upon whether the spasms involve the fundus or the orifices, thus rendering the act of emesis more difficult, a point to which Skoda has directed attention. The reaction of the vomited matter is neutral or faintly acid; we never find free hydrochloric acid, but fatty and lactic acids; at the same time the latter are not constant, their presence depending, as I have said above, upon whether the last meal contained a large amount of sub-

stances which can produce lactic acid. Although the bowels are constipated at first, the passage of the chyme into the intestines irritates the mucous membrane of the latter, causing borborygmi, which may sometimes be heard even at a distance, the expulsion of offensive flatus, and watery stools, accompanied by some tenesmus.

Under proper care the condition disappears in three to five days, or it becomes subacute or chronic.

Febrile catarrh is distinguished from the afebrile form only by the greater intensity of the symptoms and the occurrence of fever from the onset. The latter appears suddenly and may reach 40° C. [104° Fahr.] or more. The skin becomes dry and livid and the rapidity of the pulse is increased. There is no proof, such as is accepted to-day—i. e., bacillary infection—for the infectious febrile gastric catarrh of Lebert. Formerly these cases were called gastric fever, and were classified with typhoid fever, but we have since learned to sharply differentiate these two conditions, owing to our better knowledge of the nature of the latter. F. Schmidt* attempted to "rescue" gastric fevers's existence as "an infectious disease peculiar to itself" as the result of observing a small epidemic among soldiers that could not be attributed to a typhoid infection; unfortunately, the most important factor, the proof of infection, is lacking. The same is true of an epidemic among the inmates of the Stuttgart Orphan Asylum described by Gussmann,* in which 24 out of 108 children (22·3 per cent) were taken sick with an acute febrile gastric catarrh, running a rapid course, with temperatures as high as 104·6° C. [105° Fahr.]. The disease ran its course with the usual symptoms, with one striking exception, namely, the color of the skin was at first yellowish, then more of a greenish hue, and finally dark red. Here it is very natural to think of an infection, especially as the well-known toxic causes could be excluded, and as attacks of acute gastritis were very prevalent at the same time in the city and among the garrison.

The diagnosis of *simple afebrile gastritis* is easily made. There

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* F. Schmidt. Zur Frage nach der Existenz des gastrischen Fiebers als einer eigenartigen Krankheit. Dissertation, Berlin, 1885.

† Gussmann. Eine Epidemie von acuter Gastritis. Württemb. Correspondenzblatt, 1888, No. 22.

can only be a doubt as to whether the stomach was primarily affected, or whether there was at first a catarrh of the duodenum which suddenly "exploded upward," as it were, in the form of the symptoms of acute gastric catarrh. But in such cases the tongue is clean, as a rule, and the onset of the specific gastric symptoms is usually preceded for a longer or shorter time by the signs of irregular intestinal digestion. The stools have been either irregular, or lessened in quantity, or the color has indicated a deficiency in the biliary secretion. The result of this sluggishness of the intestines is manifested in a reactive stagnation of the ingesta, the duodenum becomes filled and keeps back the contents of the stomach; and thus without any preceding dietetic error the symptoms of a gastric catarrh suddenly appear. In my own case which I have mentioned above this was obviously the course of events, for it is a fact that the sudden vomiting was preceded by a period of lessened intestinal activity. Nausea and anorexia continued for more than twenty-four hours, and were only relieved after I had provided for thorough evacuation of the bowels by means of several fairly large doses of calomel. Such cases are therefore typical examples of the reflex action of the intestines upon the stomach which was mentioned at the beginning of this lecture.

In my remarks I have often called attention to the *condition of the tongue*, and shall do so frequently in the following pages. Is the appearance of the tongue really a mirror of the stomach, or has it, as was held for a long time, nothing whatever to do with it; and is its condition to be regarded simply as an index of the existing state of the oral mucous membrane? In Henoch's *Klinik der Unterleibskrankheiten*,* a splendid work for its time, will be found a confirmation of the latter view that the fur on the tongue in disease † denotes nothing more than a catarrh of the mucous membrane of the mouth, caused either by direct local irritation (such as smoking, bad teeth, periostitis, angina, or drugs), or produced by spreading from other mucous membrane—e. g., the stomach and intestines.

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* Berlin, 1863, S. 382.

† This does not include the coating frequently found at the base of the tongue, in many persons, especially in the morning and in those who smoke excessively, which consists of desquamated epithelium, detritus, remnants of food, and bacteria.

This is undoubtedly true, and we must always bear in mind the various factors which may produce a coated tongue in order, in a given case, to distinguish between local and remote causes; but the uniform relation of the state of the tongue and that of the stomach in all cases in which a primary disease of the mouth is out of the question, indicates that the existing relations must be much deeper than would be inferred from an independent catarrh which received its first impulse from the stomach, and persisted even after the removal of the gastric trouble. Surely an uninterrupted reflex action, the direct nervous track of which we can easily trace, must exist here; and the old physicians were undoubtedly right in laying great stress on the appearance of the tongue as an indication of the condition of the stomach, and in frequently making it serve as a guide for their treatment.

Furthermore, although the condition of the tongue, even when not coated in the ordinary sense of the term, may be very variable, yet it may give some information as to the character or cause of the dyspeptic manifestations. Thus, in ulcer of the stomach, it is almost the rule to find the tongue red, moist, smooth, and with a thin white fur at its base. In nervous dyspepsias and neurasthenic conditions the tongue is strikingly pale, smooth, moist, and of a bluish rather than a reddish tinge; at times there are also deep transverse fissures or depressions at the side which look like excoriations, but are smoothly covered over by the mucous membrane; the latter are very annoying. At times the organ may seem to be covered with a white fur, whereas this appearance is really only due to an anæmic condition of the filiform papillæ. In other patients the tongue feels swollen or enlarged, causing them to make incessant attempts at swallowing, as if they wished to get rid up of some foreign body in the mouth; such a feeling is also exceedingly annoying.

The recognition of *acute febrile gastritis* may at times not be so easy. It is true that with a little attention we can not mistake it for a beginning typhoid, the step-like temperature curve of which is quite characteristic. But meningitis, peritonitis, and hepatitis may begin in the same way, so that we can only feel sure of our diagnosis after waiting a little while. If the gastralgic pains in gastritis are unusually severe, but only moderately developed in biliary colic,

the accompanying gastro-duodenal catarrh well marked, while jaundice is absent—in such a case the diagnosis may remain doubtful, unless the characteristic sensitiveness in the right hypochondrium helps us out. However, these difficulties occur more frequently on paper than they do in practice, and diagnostic errors here are of still less importance, since the rapid course of the disease reveals the true condition.

Treatment of Acute Gastric Catarrh.—If it be true that this disease never occurs spontaneously, but is always caused by some irritation introduced from without, and that after its removal the inflamed mucous membrane rapidly returns to the normal, the indications for treatment can only be to remove any noxious substances and to prevent any further disturbance—in other words, to spare the organ. But even this the stomach, as a rule, does for itself. The vomiting and the anorexia are Nature's cure, which will act promptly provided it is not hindered by overzealous physicians. I do not even consider it necessary to use the mild vegetable aperients, especially the favorite emulsion of castor oil, for as a rule the bowels move spontaneously, and the fat of the castor oil can simply irritate the stomach still more. Under such circumstances it is much better to give a *Brausepulver*,* or some effervescing citrate of magnesia, or a Seidlitz powder; furthermore, a fast of twenty-four or even seventy-two hours is absolutely necessary, and it is only to be broken on the appearance of a feeling of real hunger. Few things are more foolish than the popular notion that "we must offer something to the stomach" or "you can't live two days without eating," for the public ought to have learned that a man can easily live for a day or two on his own fat from the example of the celebrated fasters of the past few years.

We should only attempt to empty the stomach artificially when spontaneous vomiting has not occurred, and pressure, fullness, pains, and dullness over the stomach, as well as the belching of foul-smelling gases, show that the viscus is still full, and that the natural resources of the organism are not adequate to empty it either by the

* [The *Brausepulver* (Ph. Germ.) consists of sodium bicarbonate 10 parts, tartaric acid 9, white sugar 19 parts. Mix the well-dried powders.—Tr.]

mouth or the bowels. The simplest and best method is to let the patients drink considerable quantities, say ½ to ¾ litre [quart], of warm salt water, and then to tickle the back of the throat with a feather or the finger; where these fail the tube should be introduced. As a result the patients vomit after this, and we thus avoid causing them any more disgust or producing fresh irritation of the stomach by the use of specific emetics. Otherwise the best remedies are a dose of apomorphia, 0·25 to 0·50 centigramme [gr. $\frac{1}{24}$ to $\frac{1}{12}$], or

℞ Pulv. ipecac ..... 1·5 [gr. xxiij]
Antimon. et potass. tartrat..... 0·05 [gr. ⅚]

M. Ft. chart. no. j. Sig.: To be taken at once or in divided doses. In children we may give a teaspoonful of syrup of ipecac. Should constipation continue after the first two days, prompt action can be obtained by administering some carbonate of magnesia in the form of an effervescing lemonade, or a teaspoonful of compound liquorice powder, or a glass of Hunyadi water. In such cases I am very fond of using calomel, given once or not too frequently repeated, and regret that with us in Germany, irrespective of its use in children's diseases, it is not prized as highly as it is in England. It possesses so many advantages—its mild purgative effect, its cholagogue properties, its disinfecting action (since it is converted into corrosive sublimate)—that the idiosyncrasy of its easily causing salivation in rare cases can by no means outweigh. In adults it must not be given in too small doses, about 0·4 [gr. vj] repeated in an hour;* it may advantageously be combined with small quantities of aloes (0·1 [gr. jss.] of the extract) or colocynth (0·01 [gr. ⅙] of the extract). The decoctions of cortex frangula and also of senna, which have been recommended, cause much more discomfort and pain in acute gastro-duodenal catarrh than in chronic cases. Should marked pyrosis exist, it is advisable to follow the old practice of using alkalies to neutralize the acids which have been formed; the best of these is carbonate of soda; possibly the generated carbonic-acid gas has the same

* [By using reliable tablet triurates, small, frequently repeated doses up to 0·15 [gr. ij] will usually be ample. The combination of calomel and bicarbonate of soda, which has been recommended to prevent salivation and to lessen the griping, will be found to be valuable.—Tr.]

refreshing and stimulating effect upon the mucous membrane as it has elsewhere; or perhaps—and this seems to me to be much more probable—the well-known good effect is due to the anæsthetic action of this gas which was demonstrated by Brown-Séquard. In these cases it is not advisable to give magnesia usta, for the caustic magnesia is quite insoluble.

Gastritis sympathica acuta is an exceedingly frequent accompaniment of numerous acute febrile disorders. All the exanthematous infectious diseases—small-pox, measles, scarlatina, typhus and typhoid fevers—the croupous and diphtheritic processes, dysentery, pyæmia, and puerperal fever, may have disturbances of the gastric functions associated with them. We can directly prove that not only are they due to reflex nervous action (for instance, the influence of fever on the gastric juice proved by Hoppe-Seyler* and Manassein†), but also that they directly alter the mucous membrane. However, I must add that this effect of fever on the secretion and composition of the gastric juice is by no means always present. It is true that I have myself published‡ some results of my own which agree with Manassein, that the gastric juice of febrile patients digests more slowly than that of healthy persons, yet Sassezki# found that in fever patients without marked dyspepsia there was no diminution in the digestive power. That the secretion of hydrochloric acid need not be specially changed has been proved by Edinger‖ in five cases of fever (phthisis, recurrent, intermittent, and typhoid fevers). Klemperer^ and Schetty◊ have made similar observations in phthisical patients with fever. Recently I used the test-breakfast on the fourth and fifth day of fever in a young woman, twenty-seven years old, who had facial erysipelas with a febrile movement

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* Hoppe-Seyler. Allgemeine Biologie, 1877, S. 242.

† Manassein, *loc. cit.*

‡ Ewald. Klinik, etc., I. Theil, 3. Auflage, S. 128.

Sassezki. Ueber den Magensaft Fiebernder. Petersburger med. Wochenschr., 1879, No. 19.

‖ L. Edinger. Zur Physiologie und Pathologie des Magens. Deutsch. Arch. für klin. Med., Bd. 29, S. 555.

^ G. Klemperer. Ueber Dyspepsie der Phthisiker. Berlin. klin. Wochenschr., 1889, No. 11.

◊ F. Schetty. Untersuchung über die Magenfunction bei Phthisis. Deutsch. Arch. f. klin. Med., Bd. 44, S. 219.

up to 39° to 40·5° C. [102·5° to 104·9° F.]. Although the acidity was low—namely, 24 and 36 respectively—yet free HCl was present, the digestion test with the filtered stomach-contents took the usual time, and a retardation of the gastric digestion could only be recognized by the presence of an amount of propeptone somewhat larger than usual. Up to that time the patient had received no medicines. Her general condition was good, with the exception of prostration, loss of appetite, and the local trouble. On examining the stomach ten days later, when the patient was fully convalescent, I found the acidity to be 32 and the other chemical functions the same as before. It must remain a matter of doubt whether the average normal acidity in this case might not be somewhat higher, for I did not have another opportunity of repeating the examination. At all events, this case proves that even with high fever the gastric juice need not be specially altered, and that therefore the temperature *per se* neither directly nor indirectly influences the glands of the stomach.

This is an additional reason for assuming an actual change in the mucous membrane in the above-mentioned sympathetic disorders of the stomach. Although the gastric symptoms are relegated to the background by the other manifestations, yet in those cases with dyspeptic disturbances in which we are enabled to examine the organ soon after death, we will find the anatomical changes of acute gastritis.

In diphtheria, variola, and scarlatina even false membranes and diphtheritic ulcers may be formed.* According to Smirnow, we must here deal with two forms of the disease. In the one form there is a more or less marked hyperæmia with extravasation and desquamation of the glandular epithelium without any disturbances of the true secretory parenchyma—i. e., a fibrinous inflammation; in the other, the mucous membrane itself is attacked by a necrobiotic process and passes into the condition described by von Reck-

* Cahn. Ein Fall von Gastritis diphtheritica bei Rachendiphtherie mit acuter gelber Leberatrophie. Deutsch. Arch. für klin. Med., Bd. 34, S. 113.—G. Smirnow. Ueber Gastritis membranacea und diphtheritica. Virch. Arch., Bd. 113, S. 356.—G. Kalmus. Ein Beitrag zur Statistik und pathologischen Anatomie der secundäre Magendiphtheritis. Inaug. Dissertation. Kiel, 1888.

linghausen as hyaline degeneration of the cellular elements. In addition, Kalmus claims to have found numerous bacteria not only in the exudate and necrotic tissue, but also in the depths of the still sound tissues, and even in the submucosa; while Smirnow, as stated above, found the tissues entirely free from them. Kalmus found gastric diphtheria in 6·5 per cent of his cases (199). The site of the diphtheritic ulcers is usually at the cardia, whence they spread in radiating lines toward the fundus. In other cases we find, especially at the fundus, small yellowish or brownish sloughs surrounded by a reddened zone, or even membranes which consist of fibrin, mucus, desquamated glandular cells and their products of disintegration, or which may be partly of an exudative character. When they are cast off they leave deep losses of substance behind, and are accompanied by necrosis of the layers of the mucous membrane; they may also cause fatal hæmorrhages. This process is naturally much more than a simple acute gastritis; furthermore, even if they do not have such severe results, the acute inflammation accompanying the above-mentioned diseases easily assumes a chronic form, and may therefore persist long after the primary disorder has subsided, and thus delay convalescence.

Acute gastritis may become subacute or chronic. The assertion that a subacute catarrh is always developed from an acute attack can only be accepted with a reservation. Many cases undoubtedly run a subacute form at first, and become acute after some severe irritation.

The French very appropriately designate **subacute catarrh** *embarras gastrique*, the English call it indigestion, while we [in Germany] describe it as *status gastricus*. Its symptoms and treatment are so closely connected with chronic gastritis that their discussion may be deferred to the lecture on the latter.

Suppurative Inflammation of the Stomach; Gastritis Phlegmonosa Purulenta.—This lesion, which is usually acute and rarely subacute, differs from acute gastritis in the fact that it is not situated like the latter on the glandular layer of the stomach, but in the submucosa and muscularis. The condition is rare, and I can only recall one case of a female servant whom I saw at Frerichs's clinic. Quite a

number of such cases have been published, especially of late, after Andral and Cruveilhier, Rokitansky and Dittrich, Habershon and Brinton had described and classified them; hence it is not difficult to obtain a complete description of the disease.

Occurrence and Etiology.—Men seem to be especially liable; of Lebert's 31 cases, 26 were men and 5 women. According to Glax* the number of cases published since then (1878) would increase the total to 51; 41 of these include 33 men and 8 women. It occurs most frequently between the twentieth and sixtieth years.

We may distinguish an *idiopathic primary* and a *metastatic form.*

The causes of primary phlegmonous gastritis are unknown; at least I can not attribute any importance to the vague claims for alcoholism, dietetic errors, traumatisms, etc. It is just here, if anywhere in the whole field of the diseases of the stomach, that we can assume that the disease is due to infection, and, in accordance with our present knowledge, to bacteria. In fact, Ziegler† claims to have found numerous streptococci partly free in the tissues and partly inclosed in the cells.

The metastatic form occurs in severe pyæmic, puerperal, and exanthematous diseases, or is due to an extension of a perigastric phlegmon.

Pathological Anatomy.—Circumscribed abscesses, gastritis phlegmonosa circumscripta, also called abscess of the stomach, must be differentiated from diffuse purulent infiltration. As a rule the abscesses are small, varying in size from a pea to a hazel-nut; sometimes they are as large as a walnut or goose-egg. The mucous membrane is raised over these areas, and on cutting into it we find that the abscesses are in the submucosa, possibly infiltrating and causing purulent liquefaction of the muscularis and extending down to the serosa. In advanced stages, perforation may occur into the cavity of the stomach or peritonæum. The diffuse infiltration advances in the submucous tissue and extends up between the glandular tubules of the mucosa or along the bundles of muscular fibers in

* J. Glax. Die Magenentzündung. Deutsch. med. Zeitung, 1884, No. 3.

† Ziegler. Lehrbuch der allgemeine and spec. pathologische Anatomie, 1887 [Bd. 2], S. 516.

the muscularis; the muscle-fibres themselves undergo fatty degeneration, or show proliferation of the nuclei and infiltration with pus-cells. Cribriform perforations of the surface of mucous membrane now occur, through which pus wells up on pressure; or the pus penetrates down toward the serosa, separates and perforates it, unless adhesions with the adjacent viscera have been formed as the result of preceding inflammation.

Symptoms.—In the majority of cases the disease runs an acute or even *foudroyant* course; a chronic form is very rare indeed. The onset is either sudden, as in the case observed by me, or it may be preceded by vague dyspeptic disturbances; it is marked by exceedingly violent and intense pain in the epigastrium, severe burning in the stomach, raging thirst, dry tongue, and complete anorexia. From the beginning the patients feel that they are very ill; high fever at once sets in, the temperature reaching 40° C. [104° F.] or more, with occasional chills and slight remissions. The pulse is small, frequent, or irregular. Emesis is rarely absent; the vomit consists of biliary or mucous masses or large quantities of pus.* The sensorium is always severely affected; the patients are restless and anxious; in one case observed by Lebert this condition was so marked that the sufferer threw himself out of a window and died at once; delirium may now appear, and the patient dies in coma or in general prostration. It is not surprising that such a clinical picture should resemble acute articular rheumatism, and indeed we find the following case described by Macleod:†

A laborer, thirty-six years old, was ill for a fortnight, apparently from acute articular rheumatism. No pain in the epigastrium, no vomiting. Delirium and great restlessness were attributed to alcoholism. Died comatose. The autopsy showed that the wall of the stomach in the vicinity of the greater curvature and pylorus was 1·5 centimetre [$\frac{3}{5}$ inch] thick and contained large quantities of yellow pus between the muscularis and submucosa. The mucosa was unchanged. There was no inflammation of the joints or any other suppurative processes.

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* Bukler. Idiopathisch-phlegmonöse Gastritis. Bayer. ärztliches Intelligenzblatt, 1880, No. 37.

† Macleod. Suppurative Gastritis; Death; Necropsy. Lancet, 1887, vol. ii, p. 1166.

Grainger Stewart has observed inflammation and gangrene of the gall-bladder.* W. Lewin † has seen petechiæ over the entire body, those on the right thigh reaching the size of a hazel-nut; there was also jaundice. The autopsy revealed multiple abscesses between the mucosa and serosa of the stomach, diffuse purulent peritonitis, and suppurative pleurisy on the left side. Brinton and Chvosteck ‡ have also found jaundice in idiopathic phlegmonous gastritis; it might perhaps be explained by the extension of the inflammation to the duodenum and the mouth of the common bile-duct, unless it is a pyæmic icterus.# Gläser reports the very rare occurrence of this disease in the course of a carcinoma and an ulcer of the stomach; in these two cases, strange to say, vomiting, which is otherwise so constant, was absent.

During the course of the disease there is either absolute constipation, or, what is more common, diarrhœa occurs with marked meteorism and *gargouillement*. The duration is two weeks at the utmost, but it generally lasts a much shorter time. Lewin's case, quoted above, which lasted four weeks, is an exceedingly rare exception.

Diagnosis.—You will have seen from the clinical picture that in the majority of cases the diagnosis of this disease can only be a matter of chance; for, on the one hand, the process so closely resembles a circumscribed peritonitis, and, on the other, perigastric inflammations or abscess formation may give rise to such confusingly similar symptoms—e. g., arteritis or abscess of the left lobe of the liver or of the spleen—that a differential diagnosis is absolutely impossible.

I can not agree with Deininger ‖ in considering that high temperature, constant pain in the stomach which is not increased on movement, and increased resistance in the epigastrium, are sufficiently characteristic points on which to base a diagnosis; and it is my opinion that the doubts of the possibility of establishing a diag-

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* Edinburgh Med. Journal, February, 1868.

† W. Lewin. Berl. klin. Wochenschr., 1884, S. 73.

‡ Wiener Klinik, 1881, and Wiener med. Presse, 1877, Nos. 22–29.

Berl. klin. Wochenschrift, 1883, S. 790.

‖ Deutsch. Archiv f. klin. Med., Bd. 23, S. 628.

nosis, already expressed in 1879 by Leube, have not been removed by the cases which have since been published. Even if large quantities of pus should be vomited, and, as happened in a case of Callow and also of Deininger, a previously palpable tumor should disappear after such vomiting, the presence of a gastric phlegmon could not be positively asserted. The differential diagnosis from typhus fever, which it might resemble in its febrile movement and the possible occurrence of petechiæ, might more readily be made by the violent and continuous pain.

Treatment can only be symptomatic—i. e., antiphlogistic. Cold applications to the abdomen, possibly the use of leeches, swallowing pieces of ice, ice-cold effervescing mixtures, hypodermic injections of morphine, and restoratives, are the only means at our disposal in such cases.

Gastritis Mykotica et Parasitaria.—The little we know about the invasion of the mucous membrane of the stomach by fungi may fittingly be discussed in connection with gastric phlegmon.

I know of only one case of the invasion of the grosser fungi, namely, that reported by Kundrat* of a drunkard with favus universalis, in which the parasites had even penetrated as far as the mucous membrane of the stomach and intestines. Here the fungi had caused a diphtheritic inflammation with ulceration and sloughing and fibrinous exudations. Kundrat thinks that the mucous membrane was predisposed by the drunkard's chronic catarrh. Death was due to diarrhœa which resisted all treatment.

Some time ago Klebs† described a *bacillus gastricus* which occurred in a number of cases; it had numerous spores, and was found free in the lumen of the glands as well as between the membrana propria and the epithelium of the latter. Unfortunately, we have learned nothing of the clinical features of these cases. Orth‡ reports a case of gastric ulcer in which there were gray sloughs of the mucous membrane looking like bran and containing bacilli.

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* Kundrat. Ueber Gastroenteritis favosa. Wien. med. Blätter, 1884, No. 49.

† Klebs. Ueber infectiöse Magenaffectionen. Allgemeine Wiener med. Zeitung, 1881, Nos. 29, 30.

‡ J. Orth. Lehrbuch der spec. patholog. Anatomie, 1887, S. 704.

E. Fränkel * has reported a case of emphysematous gastritis which was probably of mycotic origin.

A laborer, thirty-five years old, sustained a severe contusion of the right hand, with crushing of the last phalanx of the index-finger. Under appropriate surgical treatment the patient did very well ; but on the seventh day he suddenly went into collapse, complained of pain in the stomach, and vomited bloody masses. In spite of the excellent condition of the wound, which in no way corresponded to the severity of the general condition, the symptoms persisted two days longer, when the patient died in collapse.

At the autopsy it was found that the mucous membrane of the stomach was of an intense red color and was dotted with numerous bubbles of air which had been formed between the mucosa and the submucosa. There were neither extravasations of blood, nor losses of substance, either of short or long standing. Processes of putrefaction were also absent. Microscopic examination of the tissue surrounding the bubbles revealed numerous bacteria, resembling those of anthrax. They were not found within the glands of the stomach or blood-vessels. This tissue also had foci of infiltrations with small cells, its vessels were filled to distention, and there were also microscopic extravasations of blood.

Fränkel properly rejects the supposition that the process was one of putrefaction or the invasion of bacteria from the free surface of the gastric mucous membrane ; he attributes it to an involvement of the gastric mucosa by bacilli which had probably entered the circulation through the wound, but had not caused any infection at this point of entry.

The bacteria found in diphtheria of the gastric mucosa have already been mentioned (page 303).

Thus far the clearest of all have been the troubles caused by anthrax, in which the bacilli, as Orth says, "reach the stomach either as such, or as spores from without or from the blood." They cause marked swelling of small areas of the mucous membrane, and especially of the submucosa, with central sloughing and consecutive ulceration.

The presence in the chyme of sarcinæ, yeast-fungi, and numerous micro-organisms which have been mentioned in the discussion of gastric fermentation, never seems to directly irritate the mucous membrane of the stomach. On the other hand, I may add

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* E. Fränkel. Virchow's Archiv, Bd. cxviii, S. 526.

concerning foreign parasitic organisms, even if they are not mycotic, that Gerhardt* reports an acute gastritis which was due to the invasion of larvæ of dipteræ which were probably swallowed with raspberries, and that Meschede† has seen the same disease caused by maggots in cheese. On the other hand, Lublinski‡ found that no special effect was produced by larvæ of the house-fly which had been swallowed in raw meat and got rid of by vomiting.# A long time ago Fermaud‖ observed a somewhat similar case in which gastritis and gastralgia were caused by an earthworm in the stomach; it has also been known for a long time that ascarides and even tænia may wander into the stomach and cause intense catarrh of this viscus.

Gastritis Toxica.—I can only give a short review of those poisons which directly affect the gastric mucous membrane. The commonest are alcohol, phosphorus, cyanide of potassium, arsenic (Schweinfurt green),^ corrosive sublimate, chlorate of potash, nitrobenzol, concentrated mineral acids (also carbolic acid), and caustic alkalies.

After Virchow◊ had described the fatty degeneration of the glandular epithelium in an interesting series of investigations, Ebstein‡ showed what influence alcohol and phosphorus have upon the stomach; he also discovered the very important fact that after ingestion of these substances (which also serve as prototypes of a number of drugs with a similar action), the macroscopic changes may be comparatively slight, while the finer structure of the glandular

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* C. Gerhardt. Magenkatarrh durch lebende Dipterenlarven. Jenaer med. Zeitschrift, Bd. 3, S. 522.

† Meschede. Ein Fall von Erkrankung, hervorgerufen durch verschluckte und lebend im Magen verweilende Maden. Virchow's Archiv, Bd. 36, S. 300.

‡ W. Lublinski. Ein Fall von lebenden Fliegenlarven im menschliche Mangen, etc. Deutsch. med. Wochenschr., 1885, No. 44a.

[Senator. Ueber lebende Fliegenlarven im Magen und in der Mundhöhle. Berl. klin. Wochenschr., 1890, No. 7.—See also Hildebrandt. Erbrechen von Fliegenlarven. Ibid., 1890, No. 19.—Tr.]

‖ Fermaud. Observ. sur une cardialgie accompag. de symptomes de gastrite intense reconnaissant pour cause la présence d'un ver terrestre dans l'estomac. Journ. de méd. pratique de Paris, 1836, tome vii, p. 57.

^ [So-called Paris green.]

◊ *Loc. cit.*

‡ *Loc. cit.*

layer is greatly altered; for, while macroscopic examination showed only a mild hyperæmia and slight extravasations of blood, the microscope revealed that the epithelium of the vestibule (*Vorraum*) of the glands and the glandular cells themselves were cloudy and granular and had partly undergone mucoid and fatty degeneration, and that the interglandular tissue was infiltrated with small cells. Thus a gastritis glandularis degenerativa is developed, which even in favorable cases disappears very slowly, and which explains the protracted digestive disturbance remaining after phosphorus poisoning and the influence of the abuse of alcohol on the stomach.

The corrosive poisons act differently. I can not here discuss the classical picture of poisoning by sulphuric, hydrochloric, and oxalic acids or the caustic alkalies; I shall only recall the fact that their effects vary according to the quantity taken and the fullness of the stomach and the nature of its contents previous to the act of swallowing the poison. In mild cases the destroyed tissue is imperceptibly cast off and cicatrization follows; in severer cases the mucosa and submucosa are cauterized and converted into a black slough, the muscularis becomes the seat of a serous or gelatinous infiltration, or is charred down to the serosa; then there is perforation of the stomach, with escape of its contents into the peritoneal cavity. Metallic poisons usually cause a general inflammation and hyperæmia, or they involve localized areas with superficial necrosis. Excellent illustrations of these conditions will be found in Lesser's Atlas.*

The **symptoms** of poisoning naturally vary according to the nature of the substance taken: if it be one of the group of caustic fluids, its effects will be manifested in the mouth, pharynx, and œsophagus. But the acute action on the stomach can also be readily recognized in the group of symptoms in poisoning; for the sudden onset of all the symptoms, the repeated vomiting which can hardly be allayed, the vomit mixed with bloody mucus or pure blood, the intense pain in the stomach which is increased on vomiting, the profound collapse, the change in the features and cyanosis, the cold extremities covered with clammy sweat, and the small pulse—all these give rise to a suspicion of the true condition, which is either

* A. Lesser. Atlas der gerichtlichen Medicin. Berlin, Hirschwald, 1884.

verified by the patient's statements or by examining the vomited matter. These acute poisonings, if not fatal, always leave behind a long illness and all the symptoms of severe disturbance of the functions of the stomach; these disturbances are partly caused directly by the profound changes in the coats of the stomach, above all in the glandular layer, and their possible ulceration, partly by the results of cicatrization. In these cases the mucosa and submucosa may also be cast off in shreds; in the patient observed by Laboulbène, a piece of membrane over twice the size of the palm of the hand was vomited fifteen days after swallowing sulphuric acid. In the lecture on chronic gastritis I shall consider the other group of chronic poisoning.

The discussion of the **diagnosis** and **treatment** of the individual varieties of acute poisoning lies beyond my province. Yet I may be permitted to make the general remark that the stomach should be immediately emptied with the tube in all cases which are not due to caustic substances, as can always be ascertained by inspecting the mouth and pharynx. I decidedly prefer this to the administration of emetics, which always require some time for their action, and which, especially in comatose persons, are by no means reliable. We can cleanse the stomach much more thoroughly by repeated siphonage than by means of an emetic, and we can always introduce the tube, even in deep coma; a piece of gas-tubing, which can be found almost everywhere at the present time, can readily be improvised, as I have already announced in 1875,* in my report of a case of poisoning with oil of mirbane (nitrobenzol); according to my experience, the only difficulty will be to rapidly make a funnel through which water may be poured into the tube. I have even gotten along with a medicine-bottle by knocking out the bottom and slipping the tube over the neck. We can proceed to the real treatment after the stomach has been thoroughly washed out. It is self-evident that the tube must not be used where there is danger of perforation from the swallowing of caustic substances; here we must give neutralizing substances in solution. Even in poisoning

* Ewald. Zwei Fälle von Nitrobenzolvergiftung. Berl. klin. Wochenschr., 1875, S. 3.

by acids the introduction of the tube will seldom be necessary, since the unabsorbed portion of the acid may be neutralized by means of calcined magnesia suspended in water (about 100 grammes [℥iij] of magnesia to 500 c. c. [a pint] of water), which forms harmless compounds with hydrochloric, sulphuric, and nitric acids and an insoluble salt with oxalic acid. But in addition we must always give alkalies, preferably very soluble sodium salts, in order to prevent the impoverishment of the blood in these metals. The caustic alkalies can be neutralized with solutions of tartaric acid (1 to 5 per cent), vinegar, or lemon-juice.

LECTURE VIII.

CHRONIC GLANDULAR GASTRITIS—CHRONIC CATARRH OF THE STOMACH —ATROPHY OF THE STOMACH.

GENTLEMEN: In the course of time chronic glandular gastritis has received a variety of names: chronic catarrh of the stomach, habitual dyspepsia, indigestion, atony of the stomach, *status gastricus*, bradypepsia [*βραδύς*, slow; *πέπτω*, to digest], apepsia, etc. This abundance of names shows that different processes have been grouped together under the above designations. Thus Copeland includes under dyspepsia a clinical picture which is evidently that of gastric ulcer. Todd* distinguishes idiopathic and deuteropathic dyspepsia, and subdivides the former into functional and organic varieties and the latter into sympathetic and symptomatic; besides these he recognizes atonic, inflammatory, irritable, and follicular gastric dyspepsia. Ross† has three great groups of dyspepsias, namely: (*a*) inflammatory, (*b*) functional, (*c*) organic; these he classifies again into no less than nine subdivisions.

If we disregard Broussais's well-known description of *gastroëntérite*, which for a long time exerted a powerful influence on the conception of diseases of the stomach among the French; even to this day in all French text-books, we find that dyspepsia embraces a large chapter. To be sure, Damaschino says, "*La dyspepsie n'est pas une entité morbide*,"‡ yet dyspepsia is discussed in very broad terms, and we find *dyspepsie flatulente acide*, *essentielle*, etc.; why, even a special "*dyspepsie des liquides*" is spoken of by Chomel!

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* Todd. Cyclopædia of Practical Medicine, article Indigestion. London, 1833.

J. Ross. Practical Remarks on the Treatment of the Various Forms of Dyspepsia. Edinburgh Medical Journal, September, 1855.

‡ F. Damaschino. Maladies des voies digestives. Paris, 1880.

Germain Sée,* who distinctly describes dyspepsia as an "*opération chimique défecteuse*," still clings to a purely symptomatic classification, and divides dyspepsias into those with changes in the chemical functions and those with mechanical disturbances. This is about as scientific as it would be to write a chapter on dropsies, although we had long ago advanced from a symptomatic to an anatomical classification.

The Germans were the first to destroy this conception of dyspepsia as a disease and to recognize it as only a pathological condition; therefore Lebert properly excluded the chapter on dyspepsia from his treatise on the diseases of the stomach. In fact, such terms as dyspepsia, indigestion, etc., are merely descriptive of a functional disturbance but not of a distinct disease; and hence to-day we ought not to find a physician who considers a disturbance of digestion as a separate disease.

In making a historical review of this chapter in the works of the writers in this field we find that its extent gradually becomes smaller—in other words, that distinct clinical types have been successively separated from this large group. Thus, to give only two examples, irritable and atonic dyspepsias are now included under the gastric neuroses, and we may equally well class some of the cases described by the older writers as pyrosis or heart-burn under what we now recognize as acid hypersecretion.

I shall revert to this topic while considering the conditions of hyperacidity which I classify among the neuroses of the stomach. I will merely say here that of necessity we must differentiate between a catarrhal (that is, a chronic inflammatory) condition of the glandular coat of the stomach and the nervous affections of the same, be the irritation direct or indirect. The inflammatory processes are always attended by a lessening of the glandular secretion—i. e., of hydrochloric acid and pepsin; and instead there is produced a more or less alkaline transudate. The sum of these two factors will give the absolute acidity or alkalinity of the stomach-contents as produced by the irritation of the ingesta. But the degree of acidity is always

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* Germain Sée. Du régime alimentaire. Paris, 1887. Des dyspepsies gastro-intestinales. Paris, 1883.

lessened, and it is therefore a distinct contradiction of the pathological meaning of the term inflammation, and especially of chronic catarrhal processes, to speak of an "acid catarrh," as has been done up to recent times, in absolute violation of fundamental medical principles.

It is entirely different, however, with the coexisting production of mucus, which, as in other glands—the submaxillary gland, for instance—does not go hand in hand with the formation of the specific secretion. The longer the stimulation lasts the smaller the percentage of the organic constituents of the saliva will be than the inorganic, and probably (although this is not yet absolutely known) the amount of mucus and ptyalin will stand not in the same but in the reverse proportion.* Analogous to this, the secretion of mucus in the stomach may be very abundant, and yet the gastric juice may be absolutely wanting; such, indeed, is often the case. But all those conditions which are accompanied by an increased secretion of gastric juice must be classified among the neuroses of the stomach, whether it is only an abnormal reaction to a normal physiological stimulation—i. e., occurring only during digestion—or whether a continual irritation keeps up a constant secretion of the glands. These are the conditions which we now call hyperacidity and hypersecretion. In accordance with these views, I shall describe these conditions among the nervous disturbances of the stomach.

Pathology.—The anatomical features are allied to the conditions described under acute gastritis. For the greater part the mucous membrane has a yellowish-gray or slate-gray color, with insular, vascular, deeply injected areas of a scarlet or brownish-red color; it is usually thickened, on an average one or two millimetres [$\frac{1}{25}$ to $\frac{1}{12}$ of an inch], and covered with a delicate but firmly adherent layer of mucus; in many places it is elevated above the tense submucosa, because at these places it has grown more rapidly than the latter, and forms papillary projections, giving rise to the so-called *état mamelonée*, a term which at all events is applied by some authors, not to this condition but to the polypoid degeneration of the mucous

* *Vide* Ewald. Klinik, etc., I. Theil, 3. Auflage, S. 47 and 50 *et seq.*

membrane.* The portion of the stomach usually involved is the pylorus, but it may extend to the fundus and even the entire mucous membrane. The submucosa and muscularis may also be thickened, and the latter especially at the pylorus may cause hypertrophy with consecutive stenosis. To this condition of well-marked hypertrophy Brinton has applied the name of cirrhosis of the stomach, while the French writers† call it hypertrophic sclerosis of the submucosa and muscularis.

The *minute anatomy* of the process is that of a parenchymatous and interstitial inflammation. The glandular cells are partly destroyed, partly granular, and partly shriveled up; differentiation between the principal (*Hauptzellen*) and the parietal cells (*Belegzellen*) is impossible; in many places, especially in the pyloric region, the ducts have lost their regular order of lying alongside of one another, and show an atypical, manifold ramification like glove-fingers. Isolated glands become separated at the fundus and appear at the border of the submucosa as cysts, which are either empty, with a smooth lining membrane, or are filled with the remains of glistening hyaline cuboidal epithelium. There is an abundant small-celled infiltration which is especially marked near the surface of the mucous membrane; the cells lie between the glands, and in places push their ducts far apart. In the hyperplastic form we see processes of connective tissue which proceed upward between the glands from the submucosa like the branches of a tree. The free surface of the glandular layer is covered with a film of mucus inclosing many leucocytes and nuclei. The superficial layer of the epithelium of the mucosa is loosened, and can be separated in adherent shreds which may sometimes be found in the wash-water after lavage of the stomach. In the accompanying drawing (Fig. 26) one can readily see the mouths of the glandular ducts and the surrounding epithelium. The epithelial cells of the *Vorraum* [the short, tunnel-like entrance to the cavity of a peptic gland] is for the greater part filled with a pale mucous mass which projects sharply against the

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* Orth. *Loc. cit.*, p. 709.

† Hanot et Gombauldt. Arch. de physiol., ix, p. 412.—Dubujadoux. Gazette hebdom., 1883, p. 198.—Kahlden. Ueber chronische sclerosirende Gastritis. Centralblatt für klin. Med., 1887, No. 16.

lumen without any inclosing membrane, as described by Kupffer* in the normal stomach. I have been able to study this and the fol-

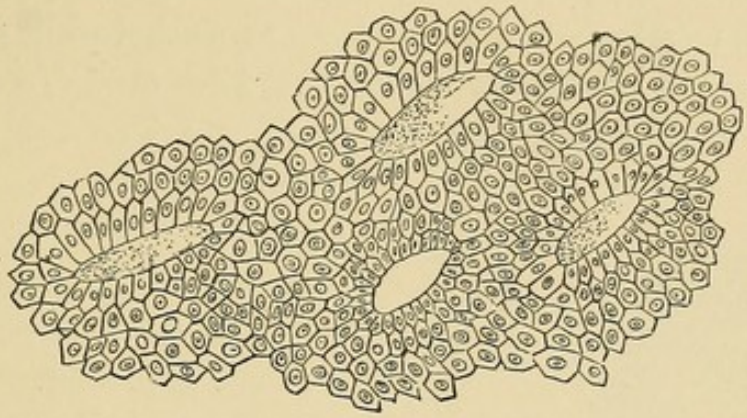


Fig. 26.—Mrs. St., September 27, 1887. From a pale, reddish shred, the size of a grain of sand, which was found between some pieces of mucus in the wash-water after lavage of the empty stomach.

lowing conditions in specimens which were obtained immediately after death, or from living persons after resection of the pylorus. In the condition (to be described presently) of mucous catarrh this mucoid degeneration may be observed to extend down to the base of the glands, so that in place of the ordinary principal and parietal cells we only find cells in the most varied stages of mucoid degeneration. This condition is especially marked in the pyloric region. Isolated cells may be found which are still intact, the mucus filling only a small part of them, while the rest of the cell is occupied by granular protoplasm and a large nucleus. In others the mucus occupies the greater part of the cells and crowds the protoplasm and the flattened nucleus against its base. In still others the cell membrane has ruptured and the mucus has escaped into the lumen of the duct of the gland, where it has been precipitated in streaks by the alcohol. This gives rise to very delicate figures, which resemble a row of horseshoes with their openings toward the lumen of the gland. Fig. 27 represents a highly magnified cross-section of a glandular duct; the section has passed obliquely through the duct just below the so-called neck of the gland. For further details see the explanation appended to the figure. That this is really mucus and not the

* Kupffer. Epithel und Drüsen des menschlichen Magens. München, 1883. Tafel I.

isolated formation of vacuoles, as described by Stöhr and Sachs, is easily proved by the reaction with acetic acid and the grayish color with hæmatoxylin; yet, I repeat, these features are only found where the mucous membrane has been placed in alcohol while still warm; in older tissues I have never met them. *Thus there is a mucoid degeneration of the protoplasm of the cells, which extends deep down into the fundus of the gland.* Whether these changes may retrograde, or whether they are permanent, I can not yet decide from the specimens which I have at present.

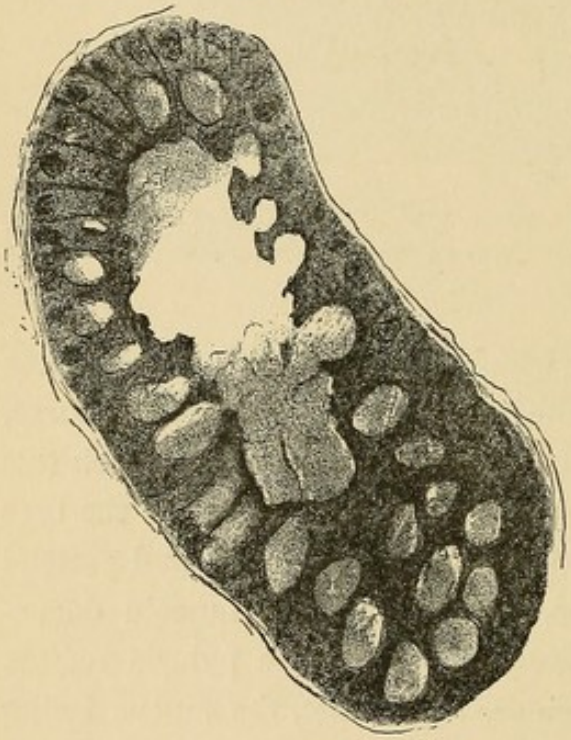


Fig. 27—The preparation from which this section was made was a piece of mucous membrane from the periphery of a resected pyloric carcinoma; the tissue was at once imbedded in alcohol while still warm. Hardening in alcohol; staining by Heidenhain's method of hæmotoxylin and chromate of potassium. The section shows the various stages of mucoid degeneration of the epithelial cells, and the crowding of the nuclei toward the base of the cell. Some of the mucus has reached the lumen of the duct of the gland by rupture of the cell membrane, and has been precipitated there in streaks by the alcohol.

As the disease advances, chronic gastritis finally causes retrogressive changes in nutrition, which are at first manifested in a progressive fatty degeneration of the glandular cells, and which finally cause complete **atrophy of the mucous membrane,** a condition to which Lewy * has recently called especial attention. This has led to further investigation on this subject, although it had already been carefully studied and illustrated by Fenwick; † yet these pictures are very incomplete according to our present notions. Freund ‡ has also described this condition in a monograph, rich in his-

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* B. Lewy. Chronische Gastritis mit Atrophie der Mucosa. Ziegler's Beiträge, Heft 1, 1886.—Ewald. Ein Fall von Atrophie der Magenschleimhaut. Berl. klin. Wochenschr., 1886.

† L. Fenwick. On Atrophy of the Stomach. London, 1880.

‡ W. A. Freund. Ueber den état mamelonné und die Granularentartung der Magenschleimhaut. Breslau, 1862.

torical data, under the name of granular degeneration of the mucous membrane of the stomach. These changes, if a large area, or especially the entire surface, of the mucous membrane be in-

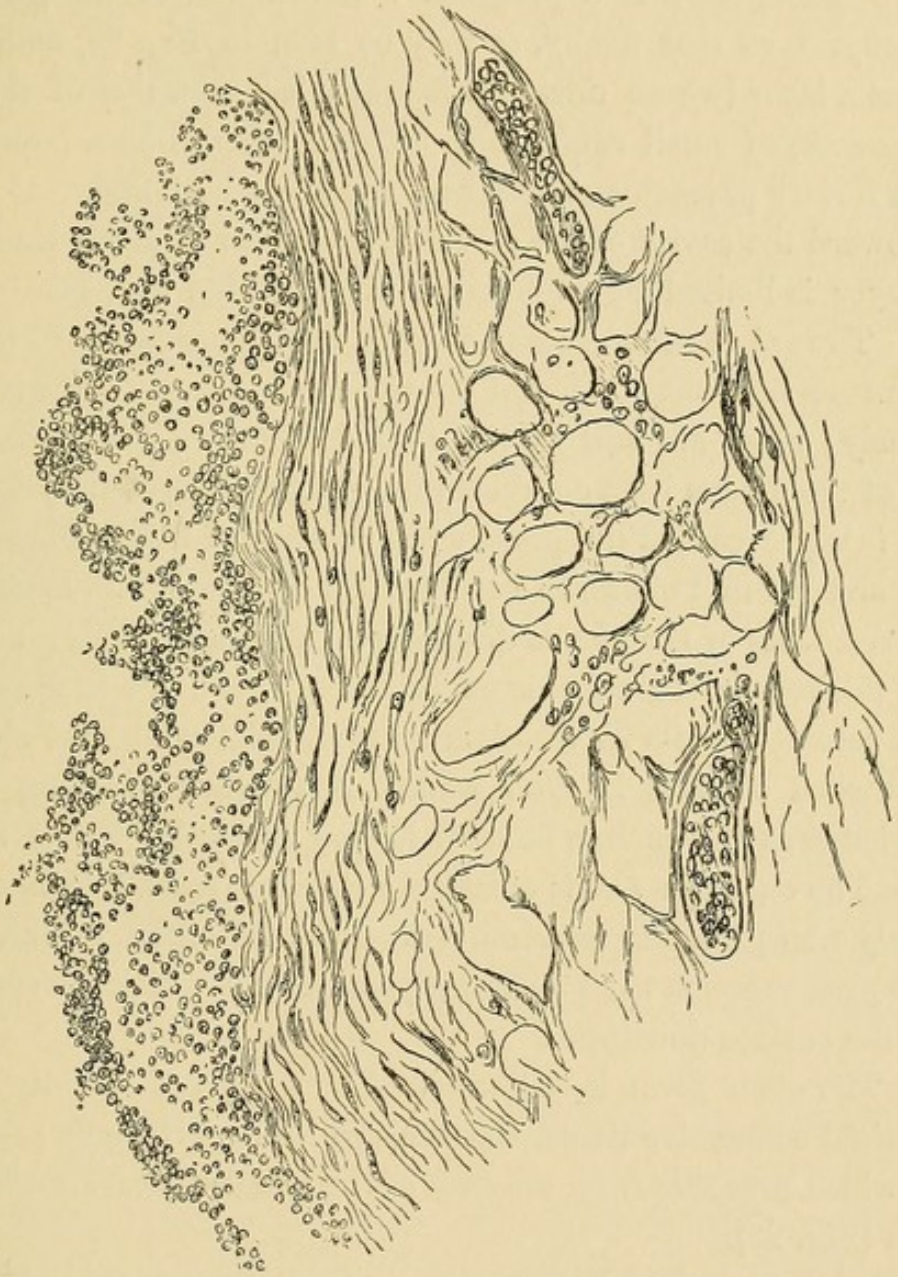


Fig. 28.—From a case of anadenia of the mucosa, with accompanying dilatation of the stomach. Instead of the mucosa we find only round cells, relatively few in number, which still barely indicate the normal villus-like arrangement. The muscularis mucosæ is much broader; the submucosa is stretched out, and contains markedly dilated blood-vessels filled with blood-corpuscles. The muscularis, which is not represented in the drawing, presented a peculiar formation of spaces between the individual bundles of muscle-fibers, causing it to look like a network of cavities. (Camera lucida.)

volved, must finally lead to a total destruction of the secreting parenchyma with all its consequences.

The process may advance in two different ways:* 1. In the one form, in addition to the above-described degeneration of the glandular cells, and a small-celled infiltration of the interglandular connective tissue, there is a progressive destruction of the glandular parenchyma, so that finally, as may be seen in Fig. 28, nothing is left but a layer (whose thickness is much less than that of the normal mucosa) of small round cells, between which isolated remnants of the former parenchyma may here and there be found.

Toward the cavity of the stomach, what was formerly the glandular layer is limited by numerous villi infiltrated with many round cells. Toward the submucosa—i. e., in the deeper layers of the mucous membrane—may be found remnants of glandular ducts running obliquely; these are still in the earlier stages of the process, and some of them have been converted into larger or smaller cysts. The latter fact proves that the process has progressed from above downward, and has first obliterated the orifices of the ducts. Later, even these remnants of the glands disappear. The muscularis mucosæ is much thickened; the submucosa becomes wider, and is drawn out into a network, while its vessels are widely dilated without showing any marked changes in their walls. A peculiar widening of the space between the muscle bundles is very noticeable in the muscularis. The organ *in toto* is enlarged; its walls appear thinned and brightly transparent in areas or throughout its entire extent. The whole process seems to be a parenchymatous one which has extended from the surface downward.

2. The other form is characterized by a marked activity of the interstitial connective tissue, and leads to its hypertrophic proliferation, which proceeds from the base of the glands upward toward the lumen (Fig. 29).

The few fibers which are normally found above the muscularis mucosæ are thickened; ascending and branching like a tree between the glands, they surround them and cut them off. Yet, unlike the

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* The description of these conditions, based upon specimens which I prepared with Dr. George Meyer, was first given by me at the meeting of the Berliner med. Gesellschaft on November 14, 1888.—Berl. klin. Wochenschr., 1888, No. 49.—[See also G. Meyer. Zur Kenntniss der so-genannten "Mägenatrophie." Zeitschr. für klin. Med., Bd. xvi, S. 366.—Tr.]

first form, no cysts are formed, since the parenchymatous cells having been deprived of their nutrition undergo atrophy; so that finally,

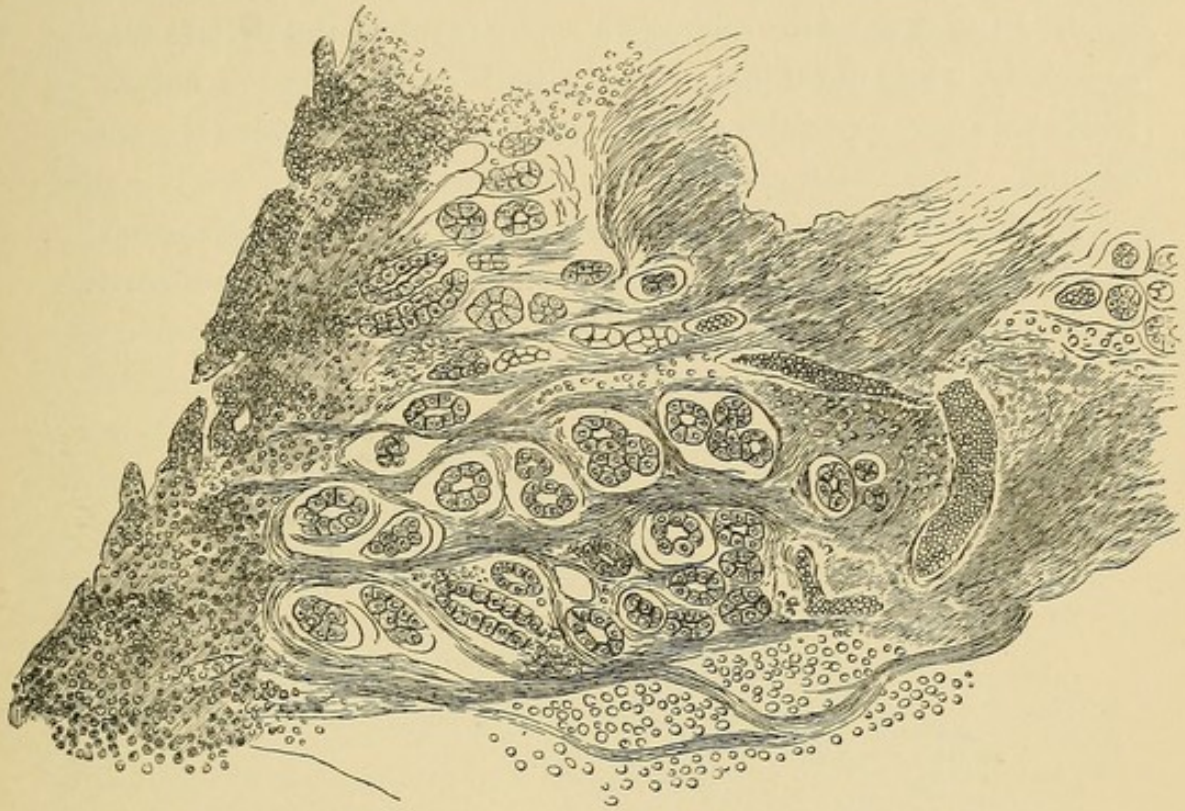


Fig. 29.—From a case of phthisis ventriculi, with cirrhotic atrophy. Broad bands of connective tissue ascend from the submucosa (situated to the right in the figure) upward between the glandular tubules, embrace them and cut them off, thereby causing the destruction of the parenchyma. In many places are to be seen numerous round cells, which surround the base of the glands, and also lie in the meshes of the connective tissue. Toward the free surface of the mucous membrane is a small-celled infiltration. The muscularis mucosæ is gone. The submucosa has been converted into a tense fibrous mass of connective tissue, in which a few isolated remnants of ruptured glands may be found. (Camera lucida.)

as is shown in Fig. 30, there remains only a meshwork with large interstices whose fibers run parallel to and terminate smoothly at the surface. Isolated remnants of ducts and cells may be found here and there in the form of hyaline inclosures. The muscularis mucosæ disappears entirely, the submucosa is traversed by bands of connective-tissue fibers, but the muscularis is apparently unaltered. The organ is not alone not enlarged *in toto*, but at times, as in a case reported by Nothnagel,* may be small and cirrhotic. I have

* Nothnagel. Cirrhotische Verkleinerung des Magens und Schwund der Labdrüsen unter dem klinischen Bild der perniciösen Anämie. Deutsch. Archiv für klin. Med., Bd. 24, S. 53.

examined such a stomach, the capacity of which was only 180 c. c. [f ℥ vj]. The membrane which has taken the place of the mucous membrane is macroscopically smooth and white, gray, or slate-colored. In such cases the sclerotic atrophy involves the pyloric region especially, while the thinning of the walls of the stomach occurs in irregular areas, especially at the fundus, or it may involve the entire organ.

In either form it is a severe, irreparable process which specially involves the glandular layer of the stomach, and which is character-

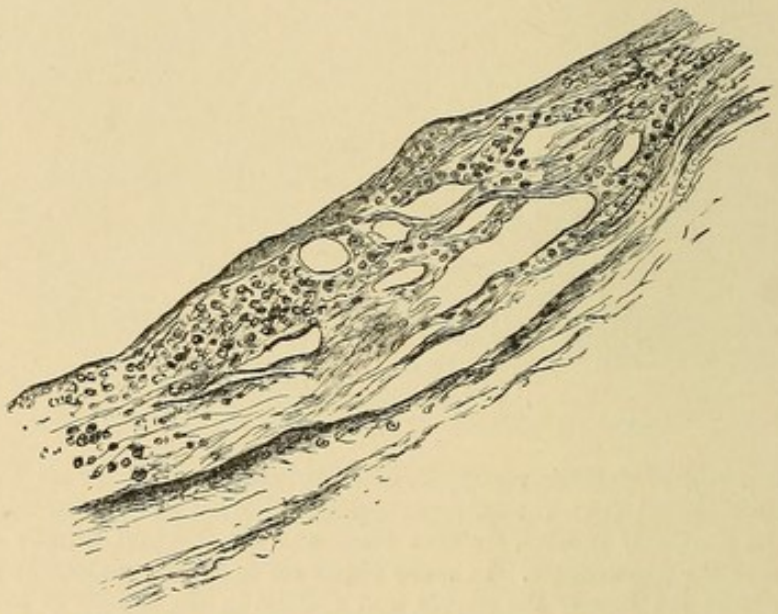


Fig. 30.—Total atrophic sclerosis of the mucous membrane, which has been converted into a long, stretched-out portion of connective tissue, with isolated round cells, and hyaline remnants of former glandular tissues. Toward the free border of what was formerly the mucous membrane (to the left of the figure) the closer packing of the fibrous bands has formed a kind of limiting membrane. The muscularis mucosæ has disappeared, the submucosa is thinned, and consists of undulating bands of connective tissue. Cystic cavities may be seen very close to the free border of the membrane.

ized by a complete disappearance of the secreting parenchyma. I therefore fully agree with Dr. George Meyer, who wishes to abolish the name of *atrophy of the stomach*, which conveys a false idea of this process, and proposes as a substitute *phthisis ventriculi*, *gastric phthisis* (*Magenphthise*). As an amendment I would suggest the name *Anadenie des Magens*, because the lesion causes a total destruction of the secreting parenchyma. It is hardly necessary to explain that such terms as *catarrhus atrophicans* or *atrophicus* are ridiculous.

So much for these final stages of chronic gastroadenitis.

Another change arises from the villous outgrowths from between the small depressions in the gastric mucous membrane; this gives rise to the *polypoid outgrowths* [**Polypi**] from it, usually the size of a milium (*Hirsekorn*) to a pea, and arranged alongside of one another in large numbers, although at times they may assume larger dimensions. Cruveilhier has a drawing of a specimen in which the polypi hang down from the mucous membrane like the teats of a young bitch. Ebstein * has studied their structure very carefully, and divides them into the pedunculated and the non-pedunculated; those occurring in groups and those which are isolated; those with a smooth and those with a polypoid mucous covering. In the affected areas the connective tissue between the glands is always increased and forces them asunder. The mucous membrane and submucosa are thickened in larger areas. In a case of Lemaître,† carcinoma and polypus were observed together; amyloid degeneration of the vessels was also present.

It is well known that intestinal polypi may not infrequently give rise to a partial or complete intussusception of the intestine, yet a similar condition due to gastric polypi is a very rare occurrence. Such a case of intussusception of the stomach, recently described by Chiari,‡ therefore deserves especial mention.

The patient was a woman, forty-four years old, who had died of marasmus. During life a tumor was felt at the pylorus; there was emaciation, accompanied by vomiting of blood; the diagnosis was carcinoma of the pylorus with consecutive dilatation of the stomach. At the autopsy a funnel-shaped depression was found on the outer wall of the stomach 8 centimetres [3 inches] from the pylorus, and into which the middle finger could be passed 6 centimetres [2·4 inches] toward the pylorus. A portion of the greater omentum had been drawn into this intussuscepted part of the stomach, but it was easily replaced. On opening the stomach it was found that the intussusception was due to three large polypi like cauliflowers, situated at the apex of the prolapsed portion of the wall of the stomach; together they formed a tumor about the size of an egg, which extended from the stomach through the pylorus into the duodenum, to a

* W. Ebstein. Die polypöse Geschwülste des Magens. Reichert und Du Bois' Archiv., 1864, S. 94.

† Camus-Corignon. Des polypes de l'estomac. Thèse de Paris, 1883.

‡ A. Chiari. Ueber Intussusception am Magen. Prager med. Wochenschrift, 1888, No. 23.

distance of 2 centimetres [0·8 inch]. Although this did not cause a complete obstruction of the pylorus, since the index-finger could still be easily passed through it into the duodenum alongside of the polypi, yet there must have been a serious obstruction to the passage of food from the stomach into the intestines. This explained what was found during life, and justified the error in the diagnosis.

The situation of polypi close to the pylorus explains why they can be drawn downward by the strong contractions of this part of the stomach, and thus cause an intussusception; the latter is exceedingly rare, as stated above, when the polypi are situated elsewhere.

Etiology.—The causes of chronic gastritis are of a very manifold nature. First, it may result from the acute and subacute forms, as oft-repeated attacks frequently lead to it, especially since the causes of all these forms may be the same. Such irritants can act more readily when the mucous membrane has been altered by changes in the circulation or in the condition of the blood, the mucous membrane being thus rendered more sensitive than it normally is. Changes in the circulation may be produced by all processes which lead to venous congestion of the stomach—that is, the affections of the organs of the portal system, especially of the liver and spleen; also diseases of the heart, and tuberculosis.

Among the conditions which probably predispose to chronic gastritis by an altered condition of the blood are chlorosis, scrofula, anæmias after dysentery, typhus and typhoid fevers, acute exanthemata, pregnancy, and uterine diseases; also diabetes, gout, and chronic affections of the kidney.

Finally, chronic gastritis may also result from direct local irritation, either as a consequence of cicatrices and neoplasms in the mucous membrane, or irritating substances which are brought in contact for a long time with the gastric mucous membrane, either from without or from the blood. Among the former is the swallowing of large, half-digested, and insufficiently insalivated morsels of food, which irritate the gastric mucosa, either directly or indirectly, by predisposing to fermentation of the stomach-contents. Another source of irritation from without may be putrefaction in the mouth from carious teeth or inflammation of the gums; these putrid products are swallowed and may cause inflammation directly or indi-

rectly. To this category also belongs tobacco-juice, which frequently causes first a subacute and then a chronic inflammation; also concentrated alcoholic beverages, and condiments in the food which may cause chronic changes after prolonged abuse; finally, true toxic substances or parasites like trichinæ, worms, larvæ, etc. On the other hand, there are also certain toxic substances which circulate in the blood and are excreted in the stomach—e. g., urea in chronic renal diseases, and the products of intestinal putrefaction in constipation.

The most important of these etiological factors is always the entrance of the above-mentioned injurious substances, and as these are usually taken of the sufferer's own free will, the disease may be classified among those in which the patient's indiscretions play a very important *rôle*. But as most persons treat their stomachs badly, and are neither able to resist culinary temptations nor take sufficient precautions at the beginning of their trouble, chronic "stomach catarrh" is one of the "best-nourished" and most prevalent diseases in the world. Indigestion is the remorse of a guilty stomach!

Clinical History.—The disease presents itself in two clinical forms, which, when fully developed, are easily differentiated: *Chronic simple gastritis* (*catarrhus gastricus chronicus*) and *chronic mucous gastritis* (*catarrhus gastricus mucosus*); both of these may finally lead to *atrophy of the mucous membrane*. Although the symptoms of these different conditions have long been known and described, yet on the one hand they have not been described as independent diseases, nor on the other hand has their mutual connection been recognized. Dr. Boas,* by using the new methods of examination, deserves the credit of having differentiated the atrophic from the mucous form, even though he goes too far in regarding the former as an independent condition. It is simply the last stage of the latter. But there are many transitional stages between the simple and mucous varieties, so that a sharp distinction between the two processes is sometimes impossible.

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* J. Boas. Zur Symptomatologie des chronischen Magenkatarrhs und der Atrophie der Magenschleimhaut. Münch. med. Wochenschr., 1887, No. 42.

In the initial stages the subjective symptoms are about the same in the different forms, namely, those of difficult digestion, or of chronic dyspepsia; it is only after the development of a progressive phthisis (atrophy) of the gastric mucous membrane—and, as it seems, only after it has been established for a long time—that the symptoms of rapid decline of the organism become manifest. The differentiation really depends on the result of the chemical examination of the stomach-contents.

Let us first consider the local and general symptoms which are common to all. The patients usually complain of a dry, pasty, or salty taste in the mouth, which is also communicated to the food during mastication. There is nothing characteristic about the tongue; it is seldom clean but usually coated, either entirely or at the base, where the reddened, swollen papillæ project like strawberries, while the edges bear the impressions of the teeth; the thick fur which accompanies carcinoma [of the stomach] is usually absent. The tongues of delicate anæmic patients have a more uniform transparent coating, giving the organ a bluish-white color. Occasionally aphthæ form at the edges and cause the patient much annoyance. In the morning the coat is much thicker than in the evening, because the movements of the tongue serve to keep it clean; if some teeth are missing, we notice that the coating is thicker on that side, although this is not always to be explained thus. The lips are usually dry and chapped. Belching is very frequent; the gas is either odorless or has an offensive sour smell and disagreeably rancid taste. It is frequently accompanied by the regurgitation of fluid or remnants of food from the stomach, having a very sour and disagreeable taste; these regurgitated masses often impart a burning and scratching sensation along the œsophagus—*heart-burn* (*Sodbrennen*) or *pyrosis*, the *ardor ventriculi* of Hoffmann. If this sensation is limited to the lower section of the œsophagus, or to the cardia, and is of an intense character, it may be termed *cardialgia*. Such an exact distinction between pyrosis and cardialgia is usually impossible, even if Cullen, of Scotland, has described, under the name of pyrosis, a peculiar group of symptoms of violent cardialgia occurring, especially among the Scotch country people, paroxysmally in the morning before eating, and which is relieved by the vomiting

of a watery fluid. On the other hand, a difference must be made between *cardialgia* and *gastralgia*, and they must not be used indiscriminately for each other, as is done by the older writers. The latter is a diffuse pain in the stomach; the former is a pain limited, as its name denotes, to about the situation of the cardia, at the line of junction between the body of the sternum and the ensiform process at the level of the sternal attachment of the seventh rib. But when the heart-burn is especially pronounced, whether along the entire course of the œsophagus or only at the cardia, or whether only sour masses are regurgitated into the mouth without causing any marked burning sensation in the œsophagus, it is always important to endeavor to ascertain its exact nature, and to distinguish sharply between the sour masses whose acidity is due to the products of fermentation and putrefaction (acetic acid, fatty acids, lactic acid) and such as owe their taste to an exaggeration of the normal acidity of the gastric juice (i. e., to a hypersecretion of hydrochloric acid), and finally from those somewhat paradoxical cases in which, in spite of the symptoms of pyrosis, as shown by MacNaught,* the acidity and condition of the stomach-contents are normal. It is only the first of these forms (which had been described by Graves as long ago as 1823) which is to be considered as belonging to chronic gastritis; the other two forms are to be classed with the neuroses of the stomach. In the latter conditions there may sometimes be such an intolerance toward acids that, as Talma† has observed, the administration of solutions of hydrochloric acid of normal or even subnormal acidity may produce the symptoms of pyrosis and cardialgia in nervous persons.

Vomiting is of very irregular occurrence; the condition of the vomited masses depends on the stage of the disease, so that the amount of digestive and putrefactive products contained in them varies a great deal. Nausea and trismus usually precede it. The appetite is either slight or may be lacking entirely; yet the good and bad phases alternate, so that in the former the patients often easily commit dietetic errors and cause fresh irritation. Many patients go

* MacNaught. Med. Chronicle [Manchester], January, 1885.

† Talma. Ueber Behandlung von Magenkrankheiten. Zeitschrift für klin. Med., Bd. 8, S. 407.

to the table with good appetites, but the first few morsels satisfy their cravings; others verify the saying, "*L'appétit vient en mangeant.*" While in the latter there is just enough irritation to stimulate the glands to secretion, in the former it is too much for the irritable mucous membrane, and may check the secretion by causing an abnormal hyperæmia. Without being really thirsty most patients desire a "hearty swallow," or some sour drink, and demand fluids, especially while eating. Soon after eating the patients feel oppressed and bloated: they do not complain of a true spontaneous pain in the epigastrium; it is more of a choking, a vague sensation which only becomes a slight pain on pressure over the stomach; true gastralgiæ do not belong to the ordinary symptoms, and their occurrence should always lead us to suspect the presence of other lesions. The patients very frequently have the feeling that the food remains abnormally long in the stomach, and they often describe very effectively the vain efforts of the oppressed viscus to drive the ingesta on into the intestines.

In fact, finally, these conditions may be combined with weakness of the gastric muscular wall—*atony of the stomach*—which in turn causes a lengthened stay of the food in the stomach. As a result, decomposition takes place in the ingesta; the carbohydrates ferment; the albuminoids putrefy—a condition which Escherich has called "alkaline fermentation." This produces distention of the stomach with gas, eructation of offensive gases, and regurgitation of sour and rancid masses. The distention of the stomach in turn paralyzes its muscular fibers and causes a feeling of tension and pain; the decomposed or insufficiently digested stomach-contents irritate the intestines, and the conditions thus produced are reflected back to the stomach, and thus the vicious circle which is present in all affections of the stomach is completed. I have already shown how these conditions may finally lead to dilatation or a true gastrectasis (pp. 130 *et seq.*); here I wish to simply add that these decompositions usually occur at night; in the morning they may be absent or only very slight.

Constipation exists, as a rule; exceptionally the evacuations are regular; in a few cases diarrhœa and constipation alternate; if hæmorrhoids are present, as frequently happens, the movements are

painful. The stools are sometimes light-colored, sometimes dark-green; or they may be very offensive and contain undigested food. The patients have the sensation that the evacuations are incomplete, and suffer much from flatulence and rumbling in the abdomen, which is sometimes loud enough to be heard at a distance. Often, instead of true fæces, the stools are watery or slimy, as a result of the irritation of the intestinal mucous membrane by hard scybalæ; for, if the rectum of these patients be examined, it will be found full of hard masses, which can not be expelled on account of the paresis of the muscular fibers of the gut.

The urine is scanty, deposits urates abundantly, and is at times alkaline from basic salts. Unfortunately, as yet we have no exact investigations to show how the disturbances of the metabolism are manifested through the kidneys, although in connection with our recent knowledge of the formation of alkaloids in the organism this would seem to be a very promising field for investigation.

Among the general symptoms we notice a diminution of mental activity, disinclination to bodily exertion, languor during the day, especially after meals, headache or a feeling of oppression in the head, and a morose, irritable disposition. The patients frequently complain of a feeling of heaviness in every limb, cold extremities, itching, and formication. Sleep is deep and longer than usual, but is not refreshing and is disturbed by hideous dreams. Yawning is frequent and is accompanied by an unpleasant sensation of puckering in the mouth and an increased flow of saliva; the patients "hack" very frequently and expectorate tenacious mucus containing dark particles. This is the so-called "stomach cough of dyspeptics," which of course has no more to do with the stomach than that the pharyngeal catarrh which causes it is usually due to the same factors as the gastritis—i. e., abuse of irritating substances, especially alcoholic beverages.* At all events, it may happen that the already inflamed pharyngeal mucous membrane may be irritated by the re-

* The existence of a true "stomach cough" has not yet been proved—that is, a reflex act starting from the mucous membrane of the stomach and causing acts of coughing. Such eminent authors as Naunyn, Nothnagel, and Edleffsen directly deny it. Recently a case of paroxysmal coughing proceeding reflexly from the gastric mucous membrane has been published by E. Bull. Deutsch. Archiv für klin. Med., Bd. 41, S. 472.

gurgitation of the acid stomach-contents and thus may cause cough reflexes to be sent out from the crossing of the œsophagus and bronchi. Such "coughs" usually disappear after neutralizing or lessening the acidity of the stomach-contents.

The pulse is small and weak, sometimes intermittent, and this irregularity of the heart action is felt by the patient as palpitation. Some patients have a certain characteristic odor which is also communicated to their underwear, and with each exacerbation this odor becomes stronger. Evening rises of temperature may also be observed in this disease, and have indeed required antipyretic treatment, and have even been mistaken for typhoid fever [or malaria].*

All of the above symptoms will not be found in all cases nor even in the majority of them. Sometimes one, sometimes another symptom will predominate and characterize the clinical picture. Thus some patients complain only of the distention of the abdomen and marked dyspnœa, and thus we have the group of symptoms described as *dyspeptic asthma* (*asthma dyspepticum*). Others are annoyed especially by the cough, loss of appetite, acid regurgitation, choking and burning sensation in the abdomen. In still others, the irregular heart action, palpitation, irregular and intermittent pulse are especially prominent and may arouse suspicions of organic cardiac disease. These symptoms occur especially during digestion, are complicated by pulsation in the epigastrium, but are less marked when the stomach-contents pass into the intestines or when the tension is lessened by belching up gas. A variety of this *cardiac dyspepsia*, which had already been described by Henoch,† has recently been especially studied and published by Rosenbach,‡ under the title of "*Ueber einen wahrscheinlich auf einer Neurose des Vagus bestehenden Symptomencomplex*" ["On a Group of Symptoms probably due to a Neurosis of the Vagus"]—(see chapters on the gastric neuroses). But common to all patients is the very slight

* [On the other hand, cases not infrequently occur in which the dyspeptic symptoms, gastralgia, and vague fever disappear promptly on the administration of antiperiodic remedies.—Tr.]

† *Loc. cit.*, p. 391.

‡ O. Rosenbach. Neurose des Vagus bei Dyspepsie. Deutsch. med. Wochenschr., 1879, Nos. 42 and 43.

tenderness on pressure or spontaneous pain in the epigastrium and the chemical changes in the digestive processes.

Here I may also mention that peculiar condition first described by Trousseau as *vertigo gyrosa* or *vertigo e stomacho laeso* (*vertigo stomachalis*), gastric vertigo, and also discussed at about the same time by Brück, of Osnabrück,* as *Schwindelangst* ("vertigo-fear"), *aura vertiginosa;* this subject has since been carefully studied by Blondeau, Niemeyer, von Basch, Westphal, Cordes, Eyselein, and others. But Trousseau deserves the credit of having first directed attention to the relation of these attacks of vertigo with chronic catarrhal gastritis. They occur without loss of consciousness, begin usually some time after eating, although sometimes they may be checked by taking food, but can not be produced either by rapid circular movements or by inclining the head forward, or similar motions. The attacks pass away after remaining quiet and regulating the diet, but are usually followed by severe headaches. Sometimes these attacks assume the form of the agoraphobia, and have been described as such by the writers last mentioned above. Here the patients experience an indefinable terror; they may even be unable to go alone over large open fields, places, or broad streets, either avoiding crossing such places entirely or seeking company even of strangers. Granting that these conditions actually belong to or border upon the mild psychoses, yet they must not be regarded as neuroses of the stomach in the sense that there is a disease of this organ due directly or indirectly to the nervous system. On the other hand, they must be considered reflexes from an organic disease of the stomach upon the brain, and are thus to be sharply differentiated from the conditions to be presently described as nervous dyspepsia. We may accept the explanation of their origin proposed by Mayer and Pribram that the arterial pressure in the cerebral vessels is raised by the reflexes from the walls of the stomach, or the assumption of Bernstein and Asp that they are due to an irritation of the splanchnic.

The following cases may be cited, since these conditions are not common. The patients were middle-aged men, for it usually occurs

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* Brück. "Vom Schwindel." Hufeland's Journal, Bd. 17, St. 5.

in such patients, although the ages of the 54 cases collected by Cordes * vary between nineteen and forty-seven years. Common to all of them is the chronic catarrhal gastritis, and the disappearance of the agoraphobia after this was cured.

The first case was a captain, who, while complaining to me that he suffered from mild local gastric troubles, and occasional slight headaches, said that for some time he had also experienced real terror when walking or riding over large, open places to such an extent that he was unable to cross the parade-ground alone ; if he did succeed in riding over it, when half-way across he was seized with such terror that he had to dismount—and that then, while leading his horse by the bridle, he could proceed without any further trouble.

The second case also happened to be a military officer, on duty at the ministry of war, who said that he had the greatest fear of a smooth level area on which there was no resting-place for the eye. Thus he could not go alone through large, empty rooms with hard-wood floors, and that it was especially disagreeable to him to walk on the smooth asphalt pavement, so that he either made detours or sought company.

The third case was a government employé who had to pass over an open square every day to reach his office ; at first, while crossing this, a feeling crept over him that it was impossible to reach the other side, and that the ground shook under him. If he attempted to force his way, after a few steps he was attacked with such vertigo that he feared he would fall, and had to give up the attempt.

In all these cases this psychosis disappeared entirely as soon as the gastric symptoms were cured by suitable treatment.

As I have already stated, the differences between these two or three varieties of chronic catarrhal gastritis are manifested not so much by the subjective and objective symptoms as in the variations in the chemical processes of the stomach, as revealed by careful chemical tests. To avoid repetitions, I shall consider this while speaking of the diagnosis. Here I simply desire to add a few words to what has already been said about **atony of the stomach.**

The conception and the term *atony* have been used so long in the pathology of the stomach that the attempts of von Pfungen † to describe a new disease under this title do not seem to me to be justifiable. If by the term atony we understand, as its name denotes, a deficiency in the muscular tone, and as a result an insufficient muscular activity, a mechanical or muscular insufficiency of the stomach,

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* Westphal's Archiv, Bd. iii, S. 521 ; also Bd. v.

† R. v. Pfungen. Ueber Atonie des Magens. Wien, 1887.

then it is not proper for certain writers to also include disturbances of the glandular secretion. Atony arises either idiopathically or deuteropathically, primarily or secondarily, as we prefer to express it now. Primary atony is, in my opinion, a neurosis and is always a rarity. Secondary atony is associated with nearly all affections which involve larger areas of the gastric mucous membrane; in fact, we may say that the first marked objective symptoms are usually due to the atony, since before the tone of the organ is lost the damage done by an insufficient secretion or incomplete absorption is compensated by the muscular fibers of the stomach—that is, the chyme is still properly expelled into the intestines. But it also occurs in conditions of general debility which lead to torpor and insufficiency of individual organs as well as of the general metabolism; hence it is especially frequently observed in the initial stages of rickets and scrofula in children and also in phthisis, chlorosis, etc. The large, distended abdomens of scrofulous children are classical proofs of this. Here there is an atony of the stomach and intestines which leads to manifold disturbances of digestion and nutrition, and causes the dilatation of the stomach which occurs sooner or later, as I have already stated. In these cases the atony is never a primary lesion, but is always the result of a general dyscrasia. It is only primary in so far as other diseases of the stomach arise from it. Therefore, atony of the stomach deserves an important place, as was first shown by Rosenbach in a careful analysis entitled "*Der Mechanismus und die Diagnose der Mageninsufficienz*," and still more completely applied in every direction by von Pfungen in the work cited above; and the more so, because the primary forms with their mechanical changes influence the chemical and other functions as well as those of motion.

Hence, in all severe cases of chronic gastritis the salol test shows a delay in the expulsion of the chyme into the intestines, but it is normal in mild cases. On the other hand, this also explains why, as has already been referred to, dilated stomachs cause no subjective symptoms as long as the muscular power of the stomach is able to maintain an equilibrium in spite of the increased burden, and as long as the salol test indicates a normal expression of the chyme. I will not now enter into an irrelevant discussion to which the latest

investigations have led as to whether there is a separate disturbance of the peristalsis of the fundal or pyloric portions of the stomach; the result is the same so far as we are now concerned, but I will consider this in greater detail when speaking of atony as a nervous condition. For in the present cases the atony is only a secondary pathological process, and is only to be regarded as a symptom and not as an independent disease. There are constitutional reasons why it appears early in some and later in others; why the course is mild or severe, and why its origin may even be traced back to childhood in some cases (*vide* reports of Wiederhofer, Kundrat, Comby, and others). But whether the atony is primary or secondary, it leads in all cases to a relaxation and distention or even a dilatation of the viscus which, as Poensgen has observed, other things being equal, occurs the more readily the more relaxed the anterior abdominal wall is and the less support afforded by it to the stomach.

A very interesting feature is the final stage of chronic catarrhal gastritis already spoken of [page 318] as **atrophy of the mucous membrane,** or better, **anadenia** [*ἀνά*, without; *ἀδήν*, gland] **of the stomach** (*Anadenie des Magens*), since this is not so much a disturbance of nutrition which spares the structure of the tissue; it is rather a process which causes a complete destruction of the glandular parenchyma, and whose gradual development may be designated *phthisis mucosæ;* it has also been improperly called gastric phthisis.

This process may be partial or complete; it assumes importance only in the latter case, since the destruction of circumscribed areas in the former may easily be compensated by the rest of the parenchyma. According to the anatomical details of the lesion already given, we observe a progressive loss of secreting elements which must finally lead to a total abolition of secretion; and with this the digestive activity of the stomach is gradually and irrevocably destroyed. The consequences of this process are self-evident. After a longer or shorter period, marked by dyspeptic complaints, so severe a disturbance of the nutrition is developed that the patient literally pines away "like a lamp the oil of which has not been replenished," and finally dies of marasmus. At all events, we now possess sufficient clinical data to show that the intestines may act vicariously for the stomach, and may assume the entire task of assimilation of the nu-

trition. But this seems to be limited to a definite time, which varies in different individuals; for sooner or later pathological processes also attack the intestine and abolish its activity, either on account of the extra work imposed upon it, or other accidental causes. Then the compensatory action of the intestines suddenly ceases, and apparently a fresh disease breaks out. The conditions which prevail here can not be different than in other viscera; at least, we know of no associated organs with vegetative functions which are of great importance to the economy where one could replace the other for an indefinite time. Of course, we know that it can be done for a short period, but not beyond that; it is true of the lungs as well as of the kidneys. The same occurs in the individual sections of the digestive tract, and just as it is impossible to nourish a person indefinitely per rectum, so the stomach can not permanently lie idle; for it is not merely a place for digestion and disinfection, but it is also an organ of vital importance.

During the period of compensation the general condition of the patient will depend entirely upon the extent to which the motor functions of the stomach—i. e., its ability to forward its contents on into the intestines—are preserved; in other words, whether the muscular fibers are intact, paretic (dilatation), or have increased power (hypertrophic cirrhosis). Finally, this vicarious activity becomes exhausted, possibly an atrophy of the intestines also develops, although we have as yet no absolute proofs of this, and now are added the symptoms due to insufficient regeneration of the blood, a picture which may be very similar to pernicious anæmia, unless there has been such a gradual failing of the faculties that death may be said to have resulted "from old age." For I have frequently convinced myself at the autopsy-table that in many of the cases said to have died from old age there has actually been an extensive anadenia, usually combined with dilatation of the stomach. The similarity of the symptoms to those of pernicious anæmia has already * been

* [Austin Flint was the first to call attention to the relation between anæmia and atrophy of the gastric glands. He expressed the opinion that some cases of obscure and profound anæmia are dependent upon degeneration and atrophy of the glands of the stomach. See American Medical Times, 1860; New York Medical Journal, March, 1871; Flint's Practice of Medicine, Philadelphia, 1881, p. 477.—Quoted by Welch, *loc. cit.*, p. 616.—Tr.]

noted by Fenwick,* Bartels,† Scheperlen,‡ and Osler.# Rosenheim ‖ has observed two cases which seemed to be pernicious anæmia. Inasmuch as these cases also have marked changes in the blood, alterations in the red corpuscles, relative increase of the white, and the formation of macrocytes and microcytes, the question may arise whether pernicious anæmia is really an independent disease or is the result of anadenia of the stomach; but in the cases of pernicious anæmia described by Quincke, and also by Immermann, the changes found in the stomach were insignificant as compared with the intensity of the symptoms. A striking feature which has been observed by several writers (Fenwick, Ewald, and Nothnagel) is the good condition of the subcutaneous fat, which, however, is not often found in disease of the blood, in consequence of the lessened thoroughness of oxidation.

Naturally, this variety of chronic gastritis is especially frequent in older persons, since the compensatory and reconstituent powers of the tissues are greater in the young. Most of the cases have been over forty years of age, and in the two young patients, eighteen and twenty-one years old, reported by Litten ^ and Einhorn, the diagnosis was not verified by autopsy.

However, that a well-marked atrophy of the stomach may also occur in the young has been demonstrated by Westphalen,◊ in a case which was very carefully observed during life, and the diagnosis verified by an exact microscopic examination of the stomach. The patient was a young man, twenty-eight years old, who presented the symptoms above mentioned; the diagnosis was made of motor insufficiency of the stomach and anadenia of the mucous membrane.

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* S. Fenwick. *Loc. cit.*

† Bartels. Ein Fall von perniciöser Anämie mit Icterus. Berliner klin. Wochenschr., 1888. No. 3.

‡ Scheperlen. Studier angaaende Anæmie. Nord. medic. Arkiv, 1879, Bd. xi, No. 3.

Osler. Atrophy of the Stomach with the Clinical Features of Progressive Pernicious Anæmia. American Journal of Med. Sciences, 1886, No. 4.

‖ T. Rosenheim. *Loc. cit.*

^ M. Litten und Rosengart. Ein Fall von fast völligen Erlöschen der Secretion des Magensaftes. (Atrophie der Magenschleimhaut der Autoren.) Zeitschrift für klin. Med., Bd. 14, S. 573.

◊ Westphalen. St. Petersburger med. Wochenschr., 1890, No. 37 u. 38.

As the emaciation became progressively greater, the operation of gastroenterostomy was performed. The patient died shortly after the operation. The results of the microscopic examination of the stomach coincided entirely with the statements of Lewy, Ewald, and Meyer.

At the present time I am treating a young druggist who has been under my observation for over two years. At first he complained of vague dyspeptic symptoms, weakness, and loss of weight. During the whole course of his illness, in spite of frequently repeated examinations, not even a trace of free hydrochloric acid or pepsin could be detected. Even the administration through the tube of a large quantity of a 0·2-per-cent hydrochloric-acid solution, which was expressed after about half an hour, did not produce any digestive action [in the test-tube] as occurs in healthy individuals. The patient daily takes 3·0 grammes [gtt. xlv] of hydrochloric acid, Ph. Germ. (containing 25 per cent pure HCl); he has improved so much that he now feels very well and works all day. He has gained in weight, and has a healthy look. The last time I saw him (September, 1891) I was again unable to find any free acid in the stomach-contents.

In my opinion, the hydrochloric acid which is prescribed has no digestive action in this and similar cases. As has already been explained, the patient owes his good condition to the vicarious action of the intestines and the competency of the muscular fibers of the stomach, which promptly propel the stomach-contents on into the intestines. The acid simply prevents their decomposition, while the stomach acts merely as a kind of reservoir for supplying the intestines.

Diagnosis.—The objects of the diagnosis are, first, to differentiate chronic catarrhal gastritis and its results from other diseases; and, secondly, to distinguish its varieties from one another. The disease occurs so frequently as an accompaniment of the most varied local affections of the stomach that I will disregard its secondary occurrence and restrict myself to the genuine varieties. From the description of the symptoms already given it may readily be inferred that the diagnosis of such a true gastritis can only be made by exclusion—that is, after having shut out all the other organic and func-

tional disorders of the organ. An idiopathic gastritis can only be diagnosticated after ulcer, carcinoma, dilatation, neuroses, or any of the acute disorders already described has been excluded. What is left is gastritis; but just as readily as the diagnosis "chronic gastric catarrh" is made, just so little is such an off-hand opinion justified in many cases; for the symptoms of chronic gastritis may at times simulate any of the above-mentioned disorders, and neither the duration, nor the etiology, nor the kind of dyspeptic manifestations will suffice to make the diagnosis at once, but in addition there must be a careful examination with the aid of all our modern diagnostic resources. The diagnosis of chronic gastritis having been made in this way, the next step is to determine which variety we have before us. Our only means for this purpose is the examination of the stomach-contents. The results of these may be grouped as follows:

1. *Simple chronic gastritis.* While fasting, the stomach contains only a small quantity of a watery, mucous fluid, frequently tinged yellow or yellowish-green by bile, and sometimes mixed with duodenal contents; on standing, it deposits a sediment containing epithelial cells of various sizes and shapes, numerous round cells and free nuclei, also small quantities of remnants of food, starch granules, muscle fibrillæ, and vegetable cellular tissue. After the test-breakfast the acidity is variable but never increased; the quantity of hydrochloric acid is lessened. Pepsin and rennet are small in amount, but form propeptone and peptone even in the stomach; can digest after acidulating. Usually contains lactic* and fatty acids, although they are not always found.

2. *Chronic mucous gastritis.* This differs from the simple form by the abundance of mucus in the contents of the stomach while fasting and after taking food, so that acetic acid always gives a marked mucin reaction. Acidity always low. Hydrochloric acid usually absent. Propeptone very abundant, peptone only in traces. Trial digestion [in the test-tube] occurs only after adding hydrochloric acid, and is slow even then. Curdling by rennet is tardy or absent. In the wash-water after lavage small, frequently bloody

* By "absence of lactic acid" I mean that the filtrate of the gastric contents gives no reaction with Uffelmann's reagent, either as such or in the ethereal extract obtained after shaking with a triple volume of ether. (See above, pp. 34 *et seq.*)

fragments of the epithelial covering of the mucous membrane may occasionally be found.

3. *Atrophy.* This differs from the two varieties already named, in that while fasting the stomach is usually empty, and that the chyme expressed after the test-breakfast contains neither mucus, hydrochloric acid, pepsin, nor rennet. At all events, some caution is required in determining the absence of pepsin. Jaworski properly calls attention to the fact that the simple addition of a few drops of hydrochloric acid to gastric contents containing none of this acid, before trying artificial digestion in the test-tube, is not sufficient to determine the presence or absence of pepsin. On the contrary, enough acid must be added till the color-tests indicate the presence of *free* acid; only then will the positive or negative results of the digestion experiments be decisive.* For a long time I have used no other method, and I confess that I have always considered the procedure self-explanatory. Now, as hydrochloric acid is a decided stimulant for the secretion of pepsin, or rather for the transformation of pepsinogen into pepsin, it is advisable to follow Jaworski's suggestion in cases of deficient hydrochloric-acid secretion where we wish to be certain of the absence of this ferment: 200–300 c.c. [f ℥ vjss.— x] of diluted hydrochloric acid are administered, and half an hour later the stomach is siphoned; the fluid is then tested as to its digestive powers, and by using suitably diluted portions we may obtain an approximate idea of the amount of pepsin present.†

Naturally, no tissue elements of the glandular parenchyma are to be found in the contents of a totally atrophied stomach; a few degenerated round cells and micro-organisms may be all that is found.

These differences will generally enable us to distinguish the different varieties of the disease. Yet, as already stated, there are intermediate forms, especially between the simple and the mucous, which can not be definitely classified. However, the greatest diag-

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* [All the methods thus far proposed for making quantitative estimations of pepsin are tedious and complicated. See Boas, *loc. cit.*, p. 24.—Tr.]

† Jaworski. Zur Diagnose des atrophischen Magenkatarrhs. Verhandlungen des vii. Congresses für innere Medicin. Wiesbaden, 1888.

nostic difficulty is encountered in differentiating atrophy or anadenia of the stomach from the cases of gastric neuroses and carcinoma, accompanied by complete loss of secretion. From the neuroses it may be distinguished, as a rule, by the fact that these occur usually in middle-aged or young persons, and that their course is irregular, while atrophy occurs in older persons and is permanent. Thus, for a long time I have been treating a young man in whom the results of the chemical examination are always those of atrophy, but whose other symptoms all point to nervous dyspepsia.

The chemical differentiation of carcinoma and atrophy is much more difficult—that is, where the ordinary symptoms of the former, tumor, swelling of the lymphatic glands, cachexia, and hæmatemesis, are absent; because in both hydrochloric acid, pepsin, and rennet may be absent. Here only one symptom has been of service to me; at all events, it is also a very valuable point in the diagnosis of cancer. I refer to the bloody color of the stomach-contents, due to the presence of altered blood pigment, which is frequently observed in carcinoma, even where there has been no hæmatemesis; so far as I know at present, this never occurs in anadenia of the gastric mucous membrane.

Course and Prognosis.—The long duration of chronic gastritis is indicated by its name. This is especially due to its tendency to relapses, or, more properly speaking, exacerbations; for, even in apparently cured cases the organ is left in such a sensitive condition that the slightest irritation, or even a deviation from a specified diet, may cause a fresh attack. Therefore the prognosis of the disease should not be considered too slightingly, especially as in prolonged cases atrophy, an incurable and fatal lesion, may be developed. A large number of the cases which are usually said to have died of old age really perish from gastric atrophy; but it is generally not recognized, since its symptoms are as yet not well known, and because the macroscopic changes in the stomach are not marked. Finally, there is another reason why the significance of chronic gastritis is not to be underestimated, namely, the disturbances of nutrition and the resulting deterioration of the tissues render the organism less resistant toward, and more susceptible to a series of other poisons, of which I shall only mention tuberculosis and acute articular rheu-

matism. As certain as it is, on the one hand, that tuberculosis leads to gastric catarrh, so probable is it, on the other, that even though the latter does not produce the predisposition for the former, yet if the stomach trouble is once present it favors and increases the advance of the tubercular infiltration.

Treatment.—Our remedies must be divided into three groups: (1) those which aim to directly replace the deficient supply of gastric juice; (2) those which are to stimulate the depressed functions of the organ; (3) those which are capable of counteracting the irritant substances introduced from without.

This includes the use of hydrochloric acid, pepsin, and of the so-called peptogenous substances. The therapeutic employment of the latter depends on the well-known claims of Schiff and Herzen of the effects of certain (peptogenous) substances (bouillon, dextrin, bread-crumbs);* but, as I have already shown, this peptogenous, or rather pepsinogenous, action of these substances depends only on the stimulation of the gastric glands, such as is exerted by all kinds of nutritious substances; the stomach is filled with active digestive substances, the peptic power of which must be of assistance to the ingesta which are swallowed later. Still, Dujardin-Beaumetz † has proposed an *elixir peptogène*, which consists of 10 parts of dextrin, 20 of rum, and 180 of sugar-water; and Labastide ‡ attributes to peptone enemata the power of at once relieving obstinate anorexia by the administration of peptogenous substances.

Hydrochloric acid is of the greatest importance in the treatment of chronic gastritis because it not alone replaces the deficiency in the secretion and forms acid albuminates so essential for peptonization, but also because it prevents organic fermentation, or lessens it if already present. Apparently in relation to such organic fermentations even Heberden says, "*Potus acidi non semper nocent aegris acore ventriculi laborantibus nonnunquam etiam auxilio sunt.*" # Pemberton says the same. As this checking of fermentation is due

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* Ewald. Klinik, etc., I. Theil, 3. Auflage, S. 108.—A. Herzen. Altes und Neues über Pepsinbildung, Magenverdauung und Krankenkost. Stuttgart, 1885.

† Dujardin-Beaumetz. Journal de thérap., 1880, p. 828.

‡ Labastide. Gazette d. hôpit., 1883, p. 332.

Quoted by Budd, *loc. cit.*, p. 424.

to hydrochloric acid alone, it is wrong for some writers to recommend lactic or citric acid instead of it, for they have no such antifermentative action. In all cases where a diminution or absence of hydrochloric acid has been determined—i. e., in all cases of chronic gastritis—it is therefore to be given, preferably as the dilute hydrochloric acid of the pharmacopœia * in large quantities, and certainly in larger doses than have thus far been recommended. Jaworski has shown that considerable quantities of hydrochloric acid may be introduced into the stomach without harm; therefore, I order it in as concentrated a watery solution as possible—i. e., as sour as the patient's mouth will tolerate—to be taken three or four times, at fifteen minutes' intervals, after the meal; a glass tube should be employed, as the prolonged use of the acid affects the teeth. Pills may also be made with bolus alba (Ph. Germ.) [argilla] and a few drops of dilute muriatic acid; five or six of these may be ordered at a time, to be taken with a glass of water. I have prescribed this remedy for months at a time, without any bad effects.

Pepsin was for a long time regularly prescribed with the muriatic acid, with the pernicious idea that even if it did not help, it certainly did no harm. To-day, however, we know that pepsin is present in a very large number of cases, even when free hydrochloric acid is absent, and that, as shown by Jaworski,† and as I can corroborate from one of my own cases, of permanent absence of free hydrochloric acid, pepsin can be extracted from the glands of the human stomach by means of this acid. We should therefore restrict its administration to those cases in which its absence can be actually proved —that is, to cases of advanced mucous catarrh and of atrophy. It is then to be given in large doses, 0·5—1·0 gramme [gr. vijss. to xv], preferably dissolved in water acidulated with hydrochloric acid, fifteen to twenty minutes after eating, for, even though small traces of pepsin are said to liquefy large quantities of albumen, yet the artificial pepsin preparations contain a considerable amount of milk

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* [Acid. hydrochlor. dil. (Ph. Germ.) has 25 per cent pure HCl.—Tr.]

† W. Jaworski. Die Wirkung der Säuren auf die Magenfunction des Menschen. Deutsch. med. Wochenschr., 1887, Nos. 36–38.—Also, Methoden zur Bestimmung der Intensität der Pepsinausscheidung. Münchener med. Wochenschr., 1887, No. 33.

sugar;* and further, only a portion of the pepsin is active, because a part of it is soon carried on into the intestines. In cases of complete absence of hydrochloric acid it would seem rational to administer pancreatin or papoid.† However, experiments made under my direction, by Dr. Haafewinkel, showed that the various preparations of pancreatin which were given with the test-breakfast had no stimulating effect on its digestion.

The object of the second class of remedies is to increase the activity of the glands. Pre-eminent in this group is *lavage of the stomach*, which, excepting in dilatation of the stomach, has nowhere achieved greater success than in chronic gastritis. This is true of the simple and especially of the mucous variety. It is well to combine the stomach-douche with the lavage; this is continued till the wash-water runs off perfectly clear, and then a quantity of water or medicated solution may be left behind in the stomach.‡

At first we use clear warm water, which may be replaced at the conclusion with an alkaline or antiseptic solution, as the case may demand. The former is employed where mucus is abundant, the latter for the fermentative processes. The great advantage of the tube is that we can introduce much larger quantities of unpleasant or irritating substances than would be possible by the mouth, because they can be removed at once. Even after a relatively small number of washings a marked improvement in the local process and a great relief to the patient may be observed. I could cite a large number of cases to corroborate this, but I shall not do so, because there is nothing characteristic about them; yet I repeat, that cases which have resisted the usual methods of treatment for months, and even years, have been greatly relieved and even cured by lavage, in a relatively short space of time, this treatment having been of course accompanied by other suitable therapeutic measures.

When the condition of the patient prevents a systematic use of the tube—the patients no longer object to the use of the much-abused "stomach-pump," now that the public is better informed of

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* [Hence the great advantage of Fairchild's glycerinum pepticum, which contains no sugar. See foot-note, p. 41.—Tr.]

† [Finkler. Therapeutic Gazette, August 15, 1887.—Tr.]

‡ [See addendum, p. 361.—Tr.]

the necessity of the modern methods of examination and treatment of gastric disorders—I replace it by ordering large quantities, up to half a litre [pint], of a one-per-cent solution of common salt at 42° C. [107·5 Fahr.], or Wiesbaden *Kochbrunnen*, or warmed *Rakoczy* [Kissingen] water. The action of lavage consists in the removal from the stomach of remnants of food which have remained there unduly long, and the loosening of the mucus which adheres to its walls, partly chemically, partly mechanically; furthermore, the introduction of the tube, combined with the entrance and exit of the water, increases the peristalsis and strengthens the muscular activity as well as favorably influences the glands, or, as put by Oser, "it produces a healthy reaction." The sodium chloride is certainly not without value, notwithstanding the fact that Pfeiffer has shown that the addition of it in artificial digestion lessens the digestive power. The experiments of Braun and Grützner, as well as of Boas, agree that the addition of common salt to the blood increases the secretion of gastric juice, and seem to me, for many reasons,* to be more convincing than experiments with the incubator. At all events, the results at Wiesbaden and Kissingen and of daily practice disprove it. Massage, and especially electricity, are excellent agents for strengthening the enfeebled muscular fibers of the stomach (gastric insufficiency or atony). As stated in Lecture II, it is best to use internal faradization of the gastric walls by means of Einhorn's electrode or my modification of it. The stomach is filled with some water in order to diffuse the current as much as possible, and the circuit is closed by a flat electrode (about the size of the palm of the hand) which is placed on the epigastrium.

Among *the stimulants of the glandular secretion* we must not fail to consider the action of the so-called *bitters* and *carminatives*, the use of which dates back to antiquity, although recently the experiments of Tschelzoff on dogs and of Jaworski † on human beings seem to prove the contrary, namely, that they lessen the amount of the secretion. On the other hand, Marcone,‡ after testing sixteen

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* *Vide* Ewald, Klinik, etc., I. Theil, 3. Aufl., S. 246.

† W. Jaworski. Experimenteller Beitrag zur Wirkung und therapeutischen Anwendung der Amara und der Galle. Zeitschr. für Therapie, 1886, No. 23.

‡ Marcone. Riforma medica, June 8, 1891.

stomachics and aromatics, claims that all of them increased the quantity of the gastric juice. He asserts that when introduced into the empty stomach they stimulated the secretion of gastric juice; if administered with the food, the period of digestion is shortened, the gastric juice increased in quantity, and the peristalsis heightened. After section of the vagi in the neck this effect was not obtained; hence there must be a direct action on the mucous membrane of the stomach. Possibly varying results will be obtained here according to the intensity and extent of the gastritis and the reactive power of the glandular parenchyma. The success of quassia, gentian, kino, calumba, chamomile, vermuth, peppermint, and recently of condurango bark, has been noted by too many and too good observers than that it should depend upon crude self-deception. I myself have always been satisfied with quassia and condurango, although I always combine them with hydrochloric acid in such proportion that the solution contains 0·2 per cent of pure hydrochloric acid. It is possible (as future research may show) that they chiefly increase the peristalsis, and that this more than counterbalances any diminution of secretion. An especial action on the muscular tone has always been attributed to nux vomica or its alkaloid strychnine and belladonna, especially in drinkers and persons with weak nervous systems. This is undoubtedly true, provided we substitute large doses for the customary small ones. The use of belladonna has already been discussed on page 212. I usually prefer to combine the tinctura nucis vomicæ with a decoction of one of the above stomachics in such proportion that at least ten drops are in each tablespoonful:

℞ Tinct. nuc. vomicæ..... 5·0 [f ʒ j ¼]
Decoct. condurango..... 150·0 [f ℥ v]

M. Sig.: Tablespoonful three to four times daily, half an hour before taking food.

Or it may be combined with belladonna, as follows:

℞ Tinct. belladonnæ..... 5·0 [f ʒ j ¼]
Tinct. nuc. vomicæ..... 10·0 [f ʒ ijss.]
Tinct. castor. canadensis*..... 10·0 [f ʒ ijss.]

M. Sig.: twenty drops (!) six times daily.

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* [This preparation was officinal in the U. S. Pharm. of 1870.—Tr.]

We may also follow the English custom and give ipecac in small doses of 2 to 3 centigrammes [gr. $\frac{1}{3}$–$\frac{1}{2}$] with the extract. nuc. vomicæ in the same dose, ordering it in powders thrice daily, half an hour before meals.

[The claims of Penzoldt* for orexin as a true stomachic have only partly been fulfilled. On account of its irritating properties it can not be used in any real lesion of the stomach; it has been employed in phthisis, anæmia, convalescence, etc. It may be prescribed in doses of 0·1–0·2 [gr. jss.–iij] or more with extract of gentian; preferably in tablets or gelatin-coated pills.]

The hydriatic measures—cold rubbings, douches to the epigastrium (highly prized by the ancients, and known as *cataclysmus*), and massage—are also useful. Apparently irrational is the use of alkaline waters, for example, as recommended by G. Sée, half an hour before meals. But since Jaworski has shown that carbonic-acid waters strongly stimulate the chemical activity and absorption, their action may probably be explained in that way; on the other hand, they neutralize where the secretion of acid is marked.

The regulation of the diet of the dyspeptic begins in the mouth. We have already seen, in the etiology of chronic gastritis, that two important factors were the care of the teeth and slow eating—that is, a sufficient disintegration and insalivation of the food in the mouth. Although the care of the mouth is now much more generally observed than formerly, yet only too often do we still find examples of shocking neglect. I will not mention poorly cleansed teeth covered with tartar, caries, diseased alveoli, or inflamed gums with a thick whitish-green coating of desquamated epithelium, fungi, cocci, and remnants of food between the teeth. These are so prominent that they are noticed at once; and we ought always to recommend the patients (and healthy persons as well) to brush the teeth after each meal. Less apparent is the layer of filth which covers the plates of artificial teeth, or the broken-off stumps beneath them. Kaczarowski has exaggerated these conditions, but he is certainly right in many cases. Thus, not long ago, a man consulted me for a

* [Penzoldt. Salzsäures Orexin, ein echtes Stomachicum. Therapeut. Monatshefte, Bd. iv, 1890, p. 59. Other papers on this subject may be found in this volume, pp. 287, 374, 496, and Bd. v, 1891, pp. 203, 309, 364.—Tr.]

typical mucous catarrh; he had a false upper plate and naïvely admitted that he never removed his teeth at night, and only cleansed them about every third day. The plate was covered with a dirty-white coating consisting of numerous fungi and masses of cocci, while the hard palate was markedly reddened and dotted with small aphthous ulcers. In the slimy stomach-contents there were small brown streaks which consisted of granular blood pigment and numberless fungi and yeast-cells. The patient's complaints were relatively slight and began only after his treatment by the dentist. In this case the swallowed bacteria unquestionably kept up a constant state of irritation of the gastric mucous membrane.

The importance of eating slowly has been told thousands of times. A striking example of this is the fact that many people with weak stomachs while on a journey can digest the poor food of the hotels, because they have nothing else to do, and stay a long time at the table,* yet they suffer from the carefully prepared and selected dishes at home which are rapidly consumed while the mind is occupied with business cares. Upon similar psychical grounds is based the observation that many dishes are sometimes well borne by dyspeptics, while at other times they cause great discomfort, according to the mental or bodily condition. Many persons also have a marked idiosyncrasy toward certain dishes, and for others, again, an entirely voluntary and, as it were, unjustifiable tolerance. In the course of practice you will frequently meet patients who assert that they can tolerate rich mayonnaises, pastries, tough or fat meat, as, for example, lobster or goose, but who suffer intensely after a cup of milk or bouillon. As a result, every physician who has much to do with diseases of digestion sooner or later ceases to forbid individual dishes, but will be guided by the patient's experience. There is a certain amount of truth in the saying of G. Sée, "*En France on peut bien soumettre un menu au malade, en Allemagne on l'y soumet.*" One can only indicate the fundamental principles of dietetics concerning the form and amount of food.* Thus it is natural

* [This subject is very well discussed in Sir William Roberts's recent work on Digestion and Diet, London, 1891, pp. 160 *et seq.* A good review of this chapter will be found in the American Journal of the Medical Sciences, 1891, vol. ci, p. 397. —Tr.]

where, for instance, the digestion of albuminoids is difficult, that this class of food, be it in the form of eggs or meat, should be reduced as far as possible, and that what is allowed should be given in the most digestible condition. Therefore forbid hard-boiled eggs, meat with very tough fibers and tendons, the flesh of too old animals or of those which have just been slaughtered, in which the post-mortem formation of acids has not yet had an opportunity to soften it. For the same reason warmed meat is to be forbidden, also that which contains too much fat, like pork, fat portions of lamb, fat fowl, fish and mollusks (salmon, carp, turbot, eel, lobster, crabs, oysters*), sausages, smoked fish like flounder, herring, eel, sprats, lamprey, etc. Under the direction of Penzoldt, Gigglberger† has experimented with various articles of food prepared in as many ways as possible, the tube being used to introduce them into the stomach of living persons. His results practically agree with those of Beaumont.‡ According to him, meat remains in the stomach between two hours and twenty-five minutes (stewed calf-brain) and five hours and twenty-five minutes (roast mutton). In general, roasted meats remain somewhat longer in the stomach than stewed. Heavy cheeses are also indigestible; hence the old proverb that they are gold in the morning but lead at night. I also consider that bouillon is not indicated, not on account of its albuminoids, but because the high percentage of salts which may irritate the gastric mucosa. Among irritant ingesta may also be included strong acids, like vinegar, strong condiments, and alcohol in concentrated form as liqueurs. Indirectly injurious—that is, by their products of decomposition—are the fats, and hence oils and fatty sauces should not grace the dyspeptic's table. A substitute for meat may be found in the peptone preparations and peptone chocolate;# the latter is expensive, but

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* H. Chittenden. On the Relative Digestibility of Fish Flesh in the Gastric Juice. Amer. Chemic. Journ., vol. vi, No. 5. Chittenden ruthlessly destroys the legend of the great digestibility of oysters, and places them at the foot of his table.

† X. Gigglberger. Ueber die Dauer der Magenverdauung von Fleischspeisen. Inaug. Dissertation. Erlangen, 1886.

‡ *Vide* Ewald. Klinik, etc. I. Theil, 3te Auflage, S. 114.

[Parke, Davis & Co. have recently introduced a similar preparation, Mosquera's beef-cacao; a tablespoonful of the powder is added to a cup of hot milk, and is boiled five minutes like ordinary cocoa. It is quite palatable.—Tr.]

may easily be prepared at home by boiling some cocoa free from fat, or even chocolate, and adding some peptone or meat peptone.

On the other side of the scale of nutritious substances are the carbohydrates, including everything from pure starch preparations to the nitrogenous flours, vegetables, fruits, and legumes. Their digestion is easy, provided that in their preparation as much starch as possible has been changed into dextrin and the thick consistency of the dough formed by mixing flour and water has been got rid of by heat and drying in the air. Hence all freshly baked articles are to be avoided; on the other hand, it explains the digestibility of the various flours, and soups, jellies, etc., prepared from them; also of vegetables and fruits when they are freed from their cellulose and softened, and in the case of the former when prepared with a minimum amount of fat. But all kinds of cabbage are to be avoided because the carbohydrates contained in them are especially prone to fermentation. This is also true of the legumes, and hence mashed peas and lentils are usually poorly borne. On the other hand, the so-called leguminous flours, which may now be bought in many forms, constitute a good diet, of which, however, the patients usually tire after a time. But it must never be forgotten that all foods with carbohydrates very easily undergo fermentation on account of the sugar which they contain; hence they must be used with caution in all atonic conditions of the stomach.*

Milk occupies an intermediate place among the above-mentioned substances; theoretically it ought to be the best. But in practice it is either rejected entirely or is borne only for a short time by many patients; however, it may be given, cooked or raw, sweet or sour, or with soda, lime water, or rum. It must also not be forgotten that an exclusive milk diet is a kind of slow starvation, and that to live on milk alone would require much larger quantities than the capacity of the stomach would allow. Still, a high nutritive value can be given to milk by adding the so-called milk powder — i. e., milk which has evaporated to dryness and pulverized; of this, 100 grammes [3½ ounces] represent about one litre [quart] of milk.

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* [The absence of sugar in Schreiber's dietetic wine (E. Loeb & Co., 55 Warren Street, New York city) renders it useful in this class of patients.—Tr.]

Finally, dyspeptics must not forget the general rule never to fully satisfy their appetite, but to stop as soon as they feel the first sensation of satiation, and to allow sufficiently long intervals to intervene between meals.

Fluids are not to be taken too hot nor too cold, nor in too large quantities, since they unnecessarily dilute the gastric juice. Dyspeptics should also avoid all strongly carbonated waters and those in which fermentation readily occurs, since the stomach becomes distended and the blood surcharged with carbonic-acid gas; for there are very few cases in which its stimulating effects neutralize these disadvantages.* As bland beverages we may use the time-honored orgeat, rice water, and decoctions of hops, salep, and barley.

That the regulation of the diet must be combined with attention to general hygiene needs hardly be mentioned in our times. The care of the skin and lungs—in short, the care to obtain good pure air—constitute the most important part, not alone of the prophylaxis, but also of the treatment of nearly all chronic diseases. But it is just in cases of chronic gastric catarrh that much harm is done, because most patients think that they have done their duty in attending to a few dietetic details, and therefore find no harm in spending night after night in a hot atmosphere contaminated with gas, crowded rooms, smoke-filled saloons, etc. The dyspeptic's programme should always include active bodily exercise, long walks, horseback-riding, baths, sometimes combined with douches, gymnastic exercises, especially those which call the abdominal muscles into action; and as most persons do not carry out these exercises for a long time unless there is some object in view, they should be taken as sport or massage. Rowing is a specially valuable exercise, and with the present sliding seats, as shown anatomically by Mitan,† offers admirable exercise for every muscle. It is to be regretted that women can not indulge in this as much as men, yet chamber gymnastics, massage, daily walks and rides can accomplish much good. "*Maximeque qua superiores partes moveat, quod genus in omnibus stomachi vitiis*

* [These remarks apply with even greater force to the use at meals of alkaline carbonated waters like Vichy, Seltzers, etc.—Tr.]

† Mitan. Das Rudern, eine heilgymnastische Uebung. Inaug. Dissertation. Berlin, 1882.

aptissimum est," says Celsus; yet it would be even better to bring the body into moderate action but not overexertion.

Finally, some special points in the treatment still require discussion.

Fermentation and decomposition of the food in the stomach are best treated by means of lavage; its systematic employment will prevent stagnation of the ingesta, and thus the chief factor of decomposition is at once removed. Where this is impossible, we must use antifermentative drugs; but it must be premised that these are useless unless at the same time the diet is regulated, because the stomach will not tolerate the large doses of these drugs which would be necessary where there are large accumulations of objectionable food. It is for this reason that these substances are useless in dilatation of the stomach with accumulations of large quantities of fermenting ingesta. Otherwise we may expect good results from creosote and thymol, in doses up to 0·1 gramme [℔jss.], in pills, emulsion, or with a mucilaginous vehicle; they are the best of this class of remedies, for, according to my own experience, there is much less certainty in the action of salicylic acid, carbolic acid, benzoic acid, naphthalin, etc.

Excellent antisepsis may be obtained with bismuth salicylate, beta-naphthol, and a new preparation, benzonaphthol.* The latter is preferable to beta-naphthol on account of its freedom from odor and taste. Resorcin is also valuable, but it must be used in an absolutely pure form, as so-called resorcinum resublimatum. I prescribe these preparations either as powders—

℞ Beta-naphthol,
Bismuthi salicylatis . . . . . āā 7·5 [ʒij]
Pulv. rhiz. calami (Ph. Ger.)† . . . . . 10·0 [ʒij℈]
Natrii bicarbonatis,
(*sive* Sacchari lactis) . . . . . āā 15·0 [ℨss.]
M. Sig.: Teaspoonful every two hours.

(Benzonaphthol or resorcin may be used instead of beta-naphthol.)

—or in solution with rhubarb or a stomachic:

* [See Merck's Bulletin, New York, January, 1892, p. 27.—Tr.]
† [Acorus calamus, U. S. P.—Tr.]

℞ Resorcini resublimati..... 5·0 [gr. lxxv]
Infusi radicis rhei..... 5·0 : 150·0 [gr. lxxv : f ℥ v]
Vini condurango.....ad 200·0 [f ℥ vj ℈]
M. Sig.: Tablespoonful every two hours.

I have had no experience with bisulphide-of-carbon water proposed by Dujardin-Beaumetz.* Chloral, with its sedative and antifermentative action, has been of great service to me in cases of moderate fermentation accompanied by gastralgia. The three cases of agoraphobia cited above [p. 332] were all cured with chloral. I order a tablespoonful of a 3 to 5 per cent solution to be taken every two hours.

I wish to call attention once more to the antifermentative action of a systematic use of hydrochloric acid. You also know that the symptoms due to fermentation may be relieved or lessened in a short time by sufficient doses of alkalies, as bicarbonate of soda in 5 to 10 grain doses alone or combined with rhubarb or bismuth; but it is simply palliative, and favors rather than opposes the cause of the process.†

The proper use of antifermentatives also puts an end to the formation of gas, and hence it is unnecessary to have recourse to the use of the more than questionable drugs recommended to absorb gas. The use of charcoal is utterly irrational; it has recently been brought into commerce in the form of "charcoal cakes"; the charcoal becomes moist in the stomach, and in that condition its absorptive powers for gas are entirely lost.

Where gastralgis resist all ordinary forms of treatment with the various opiates they may be temporarily relieved, preferably by a hypodermic injection of morphine. Hyoscyamus, hydrocyanic acid, and belladonna as well as chloroform water (1 to 200) have also been recommended for this purpose. I have found the following combination very useful:

℞ Morphinæ hydrochloratis..... 0·2 [gr. iij]
Cocain. hydrochloratis..... 0·3 [gr. v]
Tinct. belladonnæ..... 5·0 [f ℥ j ¼]
Aq. amygdalæ amaræ..... 20·0 [f ℥ v]

* Dujardin-Beaumetz. Les nouvelles médications. Paris, 1886, p. 76.
† [See Sir William Roberts. British Med. Journal, 1889, vol. ii, p. 373.—Tr.]

M. Sig.: Ten to fifteen drops every hour. Where the pains are very severe, three doses of ten drops each within an hour.

Budd attributes a sedative action to Fowler's solution, taken half an hour before eating, while Siebert* has even come to the conclusion that with the use of arsenic the pains of nervous or catarrhal gastralgia disappear in a few days, but persist where it is due to an ulcer.

Germain Sée has recently spoken very highly of the use of extract. cannabis indicæ in gastralgias of all kinds, and has laid especial stress upon the fact that it acts only locally on the mucous membrane of the stomach, and not upon the general nervous system. I can not agree with this sweeping recommendation. It is true, I have obtained analgesic effects from its use in some patients; others were attacked with severe cerebral symptoms, like intoxication and headache; in still others it had no effect whatsoever.

Codeine, especially codeine phosphate,† acted much better. I prescribe it either in drops like the morphine drops above mentioned (replacing the morphine by codeine, but in double the quantity, 0·4 [gr. vj]), or as powder with bismuth subnitrate:

℞ Codeinæ phosphatis.....	0·02–0·015	[gr. $\frac{1}{3}$–$\frac{1}{4}$]
Bismuthi subnitratis.....	0·3	[gr. v]
Sacchari lactis.....	0·2	[gr. iij]

M. Sig.: Tal. dos. every two hours.

Purgatives.—Irregularity of the bowels plays a very important part in all forms of chronic gastritis. In the early part of this work I have called attention to the close connection between the intestines and the stomach, and have repeatedly pointed out that many so-called stomach troubles are really in the intestines. Although I shall reserve a detailed description of these conditions for the portion of this work devoted to the diseases of the intestines,‡ yet the use of purgatives must be considered here, since they not alone relieve the intestinal disturbances, but also directly aid the passage

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* Siebert. Ueber Magenschmerz und Magengeschwür. Deutsche Klinik, No. 10, 1852.

† [Codeine phosphate is often preferable to codeine, on account of its solubility; the ordinary dose is 0·1 [gr. jss.]; the daily dose is 0·4 [gr. vj].—Tr.]

‡ [This portion of this work has not yet been published.—Tr.]

of the stomach-contents into the intestine by securing prompt evacuations. In the same way those drugs which act as cholagogues also increase the peristalsis of the intestines, and hence empty the bowels. In the vast majority of cases of chronic gastritis we must combat constipation and not diarrhœa.

We may at once eliminate one group of purgatives, the vegetable oils, of which the typical example is castor oil; it irritates the stomach and nauseates most patients even when given in an emulsion. Although it has undoubtedly been very useful in many cases of so-called stomach-catarrhs, yet it is just in these cases that the real trouble is in the intestines and not in the stomach, and the injurious effects on the latter are more than counterbalanced by its beneficial action on the former. I have even been able to demonstrate experimentally the disturbing effect of oil on the chemical processes of digestion.* Saline cathartics are also only to be given when an action on the small intestines is desired; then the sulphate-of-soda mineral waters are to be used, or, as these are usually insufficient, the salt itself in substance. An excellent remedy is sulphate of soda in combination with rhubarb and carbonate of soda; it is the old *solamen hypochondriacum* of Kleist which has recently been recommended by Leube:

℞ Pulv. rad. rhei.... ..... 20·0 [ʒ v]
Sod. sulphat..... 10·0 [ʒ ijss.]
Sod. carbonat.,
Sod. bicarbonat.....āā 5·0 [gr. lxxv]

M. Sig.: At bedtime, ½ to 1–1½ teaspoonfuls in a glass of warm water, as may be necessary.

According to the individual indication this may be changed and magnesia usta, or tartaric acid, or sulphate of potash may be added; or, as I prefer, it may be combined with bismuth salicylate and extract. nuc. vomic. (in atony of the stomach with tendency to flatulence from intestinal fermentation). Here I may also mention cream of tartar and Rochelle salt or tartrate of soda (Ph. Germ.); they may be given in effervescing lemonades, in powder with washed

* Ewald und Boas. Zur Physiologie und Pathologie der Verdauung. II. Virchow's Archiv, Bd. 104.

sulphur, or in decoctions with the vegetable aperients spoken of in the next paragraph.

Vegetable Aperients.—The mildest of these are the various fruits which owe their efficacy to their vegetable acids. The use of stewed prunes at night before retiring is well known; less known is a mixture of two parts of prunes and one part of dried figs: the taste is agreeable and the cathartic action is mild. Among the true laxatives rhubarb stands pre-eminent, and in fact it is a very valuable aid to all dyspeptics. Next to it stand tamarinds, then senna, buckthorn, European centaury (Herba centaurii, Ph. Germ.), taraxacum, coriander, fennel, etc., some as extracts, others as teas; of the latter the best-known preparation is the so-called Hamburg tea. Senna sometimes causes nausea and colic; this may be avoided by using an alcoholic extract (extract. sennæ fluid.) or by adding some aromatic spirits of ammonia or tincture of cardamom. Cascara sagrada, which has been so extensively used recently (50 to 80 drops of the fluid extract at night), is a mild and at first a certain remedy, but like the rest of this class it loses some of its effects in time.* Extract. fab. calabaric. (Ph. Germ.) [ext. physostigmatis, U. S. P.] 0·05 [gr. $\frac{5}{6}$] to 10·0 [℥ ijss.] of glycerin has had a very variable action in my hands.

Aloes act especially on the large intestines, either alone or combined with jalap, colocynth, or scammony. English writers also consider it a stomachic and give it especially with calomel, to which, as is well known, a cholagogue as well as a cathartic action has been attributed. But, as Rutherford has shown that podophyllin is also a cholagogue, and as it has the advantage over calomel of having none of its after-effects, I prefer to use it with aloes, etc., instead of calomel.

Enemata also deserve mention; they may consist of warm water alone or with salt, soap, decoction of senna, castor oil, and the like. It is an old rule, originally given by Trousseau, that they should

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* [This drug may also be used as a stomachic as well as a laxative.

℞ Tr. nucis vomicis..... ... . 10·0 [℥ ijss.]
Ext. cascaræ sagradæ fluidi,
Elix. aurantii..... ....āā 40·0 [℥ x]
Aquam..... .....ad 120·0 [℥ iv]
M. Sig.: Teaspoonful fifteen minutes before eating.—Tr.]

never be given immediately after a meal, since they may then easily cause severe diarrhœal discharges instead of easy movements; but it is only recently that attention has been called to the fact that no hard rubber or horn syringes should be introduced into the rectum; instead a soft, flexible, thick rubber tube, with one opening below and several laterally, should be passed quite high up, and the fluid permitted to enter or force its way slowly. Enemata are of especial value where the large intestine is relaxed; they soften the hard fæcal masses which accumulate in the sigmoid flexure and descending colon, and they also gently stimulate the muscular fibers of the lower segment of the intestine. Upon the latter also depends the action of the injections of small quantities of glycerin (which constitutes the active ingredient of the so-called "Oydtmann's purgative") and of the glycerin suppositories which are made of glycerin and any easily melting substance. As long as the enemata operate (i. e., as long as we are only dealing with the so-called torpidity of the lower bowel), they are the best and mildest means, and the bad results attributed to their prolonged use, such as causing catarrh of the intestines, occur in very few cases. Although they usually lose their effect after a time, yet I know patients who have successfully used them daily for years.

Finally, I must not neglect to state that a number of cases of chronic gastritis can not be cured with the so-called stomach remedies, but require treatment for the primary disease. These are especially the gastric catarrhs which occur in pulmonary, cardiac, and renal diseases, and those appearing during the course of chlorosis. But, as the gastric symptoms sometimes constitute the most prominent part of the patient's complaints, it not infrequently happens that these persons are for a long time treated for the stomach trouble, till a thorough examination reveals the real condition, and the proper treatment of this relieves the gastric symptoms.

Mineral Springs.—The drinking of mineral waters, either at the springs or at home, constitutes an important part of the treatment of chronic gastritis. Drinking the water at home is only an expedient, and will never replace the great advantages of a residence at the spa with all its adjuvants; the mental and bodily rest and invigoration, the *dolce far niente* of life at the springs, the constant

warning against dietetic errors—all these are lacking. This is true, even though, so far as these points are concerned, many well-situated people could just as well take the cure at home. But in spite of every care in filling and sending, bottled mineral waters never have the invigorating freshness nor the strength of the bubbling spring!

For the local treatment of stomach troubles the following four classes of mineral waters are of most importance:

1. Pure salines.
2. Salines with a large amount of carbonic-acid gas.
3. Alkaline salines in which the proportion of sodium chloride and carbonic-acid gas is much less than that of intermediate salts.
4. Alkaline and alkaline-muriatic (*alkalisch-muriatische*) waters.*

Unfortunately, I must confess that we know very little of the action of these mineral waters upon the stomach, because the criteria upon which their effects are judged are based directly upon the influence on the intestines, and only indirectly take cognizance of the stomach. Just at present this position is rendered still more aggra-

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* The following springs may serve as types of these classes:

(1) *Wiesbaden* (*Kochbrunnen*).

Sodium chloride	6·83
Calcium chloride	0·47
Calcium carbonate	0·42
Carbonic-acid gas	0·5 c. c. to the litre.

(2) *Kissingen* (*Rakoczy*).

Sodium chloride	5·82
Calcium chloride	0·28
Calcium carbonate	1·06
Carbonic-acid gas	1392·0 c. c. to the litre.

(3) *Carlsbad* (*Mühlbrunnen*).

Sodium sulphate	2·39
Sodium carbonate	1·27
Sodium chloride	1·02
Carbonic-acid gas	1·27 c. c. to the litre.

(4) *Ems* (*Kesselbrunnen*).

Sodium carbonate	1·99
Calcium carbonate	0·22
Sodium chloride	1·0
Carbonic-acid gas	553·2 c. c. to the litre.

[For further information concerning these and other springs, see George E. Walton. Mineral Springs of the United States, etc. New York: D. Appleton & Co., 1883.—Tr.]

vating because the experimental researches of Pfeiffer * and Jaworski have strongly shaken our belief in the influence of Glauber's salt on stomach disorders. Jaworski, as is well known, has concluded, from his investigations, that Carlsbad water stimulates the gastric secretion only in the beginning, and when taken in small quantities; but if consumed for a longer time it lessens it markedly, may finally cause it to disappear, and may even lead to atrophy of the glandular parenchyma.† At my request, Dr. Sandberg, of Marstrand, has investigated these striking results. Consecutive examinations were made on ten patients during a four to five weeks' treatment at Carlsbad; the result was that in half of them the acidity was somewhat lessened, in the others increased; and the lessened acidity was just in those patients who had had a high acidity before beginning the treatment. But as we know that the acidity is subject to very great variations in the same persons, too much weight must not be laid upon the above results, especially as an appreciable change was not found in the peptic power nor in the action of rennet. On the other hand, these investigations have undoubtedly shown that Jaworski's statements must be modified—i. e., that the Carlsbad water has the perfidious quality of destroying the chemical powers of the stomach in the short space of four to six weeks! At least it does not do so in Berlin! For, strictly speaking, we must depend on the bottled water as it is sent to us, and we must leave it to the physicians of Carlsbad "to rehabilitate the nymph of the spring in her own home," should they consider that necessary.

For the influence of common-salt mineral waters on digestion I refer you to what was said on page 344, and add that Boas‡ has methodically observed the changes in the secretion of gastric juice while taking warm saline waters; after three to four weeks he noticed a decided improvement in the secretion and a coincident disappearance of the symptoms. The action of the saline waters (sodium chloride) depends chiefly on a stimulation in the secretion

* E. Pfeiffer. Balneologische Studien über Wiesbaden. Wiesbaden, 1883, chapter on "Kochsalz oder Glaubersalz?"

† W. Jaworski. Ueber die Wirkung des Carlsbader Wassers auf die Magendarmfunction. Deutsch. Arch. für klin. Med., Bd. xxvii.

‡ J. Boas. Verhandlungen des Vereins für innere Med. zu Berlin, November 5, 1888.

and absorption and an increase in the metabolism. This is also true of the alkaline saline waters, yet it seems to be more pronounced in the waters with sodium chloride than those with sodium sulphate. The latter and the alkaline waters have such a high percentage of alkali that they can act as antacids. All possess the property of dissolving mucus. The saline waters stimulate the stomach's activity, the alkaline saline act principally on the intestines and liver. The simple mechanical action of washing out the stomach is common to them all.

But while it is true of the saline and alkaline springs that they can not have any bad effect on the general system, or, as the layman says, "they are not powerful," yet this is often the case to a marked degree with the sodium-sulphate waters, and, especially in nervous and anæmic persons, they may cause an increase in the irritative manifestations or the signs of depression.* Therefore we ought never to send patients with pronounced neuroses of the stomach to these springs, nor even allow them to drink any of these waters. For them we must recommend a general tonic treatment which may vary with the individual: sometimes only a stay in high mountainous districts; others need the sea-shore; others, again, require a hydropathic establishment with all its paraphernalia; in still others, mud or brine baths, together with small doses of an alkaline muriatic water, are indicated. To this class belong the great group of nervous dyspeptics, the patients with atony of the muscular fibers of the stomach upon a nervous predisposition. In this respect my experience tells me that much harm is done, and every year from a number of patients I hear the same complaint, that they were sent to Carlsbad on account of chronic catarrh of the stomach, but that they had borne the treatment very badly. Carlsbad and Marienbad are frequently these patients' greatest enemies. The high elevation of Tarasp causes it to occupy an intermediate position; Kissingen, Wiesbaden, Homburg, Nauheim, Franzensbad, etc., or the sparkling

* By way of addition I may observe that I find that so experienced a physician as Cordes (*loc. cit.*, p. 535) expresses himself thus: "On this occasion I wish to warn most emphatically against sending irritable, weak patients to the sodium-sulphate springs; for they operate badly in every case, because the reflexes proceeding from the stomach and intestines of themselves are very pernicious."

soda springs like Vichy, Ems, Neuenahr, Bilin, etc., are more indifferent, and may at times be beneficial on account of the change of life and the other well-known accessories of watering-place life.

On the other hand, experience has shown that the alkaline-saline and the alkaline springs (to say a few words in anticipation on the treatment of the gastric neuroses) are very beneficial in conditions of hyperacidity or hypersecretion. The very successful use of Carlsbad water in ulcer of the stomach is now much more readily understood, since we know that the ulcer is in many cases accompanied by hyperacidity, and that the mineral water not alone momentarily neutralizes this (just as in cases of hypersecretion), but also that it may actually lessen the activity of the secretion. A similar effect might also be produced by the purely alkaline waters, but they have not yet been used much for this purpose. Finally, the sodium-sulphate waters are to be used in those cases in which the stomach is only secondarily involved from disturbances of the liver and the intestines.

However, the saline waters are indicated in all cases of catarrh with lessening of the secretion, either with or without the production of mucus. Here we may use the simple sodium-chloride waters where the patient is otherwise well, and only the gastric and intestinal secretions are to be augmented; the sparkling sodium-chloride waters are useful where we desire the stimulating effects of the carbonic-acid gas, and where, by moderate catharsis and the use of the brine as such, the metabolism may be increased. Finally, all waters which are to act on the stomach are borne better warm than cold.

In the above I have simply given the general indications for choosing springs; for further details I must refer you to the text-books on balneology, and to the admirable treatise of Leichtenstern in Ziemssen's Handbuch der allgemeinen Therapie.* I need hardly tell you how much is left for individualizing by noting the equipment of the different resorts, such as mud and iron baths, mild effervescing iron springs, medico-mechanical [for instance, like Zander's system] and electrical treatment, etc. These details must be attended

* [Vol. IV of American translation, New York, 1885.—Tr.]

to, lest a stereotyped method of treatment be employed, and that the individual indications may be properly looked after; in other words, the treatment must be adapted to the patient, not the patient to the treatment.

It is unquestionable that the treatment will be much more successful if the diagnosis of gastric catarrh is exactly defined into one of the three varieties—simple, mucous, or atrophic catarrhal gastritis. This can only be done by employing the chemical methods, the use and success of which have been greatest in this field where they were at first least expected.

Finally, it is of equal importance to both physician and patient that in the selection of a suitable watering-place for the latter, the former should, if possible, know the place recommended from his own personal observation. Here, again, we must individualize, for even if the analyses of two mineral springs are almost identical, yet it does not therefore follow that they are equally well adapted to the same class of patients. The other adjuvants of the place must be considered, and to know the character of the physician to whom we intrust our patients is not unimportant.

[Addendum to p. 343.—Three cases of poisoning from leaving antiseptic solutions in the stomach are reported in W. Soltau Fenwick's paper, On some of the Dangers of washing out the Stomach, which appeared in the Practitioner, 1892, No. 4, after these pages had gone through the press. In one of these cases (Schmidt's Jahrbücher, 1883, Bd. cxcviii, S. 28) death resulted in six days after leaving a 2-to-3-per-cent solution of boric acid in the stomach.

Fenwick also makes a strong plea against the indiscriminate and unnecessary use of the stomach-tube, especially where its employment is not indicated. He urges that more care be taken in filling and emptying the stomach, lest syncope and sudden death occur from changing pressure on the great abdominal plexuses of the sympathetic. He also protests against assuming that we are always dealing with normal tissues. The not infrequent occurrence of tetany after lavage, twenty-three cases of which have been reported (twenty-one are collected in Bouvret and Devic [Revue de méd., February, 1892]), with a mortality of 72 per cent, should also serve as a warning. These cases, together with those on pp. 84 and 85, indicate caution. But this is true of every exploratory procedure, and, when the number of accidents is compared with the innumerable times the tube is passed safely, it becomes quite insignificant. Nevertheless, Fenwick's warning ought not to be disregarded.—Tr.]

LECTURE IX.

THE NEUROSES OF THE STOMACH.—THE PHYSIOLOGICAL RELATIONS OF THE STOMACH.

GENTLEMEN: The term *neuroses of the stomach* includes all those conditions which manifest themselves as disturbances of digestion without demonstrable anatomical lesion in that organ; or, if such be present, they are only secondary; in other words, the neuroses of the stomach are the *functional* disturbances as opposed to the so-called *organic*.

Our knowledge of this subject is by no means recent; for example, you will find a description which was excellent for the time in which it was written, by Comparetti (1790).* Since then many writers have been engaged on this theme, especially the French and English, including Barras, Beau, Trousseau, Chambers, Budd, Fothergill, Fenwick, and others. Yet since then great advances have been made as the result of the labors of investigators in every land, and in Germany especially by the work of Leube. It must be admitted that our knowledge is chiefly of a descriptive nature, and that the etiology of the disturbances is far from being thoroughly understood. However, if we remember that the stomach is the center of a far-reaching plexus whose cerebral and sympathetic fibers have many anastomoses, with the resulting crossing and mingling of both stimulating and inhibitory impulses, it will be easily understood how difficult it is to bring order out of this chaos, and to isolate the separate threads of this entangled meshwork. It will also become evident why writers, among whom we may mention Stiller, Rosenthal, and Oser,† have endeavored to establish the manifold manifes-

* Occursus medici de vaga ægritudine infirmitatis nervorum Andreæ Comparetti. Venetiis, 1790.

† Stiller. Die nervösen Magenkrankheiten. Stuttgart, 1884.—Rosenthal. Ma-

tations of the disturbed innervation of the organ upon a basis corresponding to our present knowledge of its physiology. Yet even to this day our knowledge is so limited and vague that conjecture and hypothesis still play a prominent part, while the actual clinical facts upon which our pathology is based fill only a very small space. How easily, then, can we speculate as to the probable causes and refer everything to higher centers of innervation—e. g., Rosenthal's hunger-center, for which we may bring as many arguments *pro* as *contra!* I shall therefore refrain from such discussions in the following pages; instead, I shall give you what I think will be a welcome basis for any reflections of this kind by prefacing a chapter on what we know of the innervation of the stomach, and of the general sensations proceeding from it—i. e., the pathology of the neuroses.

My brother, Dr. R. Ewald, Professor of Physiology at Strasburg, has written the following chapter at my request, and for this I desire to give him my heartiest thanks.

THE INNERVATION OF THE STOMACH.

It was an epoch-making advance when the old vital forces were dethroned and only physical manifestations were allowed to explain the operations of the organism. The physical methods of research were adopted and the vital processes were placed on a corresponding basis. This was the first step which absolved physiology from its long bondage as a subordinate part of anatomy and elevated it to an independent science. But the fond hopes which were placed on purely physical explanations even up to a few decades ago have since been proved to be unattainable, and the inevitable reaction has set in after we had in vain waited for the solution of all problems by physical science. Even some of the most enthusiastic investigators who had placed implicit faith in these explanations now ceased to blindly follow this alluring path. Not that there was a reaction to the old vital forces; not that every attempt at an explanation was rejected in despair; but experimenters became convinced

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genneurosen und Magenkatarrh. Wien, 1886.—Oser. Die Neurosen des Magens und ihre Behandlung. Wiener Klinik, 1885.

that in many, in fact in nearly all the better known phenomena the physical laws did not suffice to give a clear explanation of the mysterious vital phenomena. Unfortunately, we are now nearly everywhere compelled to assume a specific yet absolutely unknown activity of the living cell. This reaction was very beneficial; it unmasked an apparent knowledge and brought us nearer to a true understanding of Nature; and, even if we must finally admit a mechanical basis, yet we are still infinitely remote from the goal of all natural science. That we can only reach this goal by extending our knowledge of the vital phenomena in the individual cells is the advance which has resulted from the reaction against purely physical speculations. The same conceptions which elevated physiology to an independent science would merely have converted it into physics and chemistry as applied to vital phenomena. Now, however, its character as an independent science is forever preserved.

The General Relations of the Functions of the Stomach and the Nervous System.—The functions of the stomach consist mainly of secretion, absorption, and motion. It was once thought that the activity of the glands could be explained by the purely mechanical processes of filtration and diffusion. The chemical and physical changes in the blood circulating about the glands, of which the physical were regulated by the nerves, seemed sufficient to explain why the secretion of one and the same gland may vary in strength and composition.

Although Johannes Müller had long ago called attention to the specific activity of the glandular cells, yet only recently was it positively demonstrated that the mechanical processes of filtration and diffusion do not suffice to explain secretion, and that we must accept the existence of a peculiar activity of the cells.* Nerves may regulate this cellular activity, yet secretion is unquestionably possible without them, and in this respect the animal tissues do not differ from the vegetable, which have glands but no nerves.

In the process of absorption the specific activity of the individual cells becomes even more obvious. Here, contrary to physical

* Ewald. Klinik, etc., I. Theil, 3. Auflage, S. 61 und 208 *et seq.*

laws, some substances are taken up, while others are rejected. The lymph-cells have been observed to wander to the surface of the intestinal mucous membrane, and there incorporate drops of fat; they then creep back even into the lacteals, where they give up these particles of fat. In the face of such occurrences, which seem to play an important part in absorption, how can we think of purely mechanical explanations? At all events, in the processes of absorption peculiar functions of the living cells must coexist with filtration and diffusion.

The conditions are no more favorable in the motor function. I disregard entirely the fact that what occurs in a muscle during contraction is as incomprehensible as what constitutes innervation in a nerve. But the dependence of the contraction upon the nervous impulse, and the invariable result of this impulse, namely, a shortening of the muscle, were formerly regarded as a general and, in a certain sense, physical law. Indeed, for striped muscle it would be difficult to find an exception to this law, if we do not include the direct stimulation of the muscle which can only occur in an abnormal way. The striped muscle-fiber is always at rest till an impulse reaches it through its nerve; the result of this impulse is always a contraction, be it a jerk or tetanus. The apparent exception that the heart continues to beat even after all its nerves have been divided, was explained by assuming that the impulses may arise in the heart itself in its ganglion-cells, and that these impulses are transmitted to the cardiac muscle-fibers through the intracardiac nerves. It was, however, discovered that sections of the heart which positively contained no ganglion-cells continued to beat rhythmically. The greatest difficulty of maintaining the law of the dependence of muscular contraction upon nervous impulses is encountered in the unstriated muscles. Here we not alone observe movements which are independent of any nervous influence, as for example in the ureter, but we are not even able in every instance to prove that the result of the nervous impulse is a contraction of the muscle. Thus irritation of the vaso-dilator nerves causes the arterioles to relax, and as, for many reasons, we can not explain this by the longitudinal fibers, we are compelled to assume the paradox that the circular fibers lengthen upon irritation. We must therefore

admit that, with the possible exception of the striated muscles, the above law does not always operate, and that consequently the muscles may both make spontaneous movements, and may also lengthen upon stimulation.

These preliminary remarks will enable us to comprehend more readily the unpleasant fact that we know very little about the secretion, absorption, and motility of the stomach. The experiments are very frequently contradictory; many contain conditions which, upon closer examination, preclude a uniform result. It is evident that the study of the organ has been undertaken with too many physical propositions, whereas here, as in the entire digestive tract, biological laws are more important. It seems that the more highly vegetative the functions of an organ are, the more does its activity depend upon its own cells, and the less upon the nervous system. In fact, could we remove every nervous element, nerve-fibers as well as ganglia, from the walls of the stomach without injuring the other tissues, it would still secrete, absorb, and contract quite well. One may ask, Why, then, all these nerve-fibers which enter the stomach? For the same reason that nerves go to the automatic heart—to connect it with the rest of the body. On the one hand, the stomach has these connections with the central nervous system to fulfill the demands of the other parts of the body; and, on the other, to enable the entire organism to take cognizance of its condition.

Anatomy of the Nerves of the Stomach.—*The Vagus Nerve.*—Below the neck both pneumogastrics travel along the œsophagus, the left or the smaller being on its anterior aspect, the right or the larger on its posterior; they maintain the same relation in passing through the diaphragm. But these are not the only fibers of the vagi which reach the stomach, for as soon as the nerves reach the œsophagus they give off numerous small filaments which form a delicate plexus, invisible to [the naked eye of] experimenters, in the substance of the œsophagus and thus reach the stomach. Hence it will not suffice to simply divide the two vagi upon the œsophagus to sever their connection with the stomach (Brachet), but a circular incision must be made down to the muscular layer in the œsophagus just below the diaphragm (Schiff). The left nerve passes from the anterior surface of the œsophagus to the cardia and lesser curvature,

forms the anterior gastric plexus, and divides into terminal filaments, which proceed along the anterior surface of the stomach as far as the pylorus, and form many anastomoses with the sympathetic. Two thirds of the right nerve pass to the abdominal organs and only one third reaches the posterior surface of the stomach, where it forms the posterior gastric plexus. The terminal filaments radiate from this over the posterior surface, and, like those of the left nerve, form numerous anastomoses with the sympathetic.

The Sympathetic Nerves.—From the cœliac plexus, the cerebrum abdominale of the ancients, in the formation of which the vagi, especially the right, participate, is developed a series of secondary plexuses. Among these is the coronary plexus (plexus coronarius ventriculi azygos), which accompanies the left coronary [gastric] artery of the stomach to the lesser curvature, and communicates with the two plexuses of the vagi. Another secondary azygos plexus is the hepatic, which is also partially formed by the pneumogastrics; a branch of this plexus accompanies the right coronary [pyloric] artery of the stomach to the lesser curvature, where it communicates with the coronary plexus. Another somewhat larger branch of the same plexus, which has received the name of inferior coronary plexus (plexus coronarius ventriculi inferior), passes along with the right gastro-epiploic artery to the greater curvature; communicating branches to the plexus of the vagi are also given off by this plexus.

Ganglion-cells.—The radicles of the two intestinal plexuses may be traced into the stomach; beginning at the lesser curvature, the plexus myentericus has already developed into a thick network at the pylorus, and communicates here with the gastric branches of the vagi (Auerbach). The plexus submucosus (Meissner's) may also be demonstrated even at the pylorus; it probably contains fewer ganglion-cells than Auerbach's plexus, just as is the case in the other parts of the intestines.

Secretion.—In spite of numerous and careful experiments in stimulating and dividing the nerves communicating with the stomach, no definite effects on the secretion have yet been produced. We might even doubt the influence of these nerves on the secre-

tion, did we not know from other sources that both stimulating and depressing impulses pass along them to the glands of the stomach. The most important observation on this subject was made by Richet on a man with a stricture of the œsophagus which necessitated the making of a gastric fistula. It was positively proved that the œsophagus was completely occluded, and that not the smallest trace of saliva could reach the stomach; by asking the patient to chew some ferrocyanide of potassium not a trace of the salt could be detected in the stomach; yet whenever he chewed substances with a strong taste (sugar, slices of lemon, etc.) there was always a copious secretion in the stomach. This interesting case proves that the secretion of the stomach may be reflexly stimulated by centers lying outside of that viscus; hence, the glands of the stomach are innervated by the nerves communicating with it. Like the nerves of taste, the olfactory nerves may also produce this reflex directly—i. e., without the intervention of a psychical process. It is different when the reflex proceeds from the optic nerve; thus, the mere sight of meat causes a copious secretion of gastric juice in hungry dogs, just as the saliva runs freely from their mouths if they look for a long time at a lump of sugar. However, it is evident that the reflex does not proceed directly from the optic nerve, but that the sight of the food first produces a mental impression, and this it is which causes the secretion. We ourselves all know that we need not even see food, but that simply the thought of savory dishes "makes our mouths water." It will not be erroneous to infer that this reflex extends also to the stomach.

The secretion of the stomach may be reflexly lessened in the same way as it may be stimulated. The taste, smell, sight, and even thought of disgusting food cause such inhibitions. Usually these various reflexes, whether stimulating or depressing, combine and produce a more marked effect.

Having thus seen the effects of visual impressions upon the gastric secretion, it becomes evident that it may also be influenced by psychical processes; yet this connection becomes more apparent when we consider the effects produced. Taken all in all their action is inhibitory; the most potent of all is the influence of fear. It dominates the entire digestive tract; it causes the food "to stick in the

throat" on account of the stoppage of the secretion of saliva and the refusal of the muscles of deglutition to act. Fear may cause involuntary defecation by increasing the peristalsis of the intestines.* In the cases of which we hear that fear caused the food to remain undigested in the stomach for hours and to be finally vomited, we will not err in assuming that this is due to an absence of the necessary gastric juice, corresponding to a similar lack of saliva; it can not be due to an increased peristalsis of the stomach, since such a condition would favor gastric digestion.

Although it is beyond doubt that both stimulating and inhibitory impulses are conveyed along the nerves to the gastric glands, yet the fact nevertheless remains that even after the section of all these nerves the secretion does not cease and may even be increased by an irritation of the mucous membrane. It is not improbable that stimuli pass directly or indirectly along sensory paths to the ganglion-cells in the wall of the stomach, and that from these the glands are stimulated to activity. This has not yet been proved, and, as Heidenhain has already said, we can not disregard the fact that these stimuli may act on the glandular cells directly without any nervous intervention. It has been demonstrated through gastric fistulæ that normally even the contact of a foreign body with the mucous membrane causes a circumscribed secretion at the place touched. Only the mechanical stimulation operates in such a case, since the same effect is produced by a pebble or by lightly applying a feather. The amount of the secretion thus produced is very small, but immediately increases and loses its circumscribed character if absorption of even innutritious fluids like water takes place. But the entire stomach becomes active and the secretion reaches its normal strength only when the organ contains absorbable nutritious material. It is by no means essential that these fluids enter the stomach as such, but the liquids produced by the solution and digestion of solid food will suffice. It must remain an open question whether this absorbed food acts indirectly by altering the blood, or

* It has been erroneously supposed that defecation results from the relaxation of the sphincter. But the rectum is normally empty, and under such circumstances defecation can not result from simple opening of the sphincter. Hence it is absolutely impossible to explain in this way the diarrhœa which results from fear.

directly by affecting the nervous elements in the stomach; yet the reflex character of this stimulation is shown by its extension over the entire stomach. We must therefore assume that normally the contact of food with the mucous membrane causes a local secretion which is possibly produced by a direct stimulation of the glands, and that at the same time the absorption of food reflexly calls the entire secretory apparatus of the organ into activity.

Absorption.—A not insignificant portion of the food, both fluid and that liquefied in the stomach, is absorbed by the stomach itself. As the walls of the vessels and the surrounding portions of the stomach constitute an animal membrane, filtration and osmosis may play an important part. This explanation of absorption appears all the more acceptable because variations in this process which are believed to be of nervous origin may easily be attributed to vasomotor changes in the blood, and even the lymph-vessels. Absorption is also directly influenced by the nervous system. The first decisive experiment on this subject was made by Goltz; it may be briefly described as follows: In two frogs the heart was removed, thereby rendering circulation impossible; then the brain and spinal cord of one of these frogs were destroyed, in the other they were left intact. An equal amount of a strychnine solution was then injected under the skin of the hind leg of each of them; after a time it could be demonstrated that the fore leg of the frog with the intact central nervous system contained strychnine and was poisonous when some of its juices were injected into another frog; but the fore leg was not poisonous in the frog without its central nervous system, and hence contained none of the alkaloid. As there was no circulation of either blood or lymph, the strychnine must have passed from the hind leg to the fore leg by diffusion, or, if we wish to avoid the use of this strictly physical expression, by absorption. The experiment therefore proves that the rapidity of this absorption was influenced by the nervous system.

How shall we think of this influence? Certainly not from a purely physical standpoint, as if the nerves had altered the texture of the parts of the body involved, and in this way changed the rapidity of diffusion, just as a tense membrane affects filtration and diffusion differently than a relaxed one. We would rather assume that

the activity of the individual living cells had been altered, causing them to absorb and give up the strychnine solution to the neighboring cells more rapidly. The existence of an independent activity of the living cells ought not to surprise us if we recall the remarkable functions of the white blood-cells mentioned on page 365, or if we remember that some one-celled animalcules only choose certain algæ for their food.

Absorption may thus take place very easily in the stomach without any influence of the nervous system through the individual activity of the cells of the mucous membrane, and of the walls of the vessels, and even of the blood itself. It may be changed by the nervous system both quantitatively and qualitatively. It is also, to some extent, affected by the physical laws of filtration and diffusion, which in turn are influenced by chemical and physical changes in the circulation. But the physical relations of the circulation are regulated by a direct nervous influence, and in this way the nervous system may exert a double regulating action on absorption. The paths of the direct nervous regulation of the cell activity are still absolutely unknown. I will now discuss those which influence the circulation of the blood.

Vaso-motor Nerves.—Whenever the glands of a part or of the whole stomach are in active secretion it is constantly observed that the secreting area has an increased blood-supply. The arteries dilate, the blood flows more rapidly, and reaches the veins in a less oxidized condition. The object of this heightened circulation is manifestly to bring a sufficient amount of material for secretion. These changes may be recognized by the reddening of the mucous membrane and a marked turgescence and erection of its folds, especially of the large ones near the pylorus.

How does this vascular dilatation occur? The vaso-motor nerves may be stimulated directly—i. e., either by mechanical irritation produced by the weight of the ingesta, or by their rubbing against the walls of the stomach and the like, or by a chemical stimulation proceeding from the absorbed materials. The extent of the area of dilatation would thus correspond to the area to which the directly stimulated nerves are distributed. But the irritation of the mucous membrane with a feather or a solid body only produces a local red-

dening corresponding to the irritated area. This would indicate an immediate influence on the walls of the vessels themselves, and renders the above-described transfer of the stimulation to the vaso-motor nerves very improbable. A similar and even more localized reddening may be produced in the skin by rubbing or drawing a line on it; chemical irritants (stimulating plasters) also exert a local action. These manifestations are undoubtedly due to a local action on the vascular walls; and the same seems to be true of the stomach. Let it, however, not be understood that an important part may not be played by the true vascular reflex which follows mechanical, chemical, and thermal stimulation, proceeds along the sensory nerves and acts through the medullary and spinal centers (Schmidt-Mühlheim) upon the vascular nerves. For we also know that holding a piece of bacon before a hungry dog causes an increase in the temperature of the stomach which is analogous to the heightened secretion. Possibly the same influences operate here as in secretion. The reflex stimuli are probably associated with the direct local ones, but they differ from the latter by influencing the stomach in its entire extent.

We are justified in assuming that the path of the vaso-motor impulses is along the sympathetic nerves. This is rendered probable by the analogical conditions in other parts of the body as well as by the fact that very moderate vascular changes follow the division of the vagi. Vaso-constrictor nerves probably accompany the vaso-dilators everywhere; this may explain why in all the experiments to demonstrate the relations of the stomach to the nervous system not alone the various experimenters have differed so among themselves, but also the same observer has obtained such contradictory results on repeating the same experiment. The manifold functions of the nerves distributed to the stomach are indicated by their size; and we also have many undoubted proofs of centrifugal impulses in the effects of fear, in the case of Richet (p. 368), and in other similar observations. But why is the result so often absent on stimulating the vagus and sympathetic? Why do we get one result in some cases and the contrary in others? I think that these differences are not to be attributed to the longer or shorter interval after the last meal, to the various degrees of fear in the animals, or to the dif-

ferent anæsthetics. In my judgment the probable explanation is as follows:

If the vagus is stimulated, the inhibitory effect on the heart is so marked that for a long time the presence of accelerating fibers was denied. Had the effect of the accelerating fibers exceeded that of the inhibitory, then probably the former would only have been recognized at first. What would be the result if both sets of fibers were equally powerful? Stimulation of the vagus might then be followed by inhibition at one time, by acceleration at another, or by no effect at all. Where the stimulation of both sets of fibers is exactly equal, the result will be negative. But, on the other hand, slight variations in the point of application of the electrodes, different conditions of exhaustion of the various groups of fibers, and the like, may cause the result to be positive. The condition of the heart, the organ supplied by the nerve, will also influence the result. This is well shown in the experiment in which the sciatic nerve of a dog is stimulated: if the blood-vessels of the paw have been dilated by heat, the irritation will cause them to contract; but, if they have been contracted by cold, then a dilatation will be the result. Let us, then, suppose that all the inhibitory and stimulating nerves of the stomach are acting equally powerfully; then an explanation would be given why strong impulses may pass along the vagus and sympathetic during life, and yet the functions of these nerves may remain unexplained by our present methods of investigation.

The Movements of the Stomach.—When spontaneous movements are observed in an excised organ we very frequently, but not always, find ganglion-cells in these tissues; hence we are led to infer that these movements depend upon the ganglion-cells. In support of this view I may mention the active peristaltic movements of an excised piece of intestine; here we have the ganglion-cells of Meissner's and of Auerbach's plexuses. The œsophagus executes spontaneous movements twenty-six hours after excision, and here, too, numerous ganglion-cells may be found in its walls.

The conditions in the stomach are exactly the same, for it, too, manifests spontaneous movements a long time after removal from the body, and in its walls may be found the collections of ganglion-cells already described (p. 368). These movements differ from those

normally observed in being less regular in their direction. The peristaltic and the antiperistaltic movements seem to alternate irregularly, or both may affect various parts of the stomach at the same time. Normally, by means of fistulæ or by a very careful exposure of the organ, two distinct varieties of movements have been observed, those of the empty viscus and those during digestion. In the former condition the contractions are slower, less frequent, and individually less energetic—i. e., the constrictions are not so deep. On the contrary, while secreting they are rapidly executed, much more frequent in occurrence, and each contraction is more vigorous.

A great variety of movements has been observed. Most of the waves seem to proceed from the pylorus antiperistaltically to the middle of the stomach, and then run back to the pylorus as peristaltic waves. This origin of the movements would seem to indicate that most of the ganglion-cells are situated at the pylorus. The other half of the stomach also shows various movements, but they are less easily traced. A permanent transverse constriction across the middle of the organ, the so-called *cravate de Suisse*,* and many similar features have been described, but I will not enter into further details concerning them, and shall simply mention two important circumstances: First, we must distinguish between movements of the ingesta and the visible movements of the organ, as they by no means coincide with each other. The former should be such that the food makes a circuit of the stomach in one or another direction. Secondly, at no time is the peristaltic motion exclusively in one direction, and hence it is impossible to determine from the outside whether or not the chyme is forced through the pylorus. Long pauses may occur in the movements of the empty as well as of the full stomach; they are most marked in the former and may continue for hours, but when full the periods of repose last only a few minutes.

Concerning the object of these movements I may premise that, as there is only a thin layer of muscular fibers, the amount of force

* [This term has been applied to "the layer of oblique muscular fibers which pass from behind the cardia to below the pylorus. By contracting they form a continuous canal between these two orifices, separate from the fundus."—Tr.]

generated must be small, and that any mechanical trituration or grinding of the food is out of the question. Such a mechanism is not compatible with a secretory apparatus, since strong pressure would be injurious. Hence, in birds, where such grinding and crushing take place, we observe that this is done in a separate muscular stomach, while secretion occurs in another stomach specially arranged for the purpose. Therefore, in mammals the movements of the stomach can only serve the twofold purpose: first, to move the ingesta about so that they may be brought into thorough contact with the gastric juice, and to stimulate the secretion of the latter by this mechanical irritation of the walls of the organ; and, secondly, to expel the chyme.

The origin and insertion of the muscular fibers at the cardia and pylorus are arranged in a special manner, and also have special functions. While there is very little agreement as to the functions of these sphincters, yet the following facts may be accepted: Both orifices are normally kept lightly closed by the tone of the sphincters. The opening of the cardia constitutes the last part in the act of deglutition. On introducing the finger into the cardia from within the stomach, rhythmical contractions may be felt like those of the sphincter ani after section of the spinal cord. Yet there is no rhythmical opening of the œsophagus, for this would permit the regurgitation of food; it is simply a "wandering up and down" of the closed orifice of the stomach, for as the cardia relaxes the former closes. At the same time there may also be an *active* opening of the cardia by muscular contractions through the shortening of the muscular fibers passing from it to the stomach. The pylorus not possessing such bands of muscular fibers must always open *passively*. This occurs during the later stages of gastric digestion, partly as a result of the increased pressure exerted on it by the food through the heightened peristalsis, and also partly on account of the increased amount of hydrochloric acid in the chyme. The latter does not all pass into the duodenum at once, but intermittently; this may be due to the fact that the pylorus has rhythmical movements like those of the cardia.

As already mentioned, section of all the nerves distributed to the stomach does not cause the cessation of all its various movements,

but only weakens them, and abolishes the slight degree of regularity and co-ordination which they had previously manifested. In mammals stimulation of the vagus usually causes peristaltic movements of the organ or intensifies those already present. As a rule, the pylorus also contracts powerfully, but a coincident contraction of some duration has not always been observed. The majority of experimenters believe that similar but far less powerful movements follow stimulation of the sympathetic. On the other hand, stimulation of the splanchnic nerves in the abdominal cavity is said to stop the spontaneous contractions of the pylorus (Oser).

Yet all these experimental stimulations in mammals have an indefinite and uncertain character; their success is usually not great and by no means constant.* We know only of the absolutely clear and satisfactory experiment on frogs, and it may indeed be said that it is the only positive experiment on the influence of the nerves upon the movements of the stomach. I refer to Goltz's crucial test with curarized frogs.† In spite of Goltz's warning this experiment is nearly always falsely interpreted. The main point at issue is really a stimulation which results from destroying the brain and cord, and which reaches the stomach through the vagi. The same effect may, therefore, be obtained by laying this nerve bare and stimulating it.

Vomiting.—Magendie thought that vomiting was exclusively due to the action of the abdominal pressure, which is entirely independent of the stomach. As is known, he replaced this viscus with a pig's bladder, and caused the expulsion of its contents by injecting

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* There is no lack of recent positive assertions, but confirmation is still wanting; for example, see the review of R. Kobert in Schmidt's Jahrbücher, Bd. 211, S. 244: and Bd. 215, S. 12.

† *Vide* Ewald. Klinik, etc., I. Theil, 3. Auflage, S. 76. [In brief, the experiment is as follows: Two frogs, whose œsophagi and stomachs have been laid bare, are suspended vertically after having been curarized; in addition, in the one frog the brain and spinal cord have been destroyed. A dilute solution of common salt is now poured, drop by drop, into their mouths: in the normal frog the stomach and œeophagus are distended and full of fluid, almost motionless, with only an occasional peristaltic wave, and look just like a distended pig's bladder; in the frog without the central nervous system the gullet and stomach are empty, with active peristaltic waves from above downward, and look like a rosary. The same results are obtained by dividing the vagi, but electrical stimulation of this nerve produces only slight contractions.—Tr.]

tartar emetic into the blood. But Tantini showed that this experiment was no longer successful after the cardia was left attached to the œsophagus. Therefore, during vomiting there must be an active opening of the cardia in the manner already described. At the same time that the cardia is opened the pylorus is tightly closed, and powerful peristaltic and antiperistaltic waves, especially the latter, traverse the organ; the diaphragm descends and becomes less arched; the abdominal muscles exert pressure on the stomach partly directly, partly indirectly, by compressing all the abdominal viscera. The larynx descends, the base of the tongue is depressed, and the upper part of the body is bent forward. All these movements are intended to facilitate the evacuation of the contents of the stomach. Indeed, the abdominal pressure may be said to exert most of the force necessary for the act. This is well shown in the easy vomiting of children; here we may see the entire contents of the stomach ejected from the mouth in a large, continuous stream, such as could never be caused by peristaltic contractions. It should also be observed that the ability to vomit lessens with years, especially as fat develops in the abdominal muscles, so that even in one's student days vomiting may only be accomplished by artificial pressure on the abdomen, even though marked nausea be present.

Of the nerves participating in the act of emesis we are here only interested in those distributed to the stomach. Mechanical and electrical stimulation of the gastric mucosa easily excites vomiting, since it seems that it is transmitted along the sympathetic to the vomiting center in the medulla. This has not yet been demonstrated with the other sensory stimuli, and it seems that most of the emetics can only act on this center after they have passed into the blood. The centrifugal impulses which reach the stomach during vomiting proceed along the vagi, and effect the proper co-ordination of the movements of the stomach with the other muscular contractions essential to this act. After section of the vagi this co-ordination is lost, and, although vomiting is not impossible, yet it is rendered very difficult. It will then only occur when by chance the increase in the abdominal pressure and the opening of the cardia happen to be simultaneous.

Sensibility of the Stomach.—The stomach is unquestionably sensi-

tive both upon the mucosa as well as on the serosa. A hard œsophageal bougie is felt the moment it touches the walls of the stomach. So, also, in making a gastric fistula the patient feels the thermo-cautery as it touches the stomach from without. The sensitiveness is very limited, and strong stimuli are required to produce these effects. Normally we do not feel our stomachs; we neither feel the weight of the ingesta nor do we know where the food lies, its temperature, or chemical properties, whether acid, alkaline, or bitter; neither do we feel the peristalsis called forth by eating. But the powerful stimuli above mentioned prove that even the healthy stomach is not utterly devoid of sensation; and as all sensory nerves respond to the four different kinds of stimuli, viz., mechanical, electrical, thermal, and chemical; these may also be at once assumed of the sensory nerves of the stomach. The efficiency of the electrical and chemical stimuli has also been demonstrated; this, combined with the perception of the bougie and the thermo-cautery mentioned above, demonstrates that, to a certain extent at least, all of these kinds of stimuli are effective. The thinness of the walls of the stomach may at times render it difficult to decide whether the perception has been on its inner or outer surface; it has indeed been suggested that in some cases, as, for example, the temperature of the food, the sensations are not in the stomach but in the abdominal parietes. Even if this be true under certain conditions, the fact nevertheless remains that the various stimuli mentioned may all be perceived in the mucous membrane of the stomach.

Pathologically the sensitiveness may be increased even where the nerves are not exposed, as happens in gastric ulcer, cancer, etc. Under such circumstances irritating ingesta which have been swallowed may cause pain, and even touching the wall of the stomach with the bougie may produce unpleasant sensations.

To anticipate what will be discussed later on, I will add that, although we do not normally feel whether the stomach is empty or not, yet we do know when it is overfilled; this may be due to distention and traction on the gastric walls.

All these sensations affect consciousness by means of the pneumogastric nerves, since the complete division of these nerves will prevent every conscious perception of the stomach.

Hunger.—The consideration of the causes and localization of the sensation of hunger is best taken up after the above discussion of the sensibility of the stomach. Formerly the stomach was universally regarded as the cause of hunger. Thus, Haller thought it was due to the rubbing together of the walls of the empty stomach. But hunger is unquestionably a general sensation. It is due to the impoverishment of the blood, and has been well called the appeal of the impoverished metabolism to the brain. Such being its cause, it can only be definitely satisfied by supplying the blood with fresh nutriment. It has been demonstrated in animals that hunger is abolished by injecting nutritious substances into the blood. Naturally, the experiment with the corresponding general sensation of thirst is much more easily carried out, since the simple injection of water easily relieves it.

Recently there has been no lack of contradictory statements, only the more important of which I will now mention. Thus, it has been said that hunger is due to the emptiness of the stomach. But rabbits, guinea-pigs, and other herbivoræ, never have empty stomachs; indeed, the organ retains the same degree of fullness which it had after the last meal, till the fresh food which has been taken pushes part of the contents on through the pylorus. Here we can not speak even of a relative emptiness of the stomach which might cause the sensation. In carnivora the viscus is empty hours before hunger is felt, and in new-born infants hunger is only manifested some time after tying the cord, while normally the stomach is empty up to this time without giving rise to this feeling.

Furthermore, it has been attempted to make not alone the emptiness of the stomach a direct cause, but also the simultaneous increased peristalsis or the lessening of the secretion of the gastric juice, or even its accumulation in the gastric glands. But direct observation shows that all these suppositions are not tenable, and therefore can not be advanced in explanation of this feeling. On the other hand, section of the vagi affords important proof that hunger is a universal sensation, since it may be felt even after all the fibers of these nerves have been divided. But, as I have already mentioned, after this has been done no more perceptions can proceed from the stomach to consciousness.

The vagi having been divided, reflexes might be transmitted to the brain by the sympathetic. Such a function is generally not accepted; hence it has been suggested whether, after the suppression of perceptible stimuli from the stomach by division of the vagi, other kinds of excitation of the organ which are not perceived as such by consciousness, may not affect the higher centers, and thus cause the sensation of hunger. But the latter may be felt even after the simultaneous division of both the vagi and sympathetic. Therefore the hunger-center requires no connection with the stomach.

Where shall we search for the center? At all events, not in the cerebrum or cerebellum, for monsters born without these organs give undoubted manifestations of hunger. Until recently it was observed that pigeons in which the cerebrum had been extirpated never voluntarily took food; and as they made no movements which could indicate hunger, even starving to death while quietly resting on a heap of peas, it was naturally supposed that with the destruction of the cerebrum the sensation of hunger had also been lost. But in all experiments on the central nervous system very great care must be exercised and inferences must be very cautiously drawn. Nearly one year after the destruction of the cerebrum in the usual manner I saw a pigeon again begin to take solid and liquid food voluntarily. This seems to have been the first case of this kind observed. It has also been verified by Schrader, but he asserts that pigeons can only again learn to eat when remnants of the frontal lobes have been left intact. On the other hand, the same writer saw frogs catch and devour flies after complete removal of the cerebrum. Therefore, this center does not exist in the cerebrum, and it has properly been located in the medulla; the supposition is that it is here stimulated directly without the intervention of peripheral nerves by the blood circulating about it, whenever the percentage of nutritious material in the blood has been sufficiently lowered by giving it up to the tissues.

But how can we reconcile this with the fact that most people locate the sensation of hunger in a particular spot? A comparison with another general sensation which is universally recognized as such—i. e., sleep—teaches us how easily such general sensations may be combined with local perceptions. When we are tired the feeling

of general languor and the desire to sleep is accompanied by a heaviness of the eyelids which is often supplemented by itching or burning. Here we distinctly feel that the general fatigue is associated with a localized feeling in the eyelids. But in hunger the general sensation is so indefinite that it is usually mistaken for the simultaneous local feeling. Hence, hunger is more or less positively located by most persons in a definite part of the body. Very interesting in this connection is the statement of Schiff, who asked a large number of soldiers where they experienced the sensation of hunger. Several located it in the chest and neck, twenty-three over the sternum, four did not know where to place it, and only two mentioned the stomach. Marked individual differences undoubtedly exist in the localization as well as the intensity of this sensation. After a long fast many only experience a moderate, vague feeling of oppression, while others regularly have an intense, almost painful sensation before the usual meal-hour. Yet in the majority of persons who can observe themselves somewhat closely hunger seems to begin merely with a vague oppression in the epigastrium. This localized sensation accompanying the general feeling is really central—i. e., it results from the stimulation of the centers themselves without any demonstrable intervention of the peripheral nerves. The central irritation is then transferred peripherally—that is, the cause of our perception is falsely referred to the periphery. Such, or analogous "eccentric transfers" are of frequent occurrence; thus, if the ulnar nerve is injured, the pain is felt in the little finger. However, in this example the irritant does not act upon the center, as in the sensation of hunger, but only upon the nerve at a place which is more centrally situated than the site to which the sensation is referred.

Against this interpretation of the localized feeling of hunger as a central perception it might be said that the local irritation of the stomach is often followed by very positive manifestations of hunger. Thus, the first effect of a growing cancer of the stomach may be a ravenous appetite. But why may not an "eccentric sensation" be simulated by one which is peripheral? Touching the spokes of a rapidly revolving wheel at times causes a sensation like that of the "falling asleep" of a finger. On the other hand, if this feeling of

hunger suddenly passes away, as through disgust, it is highly improbable that the perception of the existing local irritation should have been suppressed, as such an inhibition usually results only from the most intense psychical excitement. In the heat of a battle the pain of a wound may not be felt even if the attention has been casually directed to it; here stimuli are acting which affect the mind to the highest degree. But if these stimuli be feeble, as, for example, the receipt of some unexpected, affecting news, be it good or bad, we can nevertheless always positively say whether there is any abnormal sensation in any part of the body; our judgment will in no wise be different than usual. At all events, in such a case we can remove this inhibition which may finally have resulted from the mental excitement by directing the attention to the part of the body in question. But if through mental excitement we have lost our desire for food—I will rather say the sensation of hunger—we may sit down at the table, we may long to eat, we may concentrate our entire attention upon the appetite, yet this feeling of hunger remains away. What trifling excitements sometimes cause this in many persons—the news that a good friend is coming, the falling of a fly in the soup, or the narration of disgusting stories! How remarkable! A person may attempt to spoil another's appetite by telling such stories; and he may succeed, in spite of the most strenuous efforts of the eater not to be influenced by these recitals. It will always be futile to use such feeble mental efforts to suppress sensations due to peripheral irritants, even if they be slight or proceed from without or within the body. The abnormal sensation will always return whenever the attention is directed to one's own body.

It is different with sensations of central origin. Continuous self-observation will at times show that a headache may entirely disappear as a result of moderate mental excitement; possibly even more convincing is the feeling of fatigue which so often leaves us after slight mental exertion and then is craved back again in vain. I therefore believe that hunger is of purely central origin, and that it is only indirectly connected with the "rumblings of an empty stomach."

Just as we can drive away sleep for a short time by abolishing

the sensations by which it manifests itself locally, so can we do the same with hunger. Washing the eyes with cold water will keep one awake. Hunger may be put off by introducing indigestible substances into the stomach or by compressing this viscus with a tight belt, as is frequently done by the common people. But both of these general sensations have only been treated symptomatically, and have not really been suppressed. It is merely using the familiar method of obscuring one sensation by a stronger one at the site of the former, or where this may be referred in the periphery.

Even if we thus succeed in removing the manifestations of hunger which appeal most powerfully to consciousness, true hunger can nevertheless be satisfied only by introducing nutritious material into the circulation. But it is a well-known fact that when we are very hungry and have waited too long after the usual time of eating—so that the stomach "rumbles," we yawn and feel weak, etc.—a few bites will satisfy us and relieve these distressing symptoms. But is it possible that in so short a time sufficient food has been absorbed to satisfy this want? By no means. Only the more urgent manifestations have been assuaged, exactly as happens after swallowing indigestible substances and tightening a belt. Eating a meal first satisfies the urgent signs of hunger, but we are not really satiated then; the true hunger is appeased very slowly during the meal and the period of digestion. The true sign of being sated is that condition of the blood which no longer stimulates the hunger-center; hence the latter ceases to send out impulses to the other centers which cause this feeling to be manifested.

According to this theory, that satiation denotes a state of quiescence of the hunger-center, the feeling is of a negative character. Hence it might be objected that it would then be impossible to be especially "full" after a large meal, I might almost say over-satiated. But in order to show that this is really an objection to the theory it must first be demonstrated that the sensation is due to an excess of nutrition in the blood above what is needed for satiation. This is evidently not the case. We can not feel whether more nourishment than is necessary is circulating in the blood, just as we are unable to tell whether the sleep from which we have just awakened will suffice for a longer or shorter time. Consequently, after having

satisfied ourselves at a meal, and provided we have no other guide than our sensations, we will not know whether we will feel hungry sooner or later. The real cause of the varying degrees of satiation after a meal is simply the distention of the stomach, for which, as already stated (p. 378), we have a distinct perception. Whether the stomach feels especially full or not depends on the usual size of the meals. If we give only meat and wheat bread to an Irish peasant, who is accustomed to distend his stomach with potatoes, he will feel sated after having taken a much larger amount of nutriment than usual; in spite of this, he will not feel that he has eaten too much, unless his stomach is unusually distended. On the other hand, if we give innutritious and bulky food to a person whose chief article of diet has been meat, he will feel over-sated when his stomach is uncommonly distended, even if he has taken less nourishment than usual. Hence the feeling of over-satiation is really not due to such a condition, but is to be regarded only as a new and positive sensation, resulting from an unusual distention of the stomach, and which to some extent may be regarded as a warning against overloading this organ.

Finally, I must discuss the *appetite*. Let us again use the simile between hunger and general fatigue. If we are tired and wish to sleep, it is essential that certain parts of the brain should not be excited. The absence of such excitement puts us into the condition of sleepiness. Not alone do we wish to sleep, not alone do we feel the need of repose, but we also experience the sensation that we will soon be asleep if we simply keep quiet. The same exertions which have at first tired us may excite us if they are kept up too long. Then we are overtired. In the same way certain mental exertions may be exciting; in both cases, in spite of the fact that we feel a very well marked need of rest, we are yet unable to sleep—that is, we are not drowsy.

Appetite bears the same relation to hunger that drowsiness does to sleep. Normally, both sensations, hunger and appetite, precede the taking of food; but we may be over-hungry as we may be overtired. Of the mental excitements which may suppress hunger I have already spoken. Sensory stimuli act in this same way upon drowsiness and appetite; a cold sponging may awaken us, and an

offensive taste or smell may spoil our appetites. Finally, however, sleep as well as hunger overcome all obstacles and imperatively demand their rights.

We must therefore assume that the true hunger-center, which is influenced by the impoverished condition of the blood, sets into action a large series of secondary centers, which in their turn produce the manifest signs of hunger; and upon their activity depends the occurrence of appetite. If we have no appetite, as, for example, when we are over-hungry, then these centers are inhibited; the most pressing and distinct signs of hunger which urge us to eat are absent, and only a vague general feeling tells us that we are nevertheless not sated. However, the nature of appetite consists not alone in a demand for taking food, and a preference for certain articles of diet (if this were the case, then there would be an analogous sensation in the condition of thirst, which, however, does not exist, and for which also there is no word in the language); but the appetite may also exclude certain articles of diet which are relished at another time. The latter lends a special characteristic to this feeling. Of the many instances which might be quoted to illustrate this I will simply recall the striking repugnance toward fats in jaundice. The simple sight of butter may excite disgust even in persons who have been fond of butter or fatty food. I do not know any analogous instances of this regarding thirst—that is, in so far as the fluids are simply to allay thirst, but are not to have any great nutritive value, as milk, chocolate, etc. Here it is only over-indulgence which causes a disgust toward favorite beverages.

The taking of food brings into action a very large number of special centers. Among these are the centers for taste and smell, the secretion of saliva, the voluntary and involuntary acts of deglutition, etc. We also have a very distinct feeling whether a certain article will influence the taking of food favorably or unfavorably. Even the thought of them will act in the same way as the dishes themselves, but, of course, to a feebler degree. If we notice that the smell or taste of a dish is unpleasant, that the secretion of saliva is lessened, and that deglutition is inhibited (a sensation which is characterized in its most marked form as a "*zugeschnürte Kehle*"), then this article of food becomes repugnant to us. Such an occur-

rence will explain why this peculiarity does not occur in the analogous sensation of thirst, or, if present, is very feebly marked; that is, the act of drinking does not call these centers of salivary secretion, deglutition, etc., into play to the same degree. Naturally, a favorable influence on the above centers will cause a longing for special foods.

In my opinion, appetite is due: (1) to the excitation of those centers which cause the manifest symptoms of hunger, and the action of which is regulated by the true hunger-center; (2) to the favorable or unfavorable, stimulating or inhibitory action of the secondary centers concerned with the taking of food.

LECTURE X.

THE NEUROSES OF THE STOMACH.—(*Continued.*)

Classification.—The neuroses of the stomach may arise either directly from diseases of this viscus, or they may be caused reflexly from other organs—the brain, spinal cord, uterus, kidneys, liver, etc.; thus the gastric nervous centers may be called into action, either directly or reflexly. Yet, in the majority of cases, as Oser has shown, a sharp distinction can not be made; as an example he cites the so-called reflex cardialgias in uterine disorders where both affections, the uterine and the gastric, might be considered concurrent, as well as standing in a causal relation to each other.

In the following table of the various neuroses I have followed a classification which is midway between the purely symptomatic and the etiological, in order that a better general idea may thus be obtained.

THE NEUROSES OF THE STOMACH.

I. Conditions of Irritation.

a. *Sensory.*	b. *Secretory.*	c. *Motor.*
Hyperæsthesia.	Hyperacidity.	Eructation.
Nausea.	Hypersecretion.	Pyrosis.
Hyperorexia.		Vomiting.
Anorexia ex hyperæsthesia.		Colic.
Parorexia.		Tormina ventriculi.
Gastralgia.		

II. Conditions of Depression.

Anæsthesia.	Anacidity.	Atony.
Polyphagia.		Insufficiency of the pylorus and cardia.

III. Mixed Form.

Gastro-intestinal neurasthenia (Dyspepsia nervosa).

IV. Reflexes from other Organs upon the Gastric Nerves.

Reflexes from the brain, spinal cord, kidneys, liver, sexual organs, and intestines manifest themselves in the forms mentioned in I and II.*

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* I wish to state that some time *after* the appearance of the first edition of this

Occurrence and Etiology.—In looking over the various neuroses enumerated in the above table we should never forget that they rarely occur as distinct, independent diseases, but usually in groups, either appearing simultaneously or closely following one another during the course of the malady, passing before us like a panorama with ever-changing scenes. To prevent needless repetitions let it be said, once for all, that these conditions *occur most frequently in women*, and especially the younger rather than those further advanced in years. It is hardly necessary for me to say that this is due to the greater predisposition of women to the functional neuroses, and to their great frequency before the climacteric rather than after it. In both sexes the middle period of life, from about the twentieth year onward, is most frequently the time of their occurrence; they are less common before this time, and least of all after the fifties.

No such general rules like those for sex and age can be formulated for the *condition* of these patients. Some of them have severe disturbances of nutrition, are feeble, emaciated, anæmic persons with a faded, pale complexion, through which the veins may be seen; they have languid eyes, a weak voice, feeble movements, and a dragging gait; some are even bedridden; while, on the other hand, we are astonished to see people enter our offices who are apparently healthy and vigorous, and with red cheeks, yet who complain of a host of nervous disturbances. There are also exceptions to the well-known rule that the people attacked with the gastric neuroses are usually those who live in large cities, and especially those better situated, whose struggle for existence demands an especial expenditure of labor and mental excitement to keep up with the demands of an "advanced culture." I have seen quite severe neuroses in persons of the lower classes—farmers, working people, female servants, factory-girls, and finally, where one would least expect it, in sailors.

As *predisposing factors* it is not difficult to recognize the relations of severe mental exertions of men in their business affairs, and in women the absolute or relative excess of social duties and pleas-

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book a table which is very similar to the above was published by Garland in a paper on Gastric Neurasthenia, Boston Medical and Surgical Journal, October 3, 1889.

ures; and in both sexes the excessive use of the sexual organs. For, not infrequently, we see cases of periodically recurring neuroses which are due to periodical increase of these causes, inasmuch as the amount of work and of pleasures is greater at some times and is less at others; this increase and diminution are accompanied by a corresponding increase or lessening or even disappearance of the nervous symptoms. Stiller observed an exacerbation of the neuroses in some of his patients in the spring; in my practice the majority of these patients come at the close of the winter. Yet, as the patients usually allow some time to elapse before consulting a physician, this would afford very little information as to the origin of these disorders; but the patients themselves frequently assert that in the quiet season they feel entirely or relatively well.

Almost without exception these patients have symptoms of general neuroses as well as their gastric complaints; naturally these are often not well marked, or are not considered by the patient to belong to the actual trouble, so that a thorough examination may be needed to bring them to light. We may then discover a so-called nervous temperament, headaches of various location and character, disinclination toward mental exertion, depression, mental sluggishness, poor memory, absence of mind, vertigo and its curious manifestation agoraphobia, insomnia, neuralgias and parasthesiæ, especially of the trigeminus and in the lower extremities, pupillary differences, evidences of spinal irritation, intercostal neuralgias, vesical weakness, and ovarian pains—all of these manifestations relegating such patients to the great class of neurasthenics. If the disturbances of the diseased mind are projected along the most varied nervous tracts—i. e., forming the capricious and confusing picture of hysteria—another and almost equally frequent class of cases will be grouped. Naturally, it is impossible in every case to draw a sharp line between neurasthenia and hysteria. The marked cases of each are easily recognized, but there is a border province in which the judgment, I would like to say the tact, of the physician must decide the diagnosis. For our present purposes it is sufficient to know that the neuroses of the stomach are usually (although not always) only a partial manifestation of general nervousness in the broadest sense of the word—i. e., of neurasthenia and hysteria; the very im-

portant deduction from this fact is that *the main object of the treatment is to cure the primary affection, and is not to be directed only to a single symptom, however prominent.* This will impart an almost uniform character to the therapeutic measures for these troubles, and hence the essential features of the treatment will always be the group of nervines, including both medical and dietetic measures. I shall therefore consider the treatment of the gastric neuroses collectively at the close of this subject.

I. Conditions of Irritation.

Proceeding from these general considerations to the special, I will first mention the mildest disturbances of sensation, **hyperæsthesia of the stomach**, which manifests itself in a feeling of fullness and tension as well as oppression in this region, and **nausea.** These sensations are so closely allied to the normal, and are the daily and constant accompaniments of so many digestive disturbances, that they include the entire series of gastric disorders, from the "full stomach" after a good dinner and the symptoms of intoxication after a strong cigar, up to the incessant oppression and fullness in the epigastrium felt by many patients with cancer, the burning sensation in the abdomen, and nausea which may accompany hysteria, meningeal irritation, cerebral tumors, and other diseases of the central nervous system. As concomitant manifestations of other diseases they must be disregarded here, for I shall limit myself to the genuine neuroses. But it is difficult to define the latter exactly, to recognize these symptoms as such—in other words, to group them as hyperæsthesiæ of the stomach.

Positive information can only be obtained after a careful and thorough examination with all the means for the differential diagnosis of the various organic gastric disorders. Furthermore, one must not forget that many patients, either through carelessness or because they locate falsely, attribute many painful sensations to the stomach, which really do not exist there, but in the epigastrium (the so-called epigastric pain of Briquet, myalgia of the abdominal muscles); such pains are usually the result of cutaneous hyperæsthesia or muscular rheumatism, or may even proceed from the spinal column. That the greater number of patients observe themselves very

carelessly, and are very reckless in localizing painful sensations, is a daily experience; hence the patient must not alone describe the painful spot, but he must also point it out to me. Oser has frequently seen sufferers from locomotor ataxia who referred the site of their troubles to the stomach, although they did not suffer from gastric crises; they had mistaken the girdle sensation perceived in the epigastrium for gastric sensations.

The knowledge of hyperæsthetic conditions of the mucous membrane of the stomach is very old. Todd* cites examples from Hippocrates and Aretæus; Schmidtmann† and Barras‡ knew of them—the latter, strange to say, under the name of dyspepsia. Pemberton considered it a condition of muscular irritability. J. Johnson describes it as a "morbid sensibility of the stomach"; while Todd cites cases under the name of "irritable gastric dyspepsia."

The characteristic feature of hyperæsthesia is an increased irritability of the stomach, the result of which is that the gentlest irritants, including even those which are normal, may call forth very painful sensations; the latter may sometimes occur even without the presence of such direct irritants. And yet these same sensory nerve-endings in the mucous membrane of the stomach are otherwise so tolerant! When well, we know nothing of the existence of the stomach, and much less of its functions; but in these patients there is a continuous sensation of heat or cold, gnawing, pulling, burning in the organ, which may exert such a powerful influence on the physical and mental life of the patients that every sensation, and, in fact, anything which attracts their attention, is considered in its relations to their stomachs. "Le principe de tous mes maux est dans mon ventre; il est tellement sensible, que peine, douleur, plaisir, en un mot toute éspèce d'affections morales ont là leur principe. Je pense par le ventre si je puis m'exprimer ainsi." This is what a lady wrote to Pinel; it is a splendid description of a condition which has been called hypochondria; at all events, it is

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* *Loc. cit.*, p. 633.

† J. Schmidtmann. Summa observationum medicarum ex praxi clinica triginta annorum. Berolini, 1819–1826.

‡ Barras. Traité sur les gastralgies et entéralgies. Paris, 1827.

located in the hypochondrium, but it undoubtedly also belongs to the hyperæsthetic conditions of the stomach.

The nervous nature of these disturbances is also shown by the fact that, in some cases, taking food moderates them; but they may become worse after the stomach has again emptied itself; however, in the majority of cases the reverse is true, and the trouble is aggravated during digestion. Sometimes the sensations described above appear only after taking, even very small amounts—as, for example, a glass of water. Then everything which has been taken is vomited, and remedies which are usually well borne now cause severe pain, clammy sweats due to fear, and even convulsions and collapse; mild aperients may be followed by severe diarrhœa.

Sometimes the hyperæsthesia is preceded by a tangible cause. Thus, for example, it occasionally follows chloroform narcosis. Such a case I have recently seen:

A young woman, twenty-eight years old, suffered from tabes, and also had a carcinoma of the anterior lip of the os uteri; the latter was removed under narcosis. Before the operation her appetite and digestion were excellent. For three days after she remained in a condition in which she complained of severe burning in the stomach and an unquenchable thirst; everything she ate was vomited after a short time. Several times, on the day after the operation, I examined the vomit, which consisted of weak coffee, and always found hydrochloric acid in it. Small pieces of ice, morphine injections, and large doses of morphine and cocaine internally were useless. The vomiting, which was never spontaneous, ceased only a few days before death. Peritonitis, which had been suspected to be the cause of the obstinate vomiting, was not found at the autopsy.

In this case there was an acute irritation, which could only have arisen from the nerves; here its origin was central. In the chronic form, the same may be true of a number of the above-mentioned disorders, while in others the seat of the irritation is peripheral. Among the causes given is insufficient food for a long period, or sudden restriction of diet; thus, prolonged fasting is said to have caused hyperæsthesiæ of the stomach in Catholic priests, fakirs, and Brahmans; excesses and an enfeebled bodily condition are said to favor their development. On the other hand, more material causes are also given, as, for example, gastric calculi,* the well-known con-

* [Gastric calculi, or gastroliths, sometimes reach a very large size. A unique case of this kind was reported by Kooyker (Zeitschr. für klin. Med., Bd. xiv, Heft 3).

cretiones benzoarticæ,* and worms. In many cases the causal factors will be sought for in vain. Thus, I have now under my treatment a strong young man, in good circumstances, thirty years old, who has developed this condition; as yet I can discover no cause for it, with the possible exception of a transient gastric catarrh.

Idiosyncrasies may also be included among the hyperæsthesiæ. As is well known, the eating of certain foods by predisposed individuals is followed by peculiar sensations in the epigastrium, mild oppression or burning, and sometimes mild nausea, combined with singular excitation of the cutaneous nerves, pruritus, erythema, and the formation of wheals [urticaria]; even headache and mild febrile movements which either soon disappear of themselves, or are subdued by the strong reflex irritants from the gastric mucous membrane, as strong wines, cognac, and the like. This condition most frequently follows the eating of shell-fish, crabs, lobsters, etc., sometimes also oysters, strawberries, or green peas. Here we are surely not dealing with a psychosis, but only with an abnormal sensitiveness of the gastric nerves toward these articles of food. For its first occurrence is purely accidental, and it recurs after these consequences have long since been forgotten.

The patient was a druggist, thirty-five years old, who had a circumscribed tumor in the epigastrium, the position of which varied on respiration, and which was tender on pressure. Medicines had no permanent effect. Spleen, liver, and kidneys normal. Appetite good; bowels regular. Occasional vomiting of a small quantity of fluid containing mucus and bile, but never free hydrochloric acid. Nausea was constant, and it was said hæmatemesis occurred, but this was not actually observed. Gradual emaciation followed, with cachexia and indolent swelling of the left supraclavicular and axillary glands. The patient was examined under an anæsthetic and the stomach washed out, but exploratory incision was steadily refused. The diagnosis, according to the probabilities, was cancer of the stomach. The case ended fatally; the autopsy showed that the stomach was normal in size, but contained a large concretion, weighing 885 grammes (over 28 ounces), and having the outlines of the organ. At the pyloric end there were two smaller fragments, the size of hen's eggs. The gastrolith had a strong fæcal odor, but contained no skatol. No nucleus was present. Microscopic examination showed starch granules, cells containing chlorophyl, bundles of vessels, but nothing to determine the animal origin of the concretion. It was identical in composition with the "food-balls" of ruminants.—Abstract from Universal Annual Medical Sciences, 1889, vol. i.—Tr.]

* [These are of very frequent occurrence in the abomasum, or fourth stomach of ruminants. See Lancet, 1888, vol. i, p. 186. For hair-tumors of the stomach, *vide supra*, p. 199.—Tr.]

A very peculiar condition which may also be included among the idiosyncrasies was recently observed by me in a man, fifty-one years old, in whom "the smallest quantities of fat" caused severe migraine, temporary partial amaurosis (*Flimmerscotom*), flatulence, and the passage of watery and very offensive stools. This condition was said to occur twelve to fourteen hours after taking fatty food; the expression "fatty" is obviously very vague, and refers only to the more or less oily additions to the ordinary articles of food. It was characteristic of a neurosis that he could eat pure table butter without any inconvenience, but as soon as he had tasted butter which had been rendered the peculiar attacks came on! Otherwise this patient, who moved in the best society, had a good appetite, was robust, and had no real gastric disturbances. In the intervals between the attacks the bowels were regular. In order to remove every suspicion of an insufficient decomposition or absorption of the fats, the passages were examined on three different occasions after an attack, and the amount of fat was ascertained by means of extraction with ether; but the amount was always found normal in comparison with the small quantity of fat which he consumed. The patient had suffered from this trouble for years, was himself convinced that he was "very nervous," and had derived no benefit from living in the mountains or at the sea-shore, nor from drinking the waters at Carlsbad and Kissingen, nor from the use of preparations of pancreatin and the like.

The deviations from the feeling of hunger constitute a second series of sensations which become pathological by a gradual increase of those which were originally normal. As is well known, the length of time during which one can endure hunger, or, to express it more properly, during which one need not eat anything, is subject to very extraordinary variations. Some people are satisfied with two meals a day, a good breakfast and a substantial dinner at 6 or 7 P. M.; while others must eat every three or four hours. Unless this is done they experience the sensation of emptiness of the stomach, and faintness, which may even reach such a degree in nervous persons that they lose consciousness; the French call this *défailliance*. I have treated a state official who was utterly unable to take even a glance at a newspaper unless he had had his breakfast exactly at his regular time.

An exaggeration of this condition is **bulimia** (ὁ λιμός, hunger, ὁ βοῦς, ox*); it is also called cynorexia [ὁ κύων, dog, ἡ ὄρεξις, desire] or fames canina; hyperorexia, *Heisshunger* or *Wolfshunger*.

* This etymology is according to Roth-Gessler's Klinische Terminologie. Erlangen, 1884.

Sometimes this condition is only temporary and quite closely allied to the normal sensations; at other times it is permanent; in the latter it constitutes a very obstinate, weakening, and exceedingly unpleasant malady.

It may occur alone or may be a symptom of the various diseases of the nervous system, manifest diseases of the brain, hysteria, neurasthenia, and psychoses; it may also complicate constitutional disorders like diabetes and Addison's disease, and may be of temporary duration in convalescence from acute diseases, after serious operations, profuse loss of fluids, peripheral irritation, for example, worms (Pavy), uterine disorders, and even syphilis. Naturally, the most interesting cases are those in which it occurs as an independent disease.

Potton * reports the case of an hysterical girl (eighteen years old) who ate eleven to twelve times a day, and consumed 10 to 12 kilogrammes [22 to 26½ pounds]. She drank little, and her sleep was frequently disturbed to satisfy the craving for food. The stools were never diarrhœal, but were frequent and copious; the urine was negative. The patient gained in weight, but her strength began to fail. A cure was effected with increasing doses of morphine, up to 0·4 gramme [gr. vj] in twenty-four hours. In a similar case morphine was useless, but it was cured by large doses of opium, up to 3 grammes [gr. xlv].

Peyer † describes the case of a woman, thirty-two years old, who was suddenly seized with a furious attack of bulimia, so that she could not return home from the house of a neighbor whom she happened to visit. In forty-five minutes she ravenously devoured three pints of milk, twenty-three eggs, and two pints of strong wine which Peyer allowed her to take. Thereupon she became quieter, went to sleep, and awoke perfectly well on the next day. She described the attack as a feeling of hunger accompanied by an inexpressible pain and suffering in the region of the stomach; she feared that she would die; she did not feel that the food reached the stomach, and it did not relieve her condition; it was only the strong wine which affected her.

The attack had been preceded by severe psychical excitement and worry.

For many years I had under my treatment a young lawyer, the picture of health, normal in every respect, both mentally and bodily, but who

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* Potton. Études et observations sur la boulimie dyspeptique. Gaz. méd. de Lyon, Juin 1, 1863.

† A. Peyer. Beitrag zur Kenntniss der Neurosen des Magens und des Darms. Correspondenzblatt schweiz. Aerzte, 1888, No. 20.

was annoyed with continually recurring attacks of bulimy. He was attacked whenever he had not eaten anything for two or at most three hours, especially in the morning, when he was frequently aroused from his sleep. He was then utterly unfit to attend to any business, not even to follow a conversation. His whole existence and every thought concentrated itself on the immediate allaying of his ravenous appetite. A few morsels or a swallow of strong wine sufficed temporarily, but soon the torment returned with renewed vigor. The intervals were longest after severe bodily exertion, so that he suffered little during his service in the army. But a sedentary occupation caused the attacks to be very severe, and so annoying that the patient for months subjected himself to all kinds of treatment, including faradization of the stomach, systematic lavage, etc., but unfortunately all without any visible effect; the best result was obtained with large doses of bromide of potassium, but even this was only temporary.

Rosenthal gives other examples associated with migraine, hypochondria, and exophthalmic goître. The disorder also accompanies diseases of the brain. Thus, this author describes a case which occurred with cerebral embolism subsequent to mitral insufficiency and cardiac hypertrophy. In another case it was the result of concussion of the brain; it appeared after the acute symptoms had disappeared, and lasted about three months.

Analogous to bulimy are the cases of perverted appetite which occur in pregnancy, children, and mental disorders.

Guipon* considers bulimia to be an abnormal increase of the digestive powers, which, in spite of the increased consumption of food, is unable "to repair the deficit in the economy."

As I have already said, on pages 363 *et seq.*, I do not think it advisable to enter into speculations about the site of this and other neuroses, in so far as the more exact localization is concerned. That we are dealing with central and not peripheral causes is proved by the simple fact that any trifle which is introduced into the stomach—a piece of bread, a cake, a swallow of wine—may momentarily assuage the voracious hunger; yet simple appeasing of the hunger is out of the question; and, furthermore, the feeling may come on when the stomach still contains large quantities of food. This is also corroborated by the cases already cited, in which the malady followed severe cerebral injury.

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* Guipon. Des dyspepsies boulimiques et syncopales. Bull. de thérap., août 15, 1864.

The necessity of assuming the existence of a hunger-center, and of its probable situation in the medulla, has been made evident in the preceding lecture. Rosenthal gives long arguments in favor of its being in the posterior roots of the pneumogastric nerves, and bases his claims upon a case of bulbar paralysis reported by Senator,* in which there was "a loss of the sensation of satiation," and in which there was also found an atrophy of the posterior nucleus of the vagus; but in the article quoted there is no mention of a loss of the sensation of satiation, but it is simply stated that "scarcely had the patient been fed, but he again began to complain of hunger and thirst." To me it scarcely seems justifiable to infer the situation of the hunger-center from this.

The cases already narrated show that there are acute and chronic forms of bulimia; but the chief difference between them is that in the latter the attacks are less severe, and may extend over weeks, months, and even years.

Under these conditions, one would imagine that the stomach is abnormally rapidly evacuated, and that this is the cause of the feeling of hunger; but, in a typical case of bulimia, reported by Leo,† which I had an opportunity of observing for some time at the Augusta Hospital, on repeated examinations fifty to ninety minutes after the test-breakfast, and more abundant meals, the stomach was by no means found empty, but, instead, the amount of stomach-contents which could be expressed was normal. On the other hand, in a lady under my care, who for some time was awakened every two hours during the night to satisfy her ravenous appetite, the stomach was found almost empty thirty to forty-five minutes after the test-breakfast; the salol test was decidedly hastened, the reaction being present within thirty minutes, and very marked after forty-five minutes. These two cases simply show that there is no uniform condition in this respect.

Anorexia (ἡ ὄρεξις, the desire) denotes a lack of appetite or a repugnance toward food. These two conceptions do not correspond

* H. Senator. Apoplectische Bulbärparalyse mit wechselständiger Empfindungslähmung. Westphal's Archiv, Bd. xi, S. 713.

† Leo. Verhandlungen des Vereins für innere Med. Berlin, 1889.

exactly, since it is one thing for a person not to have any appetite, or not to feel hungry; it is something else if there is a repugnance toward food, or even nausea at the sight of it. Yet the latter may be regarded as an exaggeration of the former, and therefore they may be included under the same term.

Anorexia accompanies nearly every dyspeptic condition, but naturally the discussion of this variety of it is out of place when speaking of the gastric neuroses. In the latter, the loss of appetite may arise spontaneously, or may be due to hyperæsthesia of the stomach; hence, central or peripheral conditions of irritation may be among its causes.

Both combine to produce their effects; the original anorexia, due to a cerebral lesion, and the consequent disturbance of nutrition, may cause hyperæsthesia of the stomach; and, on the other hand, the latter may produce changes in the psychical processes. Thus there is developed a vicious circle which may at times lead to the most serious consequences. In the first place, a perverted taste may be manifested in a lack of desire for food, which may at first be overcome by an effort of the will, but may later develop into a decided repugnance and disgust toward food, and an almost absolute refusal to take nourishment. Frequently such patients sit down at the table with a good appetite, or may even be very hungry; yet the first bite is followed by an insuperable aversion toward eating any more. In other cases, absolutely no need of taking food is experienced. "Unless I saw how other people ate, and were I not compelled to go to meals, I would not feel any need of it," is a frequent complaint of these patients. It is inevitable that the nutrition suffers from this, and also that the gastric mucosa becomes pathologically irritable. This brings us to the end of the circle; but then the hyperæsthetic mucous membrane revolts unless the brain causes it to refuse nourishment. We may be contented if these patients simply emaciate and look pale and miserable, provided they still maintain their strength; but, in the severe cases, the condition of inanition may become very threatening, so that the patients' feebleness may permanently confine them to bed.

Marked disquiet and restlessness, which struck Fenwick as being very inconsistent with the emaciation of the patients, did not occur

in my cases, yet at times this may constitute a very prominent feature of the disease. Fenwick narrates the case of a lady whose restlessness led her to make absolutely unnecessary railway journeys, although she knew that these would be followed by severe exhaustion and many days' confinement to bed.

Hyperæsthesia of the sensory nerves of the stomach leads to the same result, but in the opposite way; for, on account of this oversensitiveness, the patients gradually eat less and less solid food. Finally, the general nutrition is disturbed, which also affects the higher centers. Not infrequently this condition may follow profound mental disturbances of a depressing nature, so that patients who had previously enjoyed excellent health can positively trace the beginning of their affliction to a definite period, sometimes even to the very day. The cause may be the death of a dear friend, deep grief, crosses in love, loss of fortune, disgust toward some particular article of food, an unappetizing dish, etc. Frequently the condition arises without any discoverable cause. The majority of these patients consist of young girls of the better classes; young or adult men are rarely attacked. As chronic anorexia may lead to marked emaciation and feebleness, and, as Fenwick * claims, even to death, it may be mistaken for constitutional diseases, especially phthisis. Such errors are frequently made, and may occur very readily, because the enfeebled condition of these patients reduces their powers of resistance, and they may therefore be easily attacked by infectious germs; this will explain their predisposition toward pneumonia, pleurisy, acute bronchitis, etc. Hence a thorough examination of the heart and lungs is very important, and should never be neglected. On the other hand, tuberculosis develops much less frequently than one would expect. I have now observed three young girls suffering from severe nervous anorexia for periods of six, four, and three years respectively; they are in bed during the greater part of the year; there have been fluctuations in the general condition, temporary improvement, either spontaneously or after a sojourn at the spas, or during some new course of treatment; but, taken all in all,

* Fenwick. On Atrophy of the Stomach and on the Nervous Affections of the Digestive Organs. London, 1880, p. 99.

the condition is about the same, without any definite cure, yet without any other marked complications. We may dispose of such cases under the generic expression of "hysteria," but this by no means alters the fact that it is a sad affliction for the patients, and especially for their relatives.

Gastralgia or **Gastrodynia** * (*ἡ ὀδύνη*, pain). Although the causes of pain in the stomach are very manifold, yet its manifestation is quite uniform. This is perfectly rational, because the pain is always due to an irritation of the sensory fibers of the vagus, either in its peripheral terminal filaments, or nucleus, or in the reflections to it from still higher centers. Hence gastralgia may be due to local causes, or to conditions of irritation in the nerves outside of the stomach.

The attacks of pain may be ushered in by a feeling of discomfort, fullness and tension in the epigastrium, or they may begin suddenly and reach their greatest intensity almost instantly. Not infrequently the scene may be opened with a copious secretion of saliva; Oser mentions a case in which the attacks began almost uniformly with a severe toothache. But the pain in the left ear, which is mentioned by this author among the initial symptoms, is surely to be regarded as a coincidence. The character of true gastralgia is an agonizing boring or cutting pain, sometimes sharply localized, sometimes diffuse, or even resembling a girdle sensation; in severe cases the intensity is very pronounced. Instinctively the patients double themselves up to relax the abdominal muscles, breathe superficially, and carefully avoid coughing and speaking aloud. Although there is decided cutaneous hyperæsthesia of the abdominal parietes, yet deep pressure often gives relief. The face is pale, distorted with pain, and covered with cold sweat, and there may be conditions of collapse with an intense sensation of impending death, and attacks of unconsciousness. The abdominal aorta pulsates vigorously, and pains radiate along the spinal column and into the intercostal spaces. At times points of exquisite tenderness may be demonstrated along the spinal column or the lumbar nerves.

* I avoid the expression cardialgia, because it localizes the pain at a definite spot in the stomach without our being able to prove it.

In its general features and duration the gastralgic attack is very variable; the paroxysms may be either brief and mild or may last for hours, and may torture the sufferer till medical aid or Nature brings relief. As a rule, the attack wears itself out and the normal condition is gradually restored; at other times it terminates suddenly with vomiting; or the patient, to whom every morsel would have been a horror only a short time before, now experiences sharp hunger and demands food after the attack is over. The urine passed after the paroxysm usually has a low specific gravity. A feeling of marked relaxation and exhaustion is left behind. Happily, these attacks do not recur frequently, yet I have seen a case in which there were three or four in one day, causing very profound exhaustion of the patient.

The *etiology* of gastralgia is very varied and may be classified as follows:

1. *Local Causes* (true gastralgia).—In the chapter on gastric ulcer I mentioned the fact that there are follicular inflammations, hæmorrhages, and losses of substance of the mucous membrane which are not manifested by the classical symptoms of ulcer of the stomach, but which give only a single symptom, recurring gastralgia which, although it does not appear after every meal, yet stands in some relation to taking food. Now, it is characteristic of nervous gastralgia that it has nothing at all to do with eating; therefore, strictly speaking, these cases just spoken of do not belong here; yet we must not classify too strictly on either side, because every experienced physician has seen cases in which these criteria could not be applied. The following is an example:

Miss von B., from D——, twenty-one years old; complained of gastralgic pains which recurred irregularly for about six months. Sometimes they stay away for weeks; at other times they recur every few days. A relation of these attacks to taking food was at times suspected, but not constantly present. They have frequently occurred very early in the morning, and have aroused her from her sleep; the pain was localized in the stomach or the infrasternal depression, and was not very severe. No history of ulcer; never had migraine; the acidity of the filtrate after the test-breakfast was 66 per cent—i. e., just at the upper limits of the normal; contains no abnormal constituents. Physical examination negative. No tenderness over the ovaries, no painful points on pressure. Although the patient did not look bad, yet recently she had lost constantly in weight. The continuous frequency of the attacks during the past few

weeks led her to come to Berlin for treatment. Diagnosis: follicular ulceration of the mucous membrane of the stomach. A rest-cure ordered.

The patient left the sanitarium after four weeks, during which time she had gained four kilogrammes [about nine pounds], and without having had any attacks during the last fortnight. Soon after she was married, and according to subsequent reports has remained free from attacks ever since.

In cases like the above, in spite of the apparently idiopathic gastralgia, there are distinct anatomical lesions. There is another group of gastralgias which, although distinctly neurotic, yet are only indirect, since the real lesion is a neurosis which consists in hypersecretion of gastric juice, concerning which I will speak later. It is evident that the very acid chyme irritates the gastric nerves, and thus causes typical attacks of gastralgia, for which no other cause than this can be found.

Thus the class of genuine gastralgias is restricted to a very small group. My own experience leads me to be very sparing of the diagnosis of idiopathic gastralgia, and I believe that many of the cases grouped under this heading would be differently classed if they were examined according to our modern methods.

2. *Gastralgias due to Diseases of the Central Nervous System.*—Diseases of the brain are manifestly very infrequently accompanied by pains in the stomach; according to Rosenthal, only a few vague data are given by Krukenberg. They are much more frequent in spinal diseases. The gastric crises of tabes were first described by Charcot; and, after attention had been drawn to them by this distinguished French clinician, they have frequently been discussed. Their clinical existence having been established, the pathological basis was found to consist in a sclerotic degeneration of the vagus nucleus or the vagus trunk; this has been demonstrated in numerous recent papers by Kahler, Demange, Landouzi and Déjerine, Oppenheim, and others.

Although Delamare * (1866) was the first to carefully study these attacks—for analogous cases were reported by Gull † as early as 1856—yet it is due to Charcot and his school that the existence of

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* Delamare. Des troubles gastriques dans l'ataxie locomotrice. Thèse de Paris, 1866.

† W. Gull. Cases of Paraplegia. Guy's Hospital Reports, 1856, p. 161.

the affection has been firmly established, and it is therefore no more than right to attach his name to the gastric crises. I can not resist the temptation to give Charcot's classical description of such crises:* "Suddenly, and frequently with an attack of fulgurating pains, the patient complains of pains which begin in the groins, ascend along both sides of the abdomen to the epigastrium, where they become fixed. There are also pains between the shoulders, which radiate like lightning to the buttocks. The heart-action is rapid and forcible; but there is no rise in temperature. At the same time there is almost uninterrupted and exceedingly painful vomiting; the vomit consists at first of food, later of a mucous fluid, which is sometimes mixed with bile or tinged with blood. This is accompanied by marked nausea and vertigo, as well as by cardialgic pains which at times reach a terrible degree of intensity. These gastric pains may continue almost uninterruptedly for two or three days. They may appear at the very beginning of the disease, and then belong to the so-called preataxic symptoms, but they may not disappear even when the disease has reached its full development with complete ataxia."

The frequency of the attacks is variable: sometimes there are long free periods, and the occurrence of the crises is irregular; at other times they recur monthly, weekly, or even at still shorter intervals; they may even seem to assume a certain regular type. A characteristic feature is the sudden transition from the condition of intense pains and complete cessation of all the functions of the stomach to one of absolute comfort, so that the patients ask for food a short time after the close of the crisis.

Examination of the stomach-contents before, during, and after the attack has not revealed anything which is characteristic, since the degrees of acidity which were found were very variable, and stood in no relation to the course of the crisis. Having made numerous examinations myself, I can corroborate these facts, which were first announced by von Noorden.†

But gastralgias may be caused not alone by sclerosis of the pos-

* Charcot. Leçons sur les maladies du système nerveux, 1881, tomes i, p. 261, et ii, p. 32.—Des crises gastriques tabétiques, etc. Gazette médic. de Paris, 1889, No. 39.

† Von Noorden. Pathologie der gastrischen Krisen. Charité Annalen, 1890.

terior columns, but also by other lesions which involve the vagus nucleus. Thus Leyden includes them among the symptoms of subacute myelitis; Oser saw them in a case of pressure myelitis following vertebral caries.*

These gastralgias would always be interesting to us, even if they were simply symptoms of tabes in the stage of complete development; but gastric crises are not infrequently the initial symptom of locomotor ataxia. This lends a peculiar importance to them; hence in every case of nervous gastralgia a thorough examination should be made in this direction, and frequently enough we may discover other symptoms of the disease which had not been noticed by the patient. Rosenthal gives a typical example of this:

After very fatiguing exertions a man, thirty-eight years old, claimed that he was seized with pains in the lumbar region, weariness in the legs after slight efforts, and frequent severe cramps in the stomach. A consultant declared the case to be one of spinal irritation, and advised the application of a magnet to the spinal column, and later over the stomach. The gastric irritation was not overcome by the magnetism, but developed into intense periodical attacks of cardialgia accompanied by syncope, severe vomiting, increased rapidity of the pulse (up to 120 beats per minute), and painful contractions of the extremities. The attacks lasted six to eight days. The stomach trouble was diagnosticated as gastritis, and a suitable medical and mechanical treatment was instituted, but without any marked result.

These were the statements of the physician who brought the case to me in the fall of 1879. On examination I found lessened sensitiveness of the spinal column toward mechanical and electrical stimulation, marked diminution of the electro-cutaneous irritability of the legs, and loss of the sensibility of the skin. The hairs on the thighs could be pulled out in bundles without any pain; the patellar reflex was absent on both sides. The stomach was painful on pressure toward the fundus, but was not enlarged; the appetite was good. On questioning the patient, he stated that at times he had formerly had double vision, but it was only recently that he had been attacked with pains, sometimes boring, sometimes fulgurating. I diagnosticated tabes with gastric crises, and recommended mild galvanic and hydriatic treatment. In later years ataxia, paralysis of the bladder, and impotence were developed; the patient finally died with symptoms of mental disturbances.

I myself have had the opportunity of seeing many cases which had previously been treated for gastralgia, without any result, by stomach specialists; yet I found typical symptoms of tabes, absence

* Oser, *loc. cit.*, p. 42.

of patellar reflexes, anæsthesiæ and paræsthesiæ, and in one case even Romberg's symptom.

Here I may also classify the condition which Buch* has described as a separate form of nervous disorder under the name of "*Wirbelweh*" [vertebral pain]—i. e., the pains which are produced by pressure made in the epigastrium, or at the level of the umbilicus, upon the anterior surface of the lumbar vertebræ. They are usually accompanied by a subjective feeling of more forcible pulsation of the abdominal aorta; they do not, however, occur if pressure is made on both sides *alongside of* the vertebral column. At times, though not always, the spinous processes are also sensitive. Among the accompanying symptoms are nausea, eructation, ravenous appetite, with nausea and languor. The stools are variable; constipation is the rule, although diarrhœa may occur.

Buch correctly assumes this condition to be a neurosis of the sympathetic plexus which proceeds from the plexus aorticus abdominalis and the plexus hypogastricus, and supplies the bodies of the vertebræ and the intervertebral disks with nerve-filaments. But this condition was recognized long ago,† and is also mentioned by me on page 407, among the symptoms of gastralgia. It remains questionable whether these cases ought to be grouped in a separate class. Buch claims to have had good effects from injections of antipyrin *in loco affecto;* but this is rendered doubtful, because at the same time he also used all the usual means of physiatric treatment, including cold rubbings, douches, baths, gymnastics, diet, etc.

3. *Gastralgias from Constitutional Causes.*—These include the cases occurring in neurasthenia, hysteria, certain psychoses, and primary anæmia.

It is important, not alone for the semeiology, but also for the prognosis, that neurasthenia be distinguished from hysteria, and, as this will not be accomplished by the epigram that "neurasthenia includes rational sensations, hysteria those which are irrational," I shall therefore endeavor to distinguish these two conditions in the

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* Buch. Wirbelweh, eine neue Form der Gastralgia. St. Petersburger med. Wochenschr., 1889, No. 22.

† Hornbaum. Ueber die Pulsation in der Oberbauchgegend als begleitendes Symptom der Indigestion. Hildburgshausen, 1836.

following, in so far as it is essential for the gastric manifestations.

Neurasthenic Gastralgias.—The expression *asthenia* was introduced by Brown, and was later applied by Broussais in the doctrine of irritants; it denotes a condition of weakness of an organ which is at first manifested by a morbidly increased irritability, and later by a diminution of its functional activity. Therefore, the term *neurasthenia* indicates an enfeebled condition of the nervous system and the consequences thereof. It is marked by a continuous and advancing course, and seldom occurs without causal factors of an enfeebling nature, mental overexertion, strong emotions, sexual excesses, anæmic conditions, etc.

Rosenthal draws a sharp distinction between the irritative and depressive forms, the former being recognized by manifestations which are pre-eminently those of irritation; the latter by symptoms of exhaustion. Both are related to each other by numerous transitional forms, and are characterized as follows by this experienced neurologist: "The patients suffering from *irritative* neurasthenia complain of diffuse or circumscribed headache, which is associated (especially in an attack) with local cutaneous hyperalgia and acoustic or optic hyperæsthesia. Marked mental excitability, uncalled-for depression of spirits, and sensations of fear and inability to speak or read for a prolonged period, indicate unusual central irritability and exhaustion. Equally annoying to the patients are the periodical pains in the spine, with *points douloureux* in the nape of the neck, more frequently between the scapulæ, less often lower down. Electrical and thermal stimulation also causes a peculiar sensitiveness here, especially over the spinous and transverse processes. This secondary condition of irritation in the distribution of the sensory roots may be demonstrated more accurately and positively by means of electricity. Most frequently I found a striking sensitiveness on the left side toward cathodal irritation and the faradic brush which extended like half a girdle over the *points douloureux* in its path, and over which it was most pronounced. Vague neuralgias or parasthesiæ in the upper and lower extremities, becoming easily tired and exhausted after exercise and work, noticeable increase of the cutaneous and patellar reflexes, as well as

disturbances of sleep and appetite, constitute many of the pathological variations of irritative neurasthenia. When located in the chest, periodical cardialgias are frequently present. We may also often observe that increase of the pain in the back, and of the tenderness over the cervical and dorsal vertebræ, together with fullness of the head, are the forerunners of the periodically recurring gastralgia. Not infrequently there are also localized hyperæsthetic areas on the trunk, and *puncta dolorifica* may be more prominent as well as more abundant. More or less rapidly these are now followed by pain in the stomach, the intensity of which gradually increases.

"The pain is characterized sometimes as 'drawing together,' sometimes as boring, and radiates from the lower ribs to the epigastrium; it is accompanied by the vaso-motor symptoms, and those due to the cerebral anæmia, which have already been described.

"The *depressive* form of neurasthenia presents itself thus: The patients complain, especially after eating, of an oppressive sensation or a dragging which extends from the stomach into the abdomen, without, however, having the paroxysmal character of the painful gastralgias. The pain in the back is also not so intense, nor is it of so neuralgic a character; on the other hand, the motor exhaustion, sexual weakness, seminal emissions, mental depression, and atonic dyspepsia are especially predominant. The diagnosis of a localized spinal meningitis, which is not infrequently resorted to, may be avoided by observing that in the latter the intense and usually widely distributed pain in the back is ushered in by fever, tonic contractions of the muscles of the nape of the neck and the back prevent any movements, contractures and partial paralyses may occur in the extremities, and finally pain in the stomach is extremely rare and temporary."

To this description I must add Burkart's *painful points.** On pressing deeply down to the retroperitonæum, over the region of the superior hypogastric, aortic, and cœliac plexuses, the patient experiences exceedingly sharp and unpleasant pains, which radiate up to the epigastrium. Burkart claims to have found these points

* R. Burkart. Zur Pathologie der Neurasthenia gastrica. Bonn, 1882.

in all cases. In 1884, in the discussion on nervous dyspepsia at the third Congress for Internal Medicine,* I stated that in my experience this was not always the case. Richter † also asserts that, as a rule, pressure over the stomach and abdomen is not painful. Since then, this has been agreed to by others. At that time I said that the same was true of the above-mentioned painful points along the spinal column, upon which so much stress was laid by Rosenthal. They may be present (according to Rosenthal, in 75 per cent of the cases), or they may be absent; but, even if they are present, they have no important bearing on the conception of the disease, and are by no means one of its essential features. On the contrary, I will say that my further experience has been that pain along the spinal column, both on pressure and with the faradic brush, may frequently be absent in undoubted cases of neurasthenia. I shall cite such a case of Rosenthal, to compare it with one of my own:

A man, thirty-two years old, says that three years previously he took cold while going home one morning after a night of dissipation. Soon after he felt a steadily increasing pain in the stomach. The pain was described as glowing and boring, radiating frequently from the lower ribs to the epigastrium, and causing him to "double up" and moan loudly. The countenance was pallid and covered with clammy sweat, the hands and feet were cold, and the pulse small and tense. The attacks recurred frequently, especially in the early part of the evening, lasted for hours, and on their termination the patient fell asleep exhausted. The attacks varied in intensity, but neither the quality nor the quantity of food had any influence upon them. The condition, which was sometimes considered gastric ulcer, at others biliary colic, resisted all the usual remedies; no marked improvement followed even after daily washing out of the stomach and the methodical drinking of the water of the *Mühlbrunnen* at Carlsbad.

A gastroscopic examination was made by Dr. Mikulicz, but no structural changes could be discovered. The stomach-contents were pumped out, but were found to have normal acidity and digestive powers. Biliary colic was excluded on account of the normal size of the liver, the absolute lack of tenderness, no icteric discoloration of the skin and the urine, as well as the absence of a febrile movement during the attacks. Again, the relief afforded during the paroxysms by deep pressure over the stomach, the typical spontaneous origin of the pain, which was never caused by eating even very indigestible substances, as well as the non-appearance of digestive disturbances and vomiting—all these could not be reconciled with

* Verhandlungen des Congresses für innere Medicin, 1884, S. 232.

† Richter. Ueber nervöse Dyspepsie und nervöse Enteropathie. Berliner klin. Wochenschr., 1882, No. 13.

a diagnosis of gastric ulcer. For the same reasons renal colic, disorders of the pancreas and the like, which sometimes cause cardialgia, were also excluded. On the other hand, the constant presence of painful spots along the vertebral column, the hyperalgias which could be traced along the intercostal nerves to the epigastrium, the diffuse occurrence of muscular spasms in various parts of the body, the marked increase of the tendon reflexes, the pale-yellow color of the patient, together with his unusual psychical irritability, indicated gastric neuralgia upon a neurasthenic basis.

The change in the diagnosis was followed by a corresponding alteration of the therapy. Local treatment was entirely avoided ; a nutritious diet, including even beer, was ordered; the abnormal irritability of the centers was lessened by large doses of bromide of potassium, 3 to 4 grammes [gr. xlv–lx], with one gramme [gr. xv] of bicarbonate of soda morning and evening. To combat the anæmia, ferrum pyrophosphoricum cum natrio citrico (Ph. Austr.) was given after the midday meal (as much as would go on the point of a knife). During the two days following he felt only a touch of the pains in the stomach, after which they did not return ; the medication was kept up a fortnight longer. He was watched for six weeks more, but remained without the slightest disturbance.

My case (the only one of this kind which has come under my observation) was as follows :

In August, 1885, a merchant, forty-five years old, was brought to me by his family physician. He complained of great fatigue, especially a feeling of heaviness in his legs, disinclination for work, and dullness and confusion of the head, especially after eating. His appetite was capricious, and he never dared to eat the same thing many times in succession. For the past six weeks he had suffered severely from painful attacks of gastralgia, which at first were far apart, but later occurred daily, and sometimes even several times a day. Although they did not occur immediately after eating, yet he thought that they were caused by eating, and consequently had restricted his diet ; as a result he lost over ten pounds in weight. A course of treatment for three weeks at Carlsbad had not alone not benefited him, but had even made him much worse. The bowels were constipated. The patient, a very active person, well nourished but pale, was the proprietor of a very large factory employing over one hundred people, a number of whom were engaged outside of Berlin ; he had to oversee many of their trips, and consequently was frequently aggravated and worried. The illness of his partner for a time threw the entire responsibility upon him. A year previously he had had a similar attack.

The physical examination revealed no abnormalities ; all signs of spinal and intercostal neuralgiæ, as well as painful points, were absent. On the other hand, the tendon reflexes were markedly increased. The chemical processes of the stomach (after the test-breakfast) were found normal.

At the first glance it was apparent that this was a tolerably clear case

of nervous gastralgia, in spite of the absence of the painful points, the symptom upon which so much stress had been laid. The treatment confirmed the diagnosis. At first bromide of potassium was used ; later a sojourn for several weeks at one of the resorts on the Baltic Sea caused the cessation of the attacks, and the patient then gained rapidly in weight. The rest was accomplished by a proper diet and hygienic measures (daily sponging and riding). Up to the present time the attacks have not recurred.

I must not omit to mention how difficult it is in such cases, as is well shown in the case of Rosenthal, to exclude the presence of biliary colic. Even in that case this point is not definitely settled. Undoubtedly, there are cases of biliary colic without icterus, swelling of the gall-bladder, and febrile movement, and in which the diagnosis between an affection of the liver and the stomach can not be made. Among ten cases of pure gastralgia under my care no less than four are marked with an interrogation point. The following may be quoted as an example :

A well-nourished woman, thirty years old, the mother of seven children, had formerly never had pain in the stomach ; five years previously, after the birth of the fifth child, had " biliary colic " ; had been to Carlsbad twice and obtained relief ; for the past year has had painful cramps in the stomach, at first infrequently, lately every fortnight. Physical examination was negative. The uterus was pronounced normal by a gynæcologist. Never had belching or vomiting ; between the attacks the appetite was good. The bowels are constipated after the attacks, otherwise regular. Although considerable relief was afforded by regulating the diet, drinking the water of the *Marienbader Kreuzbrunnen*, and taking soda to which small doses of morphine had been added ; yet, during the two months in which the patient was under my observation, she still had occasional attacks, although less severe in character. I considered the diagnosis doubtful, in spite of the fact that the patient no longer referred the pain to the right hypochondrium as formerly, but to the middle line, and even to the left of it ; the reason was, that we know that attacks of biliary colic may be followed by inflammation of the gall-bladder, with the subsequent formation of adhesions to the adjacent viscera, the stretching of which may produce colicky pains.

Hysterical Gastralgias.—It is only the peculiar nature of hysteria which will enable us to recognize as hysterical the attacks of gastralgia which may occur during its course.

In the following remarks I do not by any means propose to give a thorough description of the protean picture of hysteria ; I simply wish to give a few suggestions, upon the completeness of which I

lay very little stress, because the characteristic features of this disease are not difficult to recognize.

In this affection, unlike neurasthenia, the psychical factors, perverse thoughts and sensations, occupy a pre-eminent place. The tendency toward extraordinary behavior, the conscious or unconscious longing to be conspicuous by any means whatsoever, the turning away from every serious occupation, the degradation into the peculiar, fantastic existence about which the patient's entire being revolves, the capricious, willful, and impulsive actions are not those of ordinary life, and these are all aberrations from normal thought and sensation, denoting profound changes in the psychical processes. Associated with them are the manifold, objectively demonstrable nervous disturbances, convulsions, paralyses, pupillary inequalities, hemianæsthesiæ, and changes in electrical sensibility. The manifestations of transference give additional symptoms. In the affections with gastric disturbances I have been particularly struck by the absence or lessening of the electro-cutaneous sensitiveness of the abdominal parietes; this sign was not absent even where other hysterical symptoms were scarcely manifested. A marked example of this is afforded in the following history which I shall relate in the exact words of the physician who sent the case to me:

"The patient is a lady, fifty-two years of age, the history of whose sufferings is a very long one. Soon after marriage she began to be troubled with hæmorrhoids; constipation was always present. For years she had suffered from chronic metritis and endometritis; the menses were very profuse, lasted eight days, and were accompanied by many disturbances. Temporary relief was obtained by douches, sitz-baths, local applications to the cervical canal, and evacuants. To obtain better results she was sent to Elster; here the severe hæmorrhages lessened, yet now there were very frequent disturbances of digestion combined with pains in the lumbar, inguinal, and umbilical regions. In this year she was sent to Kissingen, on account of the incessant complaints produced by variously located symptoms due to stagnation of the portal circulation. Here, for the first time, there were also pains and stitches in the breast, which usually appeared after midnight, and in fact began only at night, very suddenly, and with great severity; after lasting for hours they ceased, with marked eructation. Sometimes these symptoms appeared on several consecutive nights; at other times the patient might be free for a number of nights.

"The patient appeared to be easily excitable, and, although emaciated, was very well preserved for her years; on the back of the left hand and forearm there was an absolutely anæsthetic zone; patellar reflexes absent; the abdominal parietes were very sensitive, even to delicate palpation; on

the other hand, faradic brushing was scarcely felt here, although it was painful on the face, arms, and legs. Undoubtedly this was a hysterical condition accompanying a reflex dyspepsia, proceeding from the uterus, the symptoms of the latter being especially prominent."

The alternation with neuralgias or neuroses in other organs is characteristic of hysterical gastralgias. Oser reports a typical case of this kind in which hysterical aphonia alternated with attacks of gastralgia; this case suggests very strongly that the nucleus of the vagus was involved. I have had under my observation at the *Siechenanstalt*, for almost eighteen months, a case in which, together with persistent constipation—the bowels are never spontaneously evacuated—peculiar sensations are experienced in the abdomen, so that the patient thinks that a frog is in his stomach; at other times he imagines he has swallowed a needle, or that he has a tumor; at times he also has attacks of hysterical hoarseness and aphonia. Occasionally he also has attacks of true gastralgia.

Recently I had the opportunity of seeing a case of hysterical gastralgia, which was so characteristic that it deserves mention here, especially as the treatment renders it remarkable:

On April 1, 1888, I was summoned to a distant suburb for a consultation. When I arrived there the family physician was not present, because, as I was told, he said that "nothing could be done for the case." I found a small, delicate woman of thirty years, very much retarded in her growth; she was living with her mother in great poverty, and had been in bed for eight months because she claimed to be too weak to walk. What little nourishment she took was liquid; nevertheless, she was tortured with such severe paroxysms of gastralgia that, as her mother stated, she scraped the chalk off of the walls and disturbed the house by her screaming. In her childhood she was said to have had chorea. On physical examination there was pain on pressure over the ovaries and in the infrasternal depression; no anæsthetic areas, patellar reflexes present, tongue clean, no fœtor; at no times vomiting, stools very constipated, and like scybalæ. The diagnosis of hysteria was beyond doubt. To show the patient that she could walk I took her out of the bed and, supporting her under the arms, I dragged her about the room. As I had thus convinced myself that there were no organic paralyses, I ordered her to visit me the next morning. During my office-hours I was disturbed by a loud noise; it was the patient, who had come to my house in a cab after a ride of about forty-five minutes, had been carried up-stairs by the coachman, and could go about the room when supported by two persons. I washed out the stomach to examine its chemical functions, to reduce the hypersensitiveness, and also to produce a moral effect; while introducing the tube she became very cyanotic. No free hydrochloric acid was found in the wash-water.

I prescribed hydrochloric acid, tincture of belladonna, and cocaine. Six days later she came again; but this time she was alone, had walked up the stairs very slowly and with great exertion, yet without any help; but after that she had a typical attack of hysterical barking cough. The stomach was again washed out; no free acid, and a little peptone was found. Three days later she came up-stairs alone. The cough had disappeared; had occasional but only slight pains. Began to have appetite. The stomach was washed out twice more at several days' intervals. On May 31st I recorded that speech was good; walked without aid, simply by holding her hand lightly; complained still of nausea, pain in abdomen after eating and walking, and heaviness in the legs. The stomach was found empty two hours and a half after the test-breakfast. Arsenic and iron were ordered, and she was sent to the country. In the fall the mother reported that with the exception of trivial ailments she had kept well.

I do not consider this case at all extraordinary. Similar cases occur every day, although possibly the cure is not so remarkable. There was one coincidence, however, which lent a peculiar interest to the case, that at my lecture one of the audience to whom the case was presented had formerly treated the patient for a long time without any success.

It is superfluous to enter into further details on this subject, as such cases occur frequently in practice. The gastralgias constitute only one link in the chain of the manifold group of symptoms; the only point is, not to be deceived about the true nature of the attacks, and to recognize the hysterical basis. This is usually easy in most cases, but it may be very difficult, especially when the hysteria is manifested by only one symptom—for example, gastralgic attacks in old women, or even in men. To exhaust all these possible forms would take me far beyond my province.

Finally, gastralgias may also occur *in psychoses*, and, what is especially important, may be among the prodromal symptoms.

For a year and a half I treated a young engineer for gastralgia associated with neurasthenia. He finally became melancholic and committed suicide. Psychoses had already occurred in the family, and one brother had died in an insane asylum.

LECTURE XI.

THE NEUROSES OF THE STOMACH (CONTINUED).

I CONSIDER **hyperacidity** and **hypersecretion** of the gastric juice to be sensory neuroses of the secretory function. Reichmann deserves the credit of having been the first to thoroughly study this subject with our modern methods; yet it is an error to suppose that these conditions were unknown formerly. On the contrary, they were described almost fifty years ago by Pemberton, Copland, Todd, Budd, Trousseau, and among the Germans by Hübner;* but later, as these descriptions were based upon speculation rather than upon direct observation, they passed into oblivion. Recently this subject has been especially investigated by the above [Reichmann], Jaworski, von den Velden, Riegel, Saly, von Noorden, and Honigmann.

Hyperacidity is an increase above the normal of the amount of hydrochloric acid secreted; it is due to the stimulation of the ingesta, the acidity of which is heightened after being incorporated therewith. Naturally, it is difficult to determine where the normal acidity ceases and the abnormal hyperacidity begins, as a sharp line

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* As early as 1820, Pemberton (Treatise of the Various Diseases of the Abdominal Viscera) speaks of "a morbidly increased secretion from the stomach, analogous to a diabetic secretion of urine by the kidneys"; also Copland: "Or in other words, that pyrosis is produced by the continuance of the secretion of the gastric juices after the food taken into the stomach has passed into the duodenum." Budd also says that pains, etc., may arise "from the presence of free acid in the empty stomach." Trousseau (Des Dyspepsies, L'Union méd., 1857, p. 306): "Le neuralgie de l'estomac augmente les sécrétions acides à ce point qu'elles se ferront non plus comme d'habitude au moment de la digestion mais encore en dehors de ces moments." In Hübner (Die gastrischen Krankheiten monographisch dargestellt. Leipzig, 1844. S. 209) we find the following: "If the morbidly altered secretion of the gastric juice . . . is the cause of the acid, then the patient suffers uninterruptedly from it; he may eat what he will, the symptoms become more marked, and, as the cause persists, it becomes more obstinate than in the formation of acid by fermentation."

like the zero-point in a thermometer can not be drawn; on the contrary, there must always be an intermediate stage in which the quantity of the secretion depends on individual circumstances; here we remain in doubt whether this should be called hyperacidity or not. However, from the average of a very large number of examinations after the test-breakfast I consider that hyperacidity begins when the amount of acid is between 60 and 70 per cent.

I have already spoken of the relation of hyperacidity to gastric ulcer; but it is beyond doubt that this condition may exist as a primary neurosis independently of any organic lesions. Von Noorden has observed it in melancholia,* Jolly claims that there is an increased secretion of gastric juice in hysteria, and Jaworski† has frequently found it among the Jews of Galicia, who are especially predisposed to nervous disturbances. It may also occur as a reflex symptom of gall-stones and renal calculi; and also where all of these factors are absent the neurotic basis of the disorder may be recognized by the want of success in treatment directed toward the cure of a supposed gastric ulcer.

In the summer of 1887 I treated a girl of nineteen years for nearly three months for a supposed gastric ulcer, because she had periodical gastralgia, and a hyperacidity of 88 per cent. The absolute failure of the treatment, and the constant recurrence of the attacks, in spite of the improvement in the general condition and the increase in weight, indicated a purely neurotic basis of the disorder, although other symptoms of neurasthenia and hysteria were lacking.

Hypersecretion, or better, *parasecretion* (the *Magensaftfluss* of Reichmann), may occur in two forms, the periodical and the continuous. The acidity is not increased, as a rule, in the former, but it is in the latter. Periodically, it usually occurs after eating, rarely while fasting, yet it does not seem to have a direct connection with the introduction of food. Wilkens‡ reports a typical case of this kind.

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* Sitzungsbericht der medicin. Gesellschaft zu Giessen. Abstract in Berlin. klin. Wochenschr., 1887, No. 18.

† W. Jaworski. Zusammenhang zwischen subjectiven Magensymptomen und objectiven Befunden bei Magenfunctionsstörungen. Wiener med. Wochenschr., 1886, Nos. 49–52.

‡ S. A. Wilkens. A Case of Hypersecretion in Intermittent Attacks. Lancet, August 27, 1887.

A musician, thirty-six years old, who led an emotional life, for the preceding three years and a half had attacks of vomiting and pain in the stomach; during the paroxysms he could neither eat nor drink, and had to go to bed. Similar attacks, which lasted twenty-seven to thirty-five hours, recurred at intervals of ten to twelve days. He lost in weight from 2 to 3½ kilogrammes [4½ to 7¾ pounds]. Intense hunger between the attacks. The gastric juice vomited was about two pounds and a half, and every time had 0·12 per cent HCl. Diagnosis, affection of the secretory nerves.

All writers agree that the condition is a functional disturbance of the nerves of the stomach, which may occur alone or as part of other neuroses. In chronic hypersecretion (*continuirliche Magensaftfluss*) there is a continuous secretion of gastric juice which is usually hyperacid,* so that even while fasting the stomach may contain larger or smaller quantities, varying between 100 and 1,000 c. c. [f ℥ iijss. to Oij], or more, of a fluid very much resembling ordinary gastric juice, but without any remnants of food, and frequently tinged grass-green or bluish-green by the admixture of bile.† The degree of acidity is high, but the amount of free hydrochloric acid which can affect the color reagents is very variable, as has been shown by Jaworski;‡ since in cases with the same degree of acidity, in some there was much free acid and a feeble biuret reaction, in others, little free acid, in spite of the absence of organic acids and a marked biuret action; finally, in rare cases having a certain degree of acidity no reactions can be obtained, although one would expect a positive result with all the color-tests. Jaworski attributes this to the larger or smaller admixture of desquamated tissue-elements of the mucous membrane or emigrated white blood-cells, or even blood-serum, which by forming peptone or acid combinations may combine with part or all of the free hydrochloric acid in the sense which I have already explained (page 27) for the albuminoids in general, and which has since been demonstrated by von Pfungen.

On taking food it is found that the digestion of starches is delayed, but is very prompt in albuminoids, so that after a meal con-

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* Jaworski, *loc. cit.*—in 121 cases of hypersecretion, hyperacidity was found at the same time in 115 of them.

† Jaworski, *loc. cit.*—77 times in 222 cases.

‡ Jaworski. Ueber die Verschiedenheit in der Beschaffenheit des nüchternen Magensaftes bei Magensaftfluss (Gastrorrhœa acida). Verhandlungen des Congresses f. innere Med. Wiesbaden, 1888, S. 280.

sisting of meat and amylaceous substances one may find abundant remnants of undigested starches, but no trace of meat (Riegel). While fasting the fluid in the stomach no longer contains the usual varieties of epithelium, but instead many nuclei with sharp contours, which Trinkler * (who first called attention to them in animals), Jaworski, and myself consider to be remains of undigested cells. According to Jaworski, this condition of chronic hypersecretion must be almost the rule, since among 159 cases he found 115 with hyperacid and continuous secretion. Riegel does not go to such extremes, yet he claims that it occurs in about half of all the cases of stomach disorders.

This does not agree with my experience. Strictly speaking, I am not competent to give an opinion on this question, because I have only examined while fasting those patients whose complaints—pains, heart-burn, eructation, etc., occurring during the night or in the morning before eating—afforded me an opportunity of exploring the empty stomach; under these circumstances, I have not often found hypersecretion. Even if I follow Riegel's example, and include the cases of dilatation, my experience extends only over 45 such cases among about 1,200 patients whom I have examined and kept records of during the past few years. I found, as other writers have, that men predominate—30 men and 15 women. We must leave it a mooted question whether, as claimed by von den Velden, hypersecretion is only a lengthened reaction toward the stimulation of the food, or whether it is continuous, as asserted by Reichmann, Riegel, myself, and others.

The irritation of the mucous membrane by the acid fluid causes hyperæsthesia, the results of which are tenderness or pain in the epigastrium, acid eructation, heart-burn, vomiting of sour masses, gastralgias, and similar digestive disturbances which constitute the symptoms of a chronic inflammatory condition. Under certain conditions, as observed by Talma,† the stomachs of neurasthenics may react abnormally toward acids. But the tongue is usually clean,

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* Trinkler. Ueber den Bau der Magenschleimhaut. M. Schultze's Archiv, Bd. xxiv, S. 195.

† S. Talma. Zur Behandlung von Magenkrankheiten. Zeitschrift für klin. Med., Bd. 8, S. 407.

and the appetite is increased rather than diminished. Excessive thirst was common in Jaworski's cases, and (what is by no means wonderful) was said to have been relieved by drinking water and diluting the contents of the stomach. Among the results of this condition we must consider atony of the muscular coat of the stomach, and the gastrectasis due to it; where the condition has lasted a long time, this is so common that twenty-nine more or less well-marked dilatations of the stomach were found in thirty cases at Prof. Riegel's clinic.* But by this time the neurosis has been converted into an organic lesion, and such conditions must, therefore, be considered among the cases of gastrectasis, and not among the gastric neuroses.

The exact diagnosis of this condition can only be made by examining the stomach-contents, and so far as concerns chronic hypersecretion this examination must be made while fasting. A clew to this state is afforded by the fact that the symptoms are temporarily ameliorated by eating proteids; this differentiates it from the disturbances caused by the pyrosis and gastralgia due to acid fermentation. The alkalies give temporary relief in both conditions of nervous hyperacidity and acid fermentation; yet the difference is this, that for the former we have no other direct remedy excepting this purely symptomatic one; but fermentation may be controlled and prevented by specific measures.

Among these neuroses I also classify the condition called **Gastroxynsis** [*γαστήρ*, stomach, *ὀξύς*, acid] by Rossbach, which differs from migraine only in the fact that it does not occur spontaneously as frequently as the latter, but as the result of definite causes, mental over-exertion, or profound emotional disturbances, and that the vomited masses are very acid, containing as much as 3·4 to 4 per thousand. However, the latter is common to both the condition and typical migraine, since I have repeatedly obtained equally high results in the latter. Jürgensen † has also observed very similar states.

Nervous Belching, Eructatio.—It is only in hysterical persons that

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* Honigmann, *loc. cit.*

† Jürgensen. Ueber Abscheidung neuer Formen nervöser Magenkrankheiten. Deutsch. Archiv für klin. Med., Bd. 43, S. 9–20.

I have seen this occur alone, for in neurasthenics it is always associated with other sensations, especially oppression and tension in the epigastrium. I agree with Weissgerber,* who has published a very long paper on eructation, that in the former [hysteria] there is a heightened contractility of the stomach, together with an increased tone of the pylorus, provided the other manifestations of hysteria are also considered among the processes of irritation. Since the sphincter at the pylorus is stronger than that at the cardia, it will contract more powerfully even if both are equally stimulated; hence, when the distention of the stomach is so great that it must expel some of its gas, this can escape more readily upward than downward. For it can not be doubted that eructation is an active and not a passive process. It may be possible, as claimed by Stiller and Rosenthal, that a relaxation of the cardia may facilitate the exit of the gases from the stomach, and that hence, according to circumstances, eructation may be due either to an increase or a paralysis of the muscular action of the stomach. However, in many cases, belching certainly has nothing to do with relaxation of the cardia, as is shown by the numerous patients who try in vain to empty their stomachs of the accumulated gas.

There is another kind of belching which is entirely independent of the stomach, in which the gas is raised only from the œsophagus by contracting the muscles of the neck, just as Bristowe† has assumed in hysterical vomiting. This form escaped Weissgerber's notice entirely. I myself can belch voluntarily, and I have convinced myself by means of the deglutition-murmur (*Schluckgeräusch*) that the air which is compressed in the œsophagus does not enter the stomach unless additional true movements of deglutition are executed. We may therefore accept the fact that it is possible to belch from the œsophagus alone, and this may explain many cases of hysterical eructation in which the stomach is not distended.

Belching may become a very annoying symptom, since it is never noiseless but is usually quite loud. In one attack, of an hour's dura-

* Weissgerber. Ueber den Mechanismus der Ructus und Bemerkungen über den Lufteintritt in den Magen Neugeborener. Berl. klin. Wochenschr., 1878, No. 35.

† Bristowe. Clinical Remarks on the Functional Vomiting of Hysteria. Practitioner, 1883, p. 161.

tion, Cartellieri * was able to count it twenty-five hundred times! The gas is always odorless and tasteless, and thus differs in this respect from that raised in true dyspepsia, fermentative processes, etc. It therefore must consist of atmospheric air which, in the opinion of most authors, must have been swallowed, but which may also possibly come up from the intestines; in many cases it is certainly raised only from the œsophagus. Cartellieri says his patient had no time to swallow air during the attack; in such cases the question then arises, Is air really expelled, or is it a manifestation in which this is simulated? So far as I know, this subject has never been investigated.

Pyrosis denotes the raising of sour masses from the stomach, an act which is well known under the name of heart-burn. In the nervous forms of this symptom at least, the stomach-contents are not necessarily hyperacid; on the other hand, severe acrid and burning sensations may be produced by the regurgitation of even normal stomach-contents or gastric juice. Here, also, one may be in doubt whether the cause resides in a heightened contraction of the muscular coat of the stomach, or in a paralysis of the cardiac sphincter. I have been led to classify this phenomenon among the motor conditions of irritation, because I have in vain searched for the sign of a marked relaxation of the cardia, the occurrence of the first deglutition-murmur. [See foot-note, p. 61.]

This brings us to the consideration of a very annoying condition called **Pneumatosis,** tympanites (*Trommelsucht*). Here the stomach is filled with gas, and may become so distended that it causes not alone the unpleasant sensation of marked tension, but even severe nervous symptoms, by pushing the diaphragm upward and pressing on the heart. The patients are seized with typical attacks of asthma —the asthma dyspepticum of Henoch—in which at first there is only the annoying feeling of being compelled to take deep inspirations after short periods of normal breathing; at the beginning this suffices, but later it develops into an incessant dyspnœa. Now there is also palpitation of the heart, pulsation of the peripheral arteries,

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* P. Cartellieri. Eine seltene vorkommende Magenneurose. Wiener allgemeine med. Zeitung, 1885, S. 3.

fullness of the head, and even the feeling of impending death, or complete unconsciousness—in short, such is the condition that I have been repeatedly told by many sufferers that they were almost driven to suicide. Relief can only be afforded by bringing up some of the gas, and then the attack rapidly subsides. This condition is probably caused by the air which has been swallowed, together with a spasm of the sphincters of the stomach. The chemical processes were normal in one case which I examined, yet the same state may be produced in dyspeptics by the gas generated in fermentation.

The attacks may be relieved instantly by introducing the stomach-tube and allowing the gas to escape. But it seems that it is very difficult to cure the disease itself where it is nervous in character. In one case of pneumatosis I had no success with—

℞ Cocain. hydrochloratis..... 1·0 [gr. xv]
Aq. amygdal. amaræ..... 10·0 [f ʒ ijss.]

M. Sig.: Ten drops every two hours.

Large doses of bromide of potassium had also been given, but without producing any effect. In another case hypodermic injections of morphine into the epigastrium gave immediate relief; a third case was cured by change of climate. The patient was a Brazilian, who, while at home, had suffered very severely from pneumatosis, but here [Germany] he was entirely free from it.

Nervous Vomiting.—This includes those forms of vomiting which are caused neither by anatomical lesions of the stomach nor by quantitative or qualitative changes in the food. It is pre-eminently reflex, and may be caused either directly by the vomiting-center or indirectly from other points in the central nervous system, or from other organs. As far as we know, the causes of this condition may include palpable changes in the brain and spinal cord, kidneys, uterus, liver, and certain organs of sense. These forms of nervous vomiting may be classed among the reflex neuroses.

I have had the opportunity of observing two such cases of nervous vomiting in close succession; during their course they seemed to be very much alike, yet the nature of the primary affection caused them to terminate very differently.

The first case was a married lady, thirty-six years old, who had been suffering for three weeks with uncontrollable vomiting and a continuous flow

of saliva, together with strong fœtor from the mouth. This condition had come on after an attack of catarrhal jaundice, traces of which were just recognizable in a slight discoloration of the sclerotics at the time I first saw the patient. She had emaciated very little considering that she had taken scarcely any nourishment during this period, for she vomited everything immediately after eating. On examination, nothing could be found anywhere, not even in the liver. The passages were loose and bright yellow. Only temporary relief was obtained by the hypodermic use of morphine with atropine, washing out the stomach with chloroform water, and chloroform internally. Finally, the attacks were controlled by withholding all food and drink by the mouth, and using nutritive enemata for several days. But the salivation kept up some weeks longer, when it ceased entirely. The condition here was probably a reflex irritation from a gall-stone; hysteria was excluded because the patient was otherwise healthy and the mother of several grown-up children. I must not conceal the fact that for a long time the patient caused me a good deal of anxiety on account of the absence of definite points on which to base a diagnosis.

The second case was a lady in the fifties, living outside of Berlin; unfortunately, I had the opportunity of seeing her only once. In the early part of 1888 she experienced profound emotional disturbances; since the following summer she had suffered from mild gastric troubles which lasted, with variable intensity, till November. After that every meal was regularly followed by vomiting, which had continued with few intermissions till the beginning of January, when I saw the patient. The woman, who had formerly been strong, was now very much run down; she had frequent attacks of unconsciousness, and complained of great weakness, especially in the legs. Sleep was good. The urine had been repeatedly examined, but albumen and sugar were not found.

I found a bedridden patient who was still quite well nourished in spite of the emaciation she complained of; she could move quite readily in the bed; she spoke with deliberation; in short, she seemed less affected than was to be expected from her history. On examination I could find nothing but a struma, and tachycardia up to one hundred and twenty beats per minute. There was no tumor nor any tenderness in the abdomen. Patellar reflexes normal; pupils reacted well; no limitation of the field of vision, and no complaints about sight. Sensation everywhere normal. Heart and lungs negative.

In my presence the patient ate two pieces of toast and drank a glass of water without vomiting. The tube was easily introduced and the stomach-contents expressed twenty-five minutes after. No hydrochloric acid found; the fragments of toast were scarcely at all digested. This result left the diagnosis in doubt between a severe neurosis and an occult carcinoma; yet the absence of true cancerous cachexia favored the former. The rapidity of the pulse was attributed to the struma; tabes accompanied by gastric crises was excluded on account of the absence of its specific symptoms.

The condition seemed to improve at first by using nutritive enemata and restricting feeding by the mouth as much as possible; small doses of

digitalis and atropine were also given. But she soon relapsed into the old condition; she gradually grew weaker, till one day she was seized with epileptic convulsions and died several days later. An autopsy was not allowed, yet the whole clinical picture led me to diagnosticate an affection of the medulla oblongata, probably a tumor, involving the roots of the vagus, thus causing the persistent vomiting and the rapid pulse. At all events, this presupposes such a situation of the suspected tumor that the nucleus of the fibers of the vagus distributed to the heart was paralyzed or destroyed, while those fibers going to the stomach were kept in a condition of chronic irritation. The soundness of this supposition remains in doubt, although it is by no means without a parallel (Rosenthal).

Both of these cases are typical examples of severe vomiting caused by nervous irritation, and at the same time they show how difficult (sometimes even impossible) it is to make a diagnosis at a given time during life.

For a certain group of cases we are unable to find this proof, although we may suspect the reflex origin. Pre-eminent among these stands the vomiting of neurasthenic and hysterical patients; it is uncommon among the former, but occurs frequently in the latter. It is characteristic of this form of vomiting that it usually occurs without any true nausea, and that the retching is reduced to a minimum. Hysterical vomiting may occur after every meal; sometimes it is less frequent. Either all food may be rejected or only certain kinds or even individual dishes. I made use of this fact in making my first investigations on the course of normal digestion in human beings; my subject was a hysterical girl who could retain all kinds of solid food, but was compelled to vomit whenever she swallowed any fluid. Another young girl, who has now been over five years at the *Siechenanstalt*, regularly vomits nearly all that she has eaten almost immediately after every meal. The general nutrition suffers surprisingly little from this persistent vomiting; thus the second patient's weight has been almost the same during the past four years; she has come down from 40·5 to 39·5 kilogrammes (89 to 87 pounds). In other cases the vomiting does seem to affect the weight. Thus Tuckwell * reports that three children were very greatly emaciated after prolonged vomiting which lasted for months; it was controlled by sitting the little patients up as soon as any tendency to vomiting occurred (and also, to be sure, carefully regulating the diet).

* Tuckwell. On Vomiting of Habit. British Med. Journal, March 22, 1873.

Barras* speaks of a woman who suffered from nervous vomiting, but who ceased to vomit while she was in the bath; she was cured after her meals were given to her in this way.

This affection may pursue an acute or chronic course; it may begin spontaneously or may follow some demonstrable cause. One young girl was attacked immediately after the death of her father; another as the result of breaking off an engagement of marriage. As in other neuroses, the female sex is especially liable.

I must confess that my experience of the infrequent occurrence of vomiting in neurasthenics does not agree with that of Rosenthal, who claims to have seen it not infrequently in this class of patients. I shall simply content myself with giving the headings of two of his histories:

Observation No. 31.—Neurasthenia, hyperæsthesia toward acids with consecutive gastric colic and vomiting. Cured by local remedies (small pieces of ice, with two to three drops of tincture of nux vomica) and general invigorating treatment.

Observation No. 32.—Neurasthenia following onanism, with frequent vomiting. After the latter had ceased it began again after each coitus, while a heavy meal did not cause any complaints. Neurasthenia and vomiting cured by prohibiting sexual intercourse at the beginning of the treatment, increasing doses of potassium bromide, with some pyrophosph. ferri citronatric. [Ph. Austr.], Neptune's girdle, galvanization of the sympathetic, and hydriatic procedures.

This difference in observation might appear striking; yet it may be readily explained by the fact that two observers in places at some distance from each other [Berlin and Vienna] deal with different kinds of patients. Concerning the multiplicity and intensity of all neuroses it is peculiar that they most frequently attack the easily excitable Southerners, and especially the nationalities living near the military border. Hypersecretion seems also to occur more frequently there than in Germany.

Finally, I must speak of a form of nervous vomiting which was described by Leyden.† It may occur as a primary neurosis, or as a secondary spinal affection, or as a reflex form. A peculiarity of this variety is the periodicity of the attacks [whence the name **periodical**

* Barras. Traité sur les gastralgies et entéralgies. Paris, 1827.

† Leyden. Ueber periodisches Erbrechen (gastrische Krisen) nebst Bemerkungen über nervöse Magenaffectionen. Zeitschrift für klin. Medicin, 1882, Bd. iv, S. 605.

vomiting], which may last from a few hours to a number (ten) of days. They begin with sudden nausea and colicky contractions of the intestines, but the abdominal wall is relaxed. At first the vomit consists of food *débris* and slimy masses, later of bile and streaks of blood; the attacks accompanied by migraine and tearing sensations in the limbs; they are followed by obstinate constipation, which is due to a spasm of the intestine. The trouble may last for years, but its origin can only be sought in the directions indicated above. In two of my cases the autopsies gave negative results.

Stomach colics are usually included among the gastralgias. In fact, they frequently occur together, since stomach colic is accompanied by severe pains. But, as indicated by the name, the pains are colicky, and are due to a spasmodic contraction of the viscus; but they are not boring and shooting, as in genuine gastralgias. The causal factors are the same as those which have been described under the gastralgias.

Localized spasms may occur at the cardia and pylorus. While introducing the stomach-tube we sometimes experience the sensation as if the instrument were spasmodically gripped at the cardia. It would be difficult to ascertain whether this is due to a contraction of the lower segment of the œsophagus or of the cardia.

Spasm of the pylorus seems to be due, disregarding the irritation from local changes, to gastric juice which is either too acid or which has been secreted at improper times. This is the only way of explaining hyperacidity and hypersecretion, as has been suggested by Boas and myself.

In distention of the stomach with gas, its escape upward or downward can only be prevented by an abnormally tight closure of the gastric sphincters.

Peristaltic Unrest of the Stomach (*Peristaltische Unruhe, Tormina ventriculi nervosa*).—This was first described by Kussmaul* as being caused by an increased peristalsis, which is so intense and so well marked that it may readily be perceived through the relaxed abdominal parietes, and which may at times be accompanied by

* Kussmaul. Volkmann's Sammlung klinische Vorträge, 1880, No. 181. [Also, Boas, Deutsch. med. Wochenschr., October 17, 1889.—Tr.]

gurgling and rumbling loud enough to be heard at a distance. This affection, by itself, is not painful, yet it may torture the sufferer to extremes. "It is just as if the intestines were twisted around inside my abdomen," was told to me recently by a female patient, forty-six years of age, in whom the noises in the gut were so marked that they were audible as soon as she entered the room. They are most intense after meals, yet they do not disappear entirely between them; and, like other neuroses, they have the characteristic peculiarity that they sometimes suddenly cease when the patient becomes excited—for example, during the doctor's visit—although a moment before they were present in full intensity. Kussmaul's earliest cases were persons with gastrectasis, and the majority of the cases which have since been observed have been such patients.

The reverse of this condition, **antiperistaltic unrest** of the stomach, has been observed by Glax* as a pure neurosis. His was a typical case; the examples which had previously been published by Schütz and Cohn were not free from criticism. Glax's case was a man, thirty-two years old, who had formerly suffered from dyspeptic disturbances and a slight dilatation of the stomach; the writer describes his condition as follows:

"A shallow but distinct constriction could be seen passing vertically downward over the stomach from the right sternal border. Suddenly to the left of this the fundus ventriculi appeared hard and tense, and gradually expanded to the size of a child's head; this swelling slowly went down, then appeared to the right of the constriction, and then began almost immediately to the left again. Often, however, the movement distinctly passed from the right back to the left in an antiperistaltic direction. I then distended the stomach with carbonic-acid gas, which caused the movements to become very active."

Errors may arise from the not infrequent occurrence of peristaltic unrest of the intestines; this may also assume an antiperistaltic form. That this may actually happen is shown by the cases of Briquet, Jaccoud and Fouquet, and Rosenstein, in which scybalæ and discolored enemata were evacuated through the mouth.† In many

* Glax, *loc. cit.*, p. 190.

† [A case of habitual defecation by the mouth has been recently reported by Desnos (Wiener med. Presse, 1891, No. 51, S. 1958). The case was that of a man who was found on the street in an epileptic attack; the saliva which flowed from the mouth was apparently mixed with fæcal matter. Upon inquiry, the patient

persons stroking the finger-nail rapidly and sharply across the epigastrium will produce distinct peristaltic movements.

II. Conditions of Depression.

Concerning the conditions of anæsthesia of the stomach we know very little, or rather, it would be truer to say, practically nothing. In Lecture IX attention was drawn to this point; and, as we normally have no perception of the processes going on in and about our stomachs, we can not, therefore, gain any distinct conceptions of a pathological lack of sensitiveness.

Polyphagia, or **acoria** [*ἀ*, without, *κορέω*, I satiate], the want of the feeling of satiation, is best regarded as a result of anæsthesia of the stomach.

If in the discussion on bulimia and anorexia I have made it evident that these conditions are due to an over-excitation of centers in the brain, then satiation must be considered an inhibition of hunger, and the absence of this sensation a negative phenomenon—i. e., either the hunger-center is no longer under the influence of the nervous paths passing to it, or the latter are defective. But I have already shown the vagueness and uncertainty of all such deductions, which still lack a tangible and well-established basis, and I believe this is also true of the above suggestions.

Purely nervous polyphagia is a very rare occurrence; naturally I exclude those gluttons of whom the old and new books on "gastrosophy" are full; but I mean those really morbid conditions which usually follow tangible lesions, and in the discussion of which these cases will be found.

Nervous anacidity of the gastric juice is not as rare as it would appear after searching through the literature. I have repeatedly found it in hysterical persons (see the case of hysterical gastralgia, p. 412). I have also observed it in neurasthenics in whom there was no reason for suspecting an organic disease of the stomach.

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said that for two years he had not passed his stools *per anum*, but at six o'clock each evening he passed a stool by his mouth. The man was under observation only two days, but his statement was corroborated. At times the evacuation took place without any effort; at others they occurred during a nervous attack with slight convulsions and pain in the œsophagus.—Tr.]

I shall restrict myself to the following case:

Mr. P., landed proprietor in Culm, a powerful man of Herculean build, forty-three years of age, said that he had been very nervous since the death of his wife; he imagined that he had a cancer of the stomach; there were also abnormal sensations in the urethra and impaired sexual powers. His appetite was absent; the stools were constipated, hard, and dry. His disposition was exceedingly melancholic.

On examination nothing could be found except a very marked sensitiveness of the spinal column on pressure against the spinous processes and with the faradic brush. The stomach and urinary tract (catheterization) were found normal. Examination of the test-breakfast after expression revealed the absence of free acid. He was admitted to the sanitarium, where he slept with potassium bromide. Hydrochloric acid was also given, as well as lukewarm baths in the morning and warm rubbings in the evening. He was kept under observation nearly two months, and in that time the stomach-contents, after the test-breakfast, were examined five times at about weekly intervals. They were always neutral, and contained the breakfast almost without any changes, but there was no mucus.

Gradually the condition improved, after all kinds of sensations in the soles of the feet, loins, larynx, and urethra had in the meanwhile appeared. He was advised to go to the hydriatic establishment at Elgersburg, where he stayed several weeks. Later on I received a report from there that "Mr. P., the neurasthenic, who leaves here to-day, has been generally improved by the use of lukewarm half- and sitz-baths, electricity, and massage; yet, in spite of this, his old complaints have returned, etc."

Recently I heard again from this patient. Although a year and a half have elapsed, his symptoms are about the same. There are no signs of real loss of strength. We may therefore exclude organic diseases, carcinoma, mucous catarrh, etc. It is simply a case of anacidity accompanying neurasthenia, of which I could cite three or four additional cases.

I have already given you my opinion on the significance of the absence of free hydrochloric acidity in Lecture V [p. 187 *et seq.*].

Relaxation of the cardia and of the pylorus must be considered conditions which resemble paralysis.

Paresis of the cardia may give rise to the annoying and troublesome nervous eructation (see above, under Eructation, page 418). If fluids or remnants of food are raised, as well as gas, the condition is called **regurgitation.** In very many persons small quantities of chyme having a very sour taste are raised after eating, but they are swallowed at once; this condition can be called neither pathological nor very annoying. But if it occurs frequently, and if larger quantities are regurgitated, then they are no longer swallowed again but

are expectorated; true rumination, such as occurs in animals, does not take place. This condition is very annoying and may lead to serious changes in nutrition, yet it may also exist for years without any bad results. At times will-power may succeed in repressing it; yet I have seen a young man in whom neither will-power nor large doses of bromide of sodium had any effect.

Regurgitation also occurs in diverticula of the œsophagus; here it may be due either to the filling up of the diverticulum and its overflowing into the mouth—this occurs most frequently when there is a stricture below the site of the diverticulum—or the contents of the pouch may voluntarily be raised, or rather pressed upward, by the patient.

At my lectures I have frequently presented a patient with a diverticulum who was able to raise its contents at will by taking a deep inspiration and bearing down. As he restricted himself to fluids, the material which he raised contained no solid substances; the greater part of it was mucus, and by its smell one could ascertain whether he had previously taken coffee, alcoholic drinks, etc. The reaction was alkaline or neutral. At first there was no odor, but recently the patient has observed that what he regurgitates has a slight foul smell.

An entirely different thing is **Rumination, Merycismus** [*μηρυκάζω*, I ruminate], *Wiederkäuen*, which has attracted the attention of laymen and physicians ever since antiquity, and has given rise to the strangest theories. Some supposed that ruminators were necessarily descended from parents with horns;* thus Fabricius says, "Ex quo forte datur nobis intelligi parentis semen aliquam habuisse affinitatem cum cornigeris animalibus neque mirum fuisse genitum filium simile quid a parente contraxisse" (that is, the father is said to have had a horn on his forehead); others imagined that these persons—at least as infants—must have suckled ruminating animals;† or even that "they had sinful intercourse with a cow." For a long time the opinion prevailed that these persons certainly had stomachs

* I have taken these data from the following treatises: Bourneville and Séglas, Archiv de Neurologie, 1883, p. 86; Schmidtmann, *loc. cit.*, p. 183; Schneider, Das Wiederkäuen beim Menschen, Heidelberger med. Annalen, 1846, xii, S. 251; A. Johannesen, Ueber das Wiederkäuen beim Menschen, Zeitschrift für klin. Med., Bd. x, S. 274.

† Daniel Perinetti, an eight-year-old child, was said to have been nourished by a goat for two years, and to have ruminated later on in imitation of it.

with different compartments, like ruminants, till it was finally shown by autopsies that in the majority of cases there were no changes in the stomach or œsophagus.

As time passed by these negative results became more frequent; but Schneider [1846] was able to report the case of a court councilor from Fulda who had died at the age of seventy years, at the end of the previous century, after having ruminated all his life. In this case it was found that the cardia was wide enough to easily admit five fingers, and that the stomach was enormously dilated. Arnold (1838) observed three cases of rumination in which a sacculated dilatation of the œsophagus was found above the cardia in the antrum cardiacum. Bourneville and Séglas * (1883) came to the conclusion that there was no real anatomical change.

In fact, the manifestations of rumination are especially liable to attract attention. Not alone is it remarkable that, a shorter or longer interval after eating, the food returns to the mouth in separate morsels, unchanged in taste, to be chewed and swallowed a second time, yet it is still more wonderful that they should come up in a definite order, and that they should taste even better than the first time;† or that the taste may be so unchanged that, as reported by Peter Frank, a patient could distinguish the food in the reverse order in which he had eaten it on the previous day. It is also stated by Darwin that any particular dish which had been eaten could be regurgitated at pleasure. This certainly seems to be almost superhuman. No light is shed by the explanation of Gallois‡ that the regurgitated masses at first consist of an indistinguishable mixture of fluid and solid ingesta; but when rumination occurred during the later stages of digestion they would then contain only solids, and finally merely indigestible remnants of food, like tendons, leaves of salad, etc. A simple explanation is that during gastric digestion the fluidified ingesta are removed from the stomach; hence, the regurgitated masses gradually contain more and more solid sub-

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* Archiv de Neurologie, 1883.

† Anthony Rechy said, "Indeed, it is sweeter than honey, and accompanied by a more delightful relish."

‡ P. Gallois. Mérycisme et étude physiologique de la digestion stomacale. Revue de méd., 1889, No. 3.

stances which can not be attacked by the stomach, and finally consist of nothing but the latter. Hence, the condition of the regurgitated food does not depend on the wishes of the patient, but upon the phase of digestion in which rumination occurs. Rossier* asked one of these subjects to keep a record of the number of the regurgitated morsels. After breakfast there were six to twelve; dinner, eleven to twenty-one; supper, seven to sixteen.

Rumination must not be confounded with the condition in which healthy persons may at will regurgitate the contents of the stomach; this is simply due to their ability to expel food from the stomach in the same manner as in my method of expression. It was this fact, for example, which led Montegre† to make his investigations on digestion.

That rumination is due to a neurosis is beyond doubt. This is corroborated by the well-authenticated cases of heredity—e. g., Windthier's case of a Swede, forty-five years of age, who had ruminated since his thirtieth year; his son also began it in his twenty-fourth year. Rossier describes a father and son, sixty-five and twenty-four years old respectively. Another factor, imitation, may play an important part; this is shown in the case reported by Körner,‡ where a ruminating governess gave it to her two pupils. Additional weight is lent by its relatively frequent occurrence in nervous persons suffering from neurasthenia, hysteria, epilepsy, and idiocy, and its cessation when the patients experience profound emotional disturbances—passion, anger, etc. The case of Ducasse# also confirms this; this was a young man who had been afflicted with this disorder from his sixth to twenty-eighth year; it was lessened on the first day after his marriage, and disappeared one week after; in other cases the reverse has occurred; there are still others in whom the malady is made worse by sexual excesses.

The state of nutrition of the patients is very variable. The dis-

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* Rossier. Mérycisme héréditaire dépendant d'une épilepsie. Annal. de la Soc. de méd. d'Anvers, avril–mai, 1867.

† Montegre. Expériences sur la digestion. Paris, 1814.

‡ O. Körner. Beiträge zur Kenntniss der Rumination beim Menschen. Deutsches Archiv für klin. Med., Bd. 33.

Ducasse. Mém. de l'Acad. royale de Toulouse, tome iii. Quoted by Schneider, *loc. cit.*

ease may occur in all classes of society and at all ages. Haste in eating and the swallowing of large morsels seem to be of very frequent occurrence in this disorder. Rumination may take place voluntarily or involuntarily, but its suppression causes pain.

The most varied speculations have been indulged in as to its cause: first a central lesion was suggested; then a peripheral one; some thought it was due to a relaxation of the cardia; others referred it to a heightened sensibility of the mucosa and stronger muscular contractions of the stomach, or even to some peculiar formation of the latter or of the antrum cardiacum of the œsophagus. We must confess that we really know nothing of the true etiology of the affection, and it would simply be a circumlocution to follow the example of Dehio,* who designates it a "perverse and combined act of motion" or a reflex functional neurosis. A study of the murmurs of deglutition shows that there can be no permanent relaxation of the cardia. Dehio heard in his patient a distinct *Pressgeräusch* "which, according to the generally accepted view of the origin of this murmur, can not be present when the cardia is paralyzed" [see foot-note, p. 61]. Distention of the stomach with carbonic-acid gas also showed that the cardia was competent. In two cases of my own in which, at all events, rumination was not very marked (possibly eructation would be the proper name), repeated examination failed to reveal the normal *Pressgeräusche* and the *Spritzgeräusch*. According to the prevailing views, this would also speak against a permanent relaxation of the cardia; on the other hand, no further proof is needed to show that at the time of rumination the tone of the cardiac sphincter must be relaxed, and that there must be a paresis, or better, an unusually easy yielding of the cardia. Unfortunately, in the patient who was able to swallow two live gold-fish, respectively $6\frac{1}{2}$ and $5\frac{1}{2}$ centimetres [$2\frac{3}{5}$ and $2\frac{1}{5}$ inches] long, and to regurgitate them alive twenty minutes after, Alt† neglected to study the murmurs of deglutition; yet this performance would seem almost impossible without a relaxation of the

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* K. Dehio. Ein Fall von Ruminatio humana. St. Petersburger med. Wochenschr., 1888, No. 1—Einhorn, New York Medical Record, 1890.

† K. Alt. Beiträge zur Lehre von Merycismus. Berl. klin. Wochenschr., 1888, Nos. 26 and 27.

cardia and œsophagus, since it is scarcely possible that the delicate fish could have been squeezed through the narrow passage alive. Naturally this does not solve the question whether the relaxation is permanent or temporary; yet to me it seems justifiable to classify rumination among the cases of insufficiency of the gastric sphincters. Finally, both of my cases were neurasthenics (male); and in this respect they agree with the other cases which have been reported.

The reports published recently in rapid succession by Alt, Boas,* Jürgensen,† and Sievers,‡ have shed some light on the chemical processes in this condition; they do not agree, for hyperacidity and subacidity were each found once and anacidity twice. From this we may infer that the changes in the chemical processes of the stomach are not an essential but only an incidental feature in the symptomatology of rumination; hence I would not be at all surprised if in one and the same patient varying degrees of acidity were found under otherwise identical conditions, since such a variable relation is characteristic of many of the neuroses.

Nevertheless, among the cases just referred to relief was obtained by the treatment which was indicated by the results of the chemical examinations; alkalies were given in one case of Alt and three of Sievers, where there was hyperacidity, and acids in Boas's case with subacidity. These results should be appreciated still more, since every kind of treatment which had previously been tried was unsuccessful. The only exception to this was Rossier, who gave relief in one case by the internal administration of morphine in increasing doses up to 40 centigrammes [gr. vj] a day; in another patient in whom this drug was powerless he succeeded with large doses of opium, 1·5 gramme [gr. xxijss.]!? In general, the best treatment seems to be that given in a case described by Pönsgen—an energetic will, and swallowing the food at once when it regurgitates, without chewing it a second time. Expectoration of the regurgitated food may lead to serious disturbance of nutrition, as occurred in the case reported by Sauvage, of a patient who had been afflicted for thirty years, but whose confessor had ordered him to spit out

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* J. Boas. Ibid., No. 31.

† Chr. Jürgensen. Ibid., No. 36.

‡ Sievers. Finske Lakares Allskapt, 1889.

the regurgitated masses. Two weeks later he had emaciated very much, but he did not improve till, at the advice of a physician, he returned to the old habit.

If the existence of paresis of the cardia in rumination is an assumption rather than a demonstrated fact, this is even more applicable to **incontinence of the pylorus,** which was considered a special nervous affection, first by L. de Séré,* and more recently by Ebstein.† It is true that the latter has positively demonstrated that the pylorus may be incompetent when unyielding neoplasms involve this portion of the stomach; this was naturally to be expected, but unfortunately we have no diagnostic criteria by which we may establish the existence of this condition as dependent upon atony of the pyloric sphincter—i. e., as a pure neurosis—for an occasional incontinence of the pylorus is a normal phenomenon. An extensive experience will demonstrate to any one what was first observed by Kussmaul, that, after introducing the tube into the stomach while fasting, intestinal contents or bile may be obtained; this occurs most frequently when the patients have gone without eating for a longer period than usual. The natural inference from this is that the pylorus was not firmly closed; consequently, it will be very difficult to distinguish its pathological occurrence from the physiological. Furthermore, Ebstein's diagnostic test, the rapid passage into the intestines of the carbonic-acid gas which has been artificially generated in the stomach, is unreliable, and is subject to many errors. First, the inflation of the stomach may displace some coils of intestines up against the abdominal wall, just as if they had been distended by the passage of gas into them from the stomach; secondly, different persons require very varying quantities of effervescing powder to distinctly inflate their stomachs; finally, the gastric contents may combine with more or less of the gas as it is generated. Hence the pylorus may be competent, in spite of the negative result of this test.

At all events, incontinence of the pylorus is a very rare occur-

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* L. de Séré. Du relachement du pylore. Gaz. des hôp., 1864, No. 62.

† Ebstein. Ueber Nichtschlussfähigkeit des Pylorus (Incontinentia pylori). Volkmann's klin. Vorträge, No. 155.—Einige Bemerkungen zu der Lehre von der Nichtschlussfähigkeit des Pylorus. Deutsch. Archiv für klin. Med., Bd. xxxvi, S. 295.

rence. In the numerous cases in which I have distended the stomach to its utmost with air, I could never distinctly demonstrate such a condition; instead of that, the air always escaped upward with explosive eructations whenever the tension became too great. Nevertheless, I believe that some dyspeptic disturbances are due to pyloric incontinence; yet many more are the result of regurgitation of the intestinal contents into the stomach rather than a too early passage of the chyme into the duodenum. On the other hand, I agree fully with Ebstein and Zeckendorf,* that the acute intestinal tympanites of hysterical persons may be largely due to the rapid passage from the stomach into the intestines of air which has been swallowed; hence the pylorus must necessarily have been incompetent.

Another fact which I have repeatedly observed may possibly be of importance in the etiology of pyloric incontinence. Not infrequently we encounter persons whose stomachs are found empty after the usual interval (an hour, or sometimes even forty-five minutes) following the test-breakfast; yet, by pouring in water, we may easily convince ourselves that the apparatus of expression or aspiration is intact. In these cases the chyme has passed unusually early into the duodenum; but it is still doubtful whether this is due to a heightened peristalsis which has overcome the normal closure of the pylorus, or whether there is an incompetence of this sphincter.

Atony of the stomach is an important neurosis to which sufficient importance has not yet been attached. We have already encountered this condition and its results as an accompanying symptom of manifold dyspeptic disturbances; but atonic states of the gastric musculosa may undoubtedly occur as a primary neurosis, as an independent disorder of the innervation of the nerve-centers regulating the peristalsis of the stomach; these may occur either *in loco affectionis* or in the central nervous system, and are frequently the cause of the dyspeptic troubles resulting therefrom. It is superfluous to speak in detail about the origin of this condition as a result of insufficient or too tardy movement of the chyme, since we have already frequently observed this reciprocal relation of cause and effect. I

* Zeckendorf. Ueber die Pathogenese der Bauchtympanie. Dissertation, Göttingen, 1883.

simply wish to distinctly state once more that I consider "atony" to include a disturbance of the gastric motor function only, not of its secretory; in other words, it is a lack of agreement between the power of the muscular force of the stomach and the task to be accomplished by it—i. e., it is an insufficiency of the stomach (Rosenbach). Otherwise we may, like von Pfungen,* include three fourths of all the lesions of the stomach under this title, and yet not obtain a clear conception of its relations.

Atony may be partial or complete, depending upon the involvement of the fundus or pylorus or the entire stomach. I consider this classification premature, for it is based upon the independence of the several portions of the stomach which has recently been repeatedly maintained. I will admit the value of the experiments of Schiff, von Hofmeister, and Schütz upon the movements of the stomach,† and also the observations of von Pfungen‡ upon a patient who had undergone the operation of gastrotomy; according to these experiments, the motor power of the body of the stomach is about one third as great as that of the antrum pylori; while the function of the latter is especially to expel the chyme, that of the former is the trituration of the ingested food. But I maintain that we know so little about the movements of the stomach in pathological cases that we may be happy to be able even to recognize the existence of these disturbances as such. Furthermore, I can not see what is gained by such a distinction between atony of the pyloric portion and of the body of the stomach; for, so far as clinical effects are concerned, the latter will always be the more important and causal factor. Where there is no movement in the body of the stomach its absence can not be replaced by the peristalsis of the antrum pylori, be the latter ever so powerful; but if a normal or even heightened peristalsis of the fundus be associated with an atonic condition of the pyloric portion, there can be no obstruction to the expulsion of the chyme; on the other hand, this must be more easily accomplished than normally, since an atonic state

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* R. Freiherr v. Pfungen. Ueber Atonie des Magens. Klinische Zeit- und Streitfragen. Vienna, 1887.

† *Vide* Ewald. Klinik, etc., I. Theil., 3. Auflage, S. 78.

‡ *Loc. cit.*, p. 261.

of this portion of the musculosa of the stomach would be inconceivable without a coincident diminution of the tone of the true pyloric sphincter which is so closely associated with it; consequently, the muscular power of the remainder of the stomach can easily overcome the resistance of the "dead channel" thus formed. In such cases we might possibly suppose that where this relaxation of the pyloric portion begins a closure of some kind might be effected by the contraction of the adjacent circular fibers of the stomach, and thus none of the chyme will pass on into the intestines in spite of the apparently vigorous peristalsis. This is how von Pfungen attempts to explain a case of this kind which had been reported by Kussmaul.* Such suppositions, however, lead us into the broad field of speculation, from which we must keep aloof as far as possible.

III. Mixed Form of Gastric Neuroses.

Neurasthenia Gastrica (Nervous Dyspepsia).—The condition which, under the name of nervous dyspepsia, has recently been the subject of so much discussion, is, in my opinion, only a complex form in which the neuroses already described in the preceding pages take a more or less prominent part, but which is at the same time characterized by an active participation of the entire gastro-intestinal tract.

But now it is quite difficult to include these conditions within one clearly defined clinical picture. It is almost like trying to grasp a medusa which is dissipated under our grasp. For, if we adhere closely to that which is indicated by its name, we can include only actual digestive disturbances, dyspeptic conditions which lead to a distinct change in the chemical functions of the stomach. But if we follow the conception of nervous dyspepsia, which was first announced by Leube in his classical work,† that it causes digestive complaints without producing digestive disturbances—i. e., without altering the chemical functions of the stomach—then, as Rossbach has very properly said, we have a condition very much like dyspepsia, but not dyspepsia. Every one will at once feel how strained such a nomenclature is.

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* Kussmaul. Deutsch. Arch. f. klin. Med., Bd. vi, S. 470.

† III. Congress für innere Medicin zu Berlin.

According to Leube,* nervous dyspepsia is a group of symptoms essentially of a cerebral nature, which are due to an abnormal irritability of the sensory nerves of the stomach toward the normal digestive processes, and which are especially manifested by the symptoms which I have already grouped together among the sensory phenomena caused by irritation.

On the other hand, Stiller includes under this title of nervous dyspepsia all those conditions in which there is a predominance of digestive disturbances which are reflected back upon the stomach from and by means of the central nervous system and the sympathetic respectively, and which may incidentally cause definite changes in its functions. Whereas the former writer proceeds from the center of the circle to the periphery, the latter goes in the reverse direction, from the periphery to the center. Furthermore, while the former claims that the true peptic activity of the stomach is unchanged, the latter maintains that it is altered under certain conditions, and, in fact, in the majority of cases.

In this dilemma it would be difficult to follow the usual course and say that the truth lies midway between these two views, for in a certain sense, or rather with certain restrictions, both of them may be correct. There are some cases—i. e., the rarer cases of Leube—which correspond to the picture of nervous dyspepsia; but I believe that this group will gradually grow smaller and smaller with the increasing delicacy of the methods of investigating the peptic powers of the stomach. On further examination, Leube's criterium of normal digestion—i. e., the stomach must be empty six to seven hours after the test-meal—has proved to be insufficient. Rosenbach, Riegel, Rodzajewski,† myself, and others have emphasized the uncertainty of this test. After a careful study of the digestive processes, I have found changes in the chemical functions in quite a large number of cases in which the nervous symptoms were the prominent feature. Furthermore, we must not forget that our present methods of chemical examination are still relatively crude, and

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* Leube. Ueber nervöse Dyspepsie. Deutsches Archiv. für klin. Medicin, Bd. xxiii, 1879.

† Rodzajewski. Ueber die Digestiondauer im Magen als diagnostische Methode. Petersburg. med. Wochenschr., 1885, Nos. 32, 33.

give us absolutely no information concerning the amount of pepsin secreted, and very little about the intensity of absorption and the strength of motion. Hence, we can only ascertain certain gross changes, while there is surely quite a large number of alterations which escape us because they lie beyond our present limits. The same may be true of anatomical changes. Jürgens* has made an important contribution upon this point. In forty-one patients who, while alive, had complained of vague dyspeptic disturbances, a complete degeneration of Meissner's and Auerbach's plexuses was discovered; in this way he gave a tangible anatomical basis to these cases of dyspepsia, many of which had been diagnosticated as "reflex dyspepsia." Furthermore, "where the disturbance was more of a sensory character," he found "a degeneration of the muscularis mucosæ of the stomach and of the intestines also, and a pronounced formation of varices in the intestinal walls, the exact examination of which revealed a degeneration not alone of the muscular fibers of the veins, but also of the sensory nerves and of the branches of Meissner's plexus in the vicinity." Unfortunately, the results of the detailed investigations have not yet been published; but, if they prove correct and are pursued further, the domain of nervous dyspepsia will also be curtailed on this side.

On the other hand, in the majority of cases we can discover no changes in the nerves outside of the stomach, of a direct or reflex nature, which may be referred to this viscus, or may give rise to immediate disturbances of the gastric digestion.

In either case the clinical symptoms of this condition will always consist of the manifestations which I have already described as those of irritation or paralysis, a mosaic in which now one stone, now another, will be lacking; sometimes one, sometimes another, will be especially prominent; but they will never be firmly fixed together, and, like man himself, will always present a kaleidoscopic picture. There is only one characteristic feature, that, taken all in all, the symptoms are usually mild, and severe forms of gastralgia and cramps, nervous vomiting, polyphagia and bulimia, do not occur.

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* Jürgens. Verhandlungen des III. Congresses für innere Medicin, S. 253.

In all these patients the symptoms of imperfect intestinal digestion will always be found associated with those due to changes in the gastric functions.* In some cases the symptoms of imperfect intestinal digestion are not well marked, and are restricted to the consequences of lessened or increased peristalsis—usually constipation, less frequently diarrhœa—or the stools may be normal but absorption is disturbed; such patients will emaciate continuously in spite of a good appetite, etc. Not very long ago attention was directed to these cases by Möbius.†

In other cases the intestinal symptoms are so well marked that one might be tempted to group them into a distinct class, as was done by Cherchewsky.‡ Here, along with mild gastric disturbances, we observe anorexia, repugnance toward taking food, coated tongue, mild nausea—in short, symptoms which might not inaptly be designated those of visceral neuralgia. The bowels are usually constipated, and there are severe pains in the abdomen, either spread diffusely or recognizable as separate painful spots. Rarely the abdomen is retracted; as a rule, it is quite distended and tympanitic, sometimes even to a marked degree, while the free escape of flatus causes great torture to the sufferer. The gas which may escape either by mouth or by rectum has caused this condition to be called *flatulent dyspepsia.* In addition there are also general nervous symptoms like those observed in the gastric form, except that they are usually more severe and even at times alarming.

If you will recall what was said in the introduction to this part about the innervation of the stomach and intestines, the mutual transition of the symptoms of these viscera ought to occasion no surprise. The close connections of the numerous plexuses of the intestines and the fibers of the vagi, splanchnics, and the various sympathetic ganglia, necessarily cause the involvement of the one to

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* One of my patients wrote to me that "I must complain most of a feeling of oppression while walking, bitter taste in the mouth, and obstinate constipation." The bitter taste in the mouth is frequently replaced by an exceedingly annoying dryness and burning sensation.

† P. Möbius. Ueber nervöse Verdauungsschwäche des Darms. Centralblatt für Nervenheilkunde von Erlenmeyer, vii. Jahrgang, 1884, No. 1.

‡ Cherchewsky. Contribution à la pathologie des névroses intestinales. Revue de médecine, 1884, No. 3.

be followed by a disturbance of the other, no matter whether the cause is located centrally or peripherally.

Therefore, I have proposed the name *neurasthenia gastrica*, or *vago-sympathica*, for this entire group of symptoms; it may be subdivided into a gastric and an intestinal form, according to the viscus which is especially involved.* I consider this name is much better than the expression nervous dyspepsia, because it corresponds more closely to the nature of the affection, and my liking for the latter designation has by no means been lessened by the reasons given by Leyden† in a splendid paper on this theme. On the contrary, it seems to me better and more suitable to the nature of the lesion to leave out the "dyspepsia" altogether; for a deficiency in the peptic powers of the stomach is either absolutely lacking or, at all events, if present plays a very subordinate part.

As I have already said, gastric neurasthenia is a complex of the various nervous disturbances already described, and therefore these can give no specific and characteristic data.

This is also true of R. Burkart's painful points in the abdomen, which have already been described [page 407]. There is nothing about them which is characteristic of gastric neurasthenia. They can not be mistaken for gastralgias, enteralgias, and the painful sensations in the abdominal parietes; the latter not infrequently radiate from the infrasternal depression as lancinating pains, and might well be called epigastralgic, as proposed by Briquet.

Leube has called attention in his classical work‡ to the fact that the symptoms connected with digestion are nearly always preceded by manifestations of a general nervousness or, as it is now designated, neurasthenia.

The writers who have since investigated the subject have laid a different stress upon this fact, according to the standpoint which they have taken. Undoubtedly there are cases in which no cause can be discovered—Fenwick# claims this for the majority of his

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* Ewald. Verhandlungen des III. Congresses für innere Medicin.

† E. Leyden. Ueber nervöse Dyspepsie. Berl. klin. Wochenschr., 1885, No. 30.

‡ Leube, *loc. cit.*

Fenwick. On Atrophy of the Stomach and on the Nervous Affections of the Digestive Organs. London, 1880.

observations—but surely there are very few patients indeed in whom the characteristics of a nervous disposition can not be discovered. Either nervous diseases are hereditary in the family, or the nervous system has been very severely taxed in some way or another—profound emotional excitement, business cares, severe mental exertion, sexual excesses—or the condition which we call cerebral or spinal irritation, or any other affection of the nervous system bordering upon hysteria, has preceded it. Thus, I have had under my treatment for a long time a young man, eighteen years old, whose father suffered from pronounced spinal irritation. Another case was an old gentleman who had all the symptoms of a well-marked neurosis of the intestinal tract, after having suffered for years from peculiar nervous symptoms, which were always associated with irregularities of intestinal digestion. There are also some cases—their number is very limited—in which intestinal neuroses are developed without these prodromata. By watching such patients for a longer period we will usually be able to observe other neurasthenic symptoms. I have frequently seen a young lady in whom the condition which at first could only be called gastric neurasthenia was aggravated on account of the cessation of menstruation, and finally became hysteria, with especial prominence of the signs of gastralgia and enteralgia. However, such an occurrence is manifestly very rare, and warrants the suspicion that it was hysteria from the beginning; in fact, all these conditions now under discussion were formerly included under this disease. Naturally, they have been known for a long time, but their exact description, and the chemical demonstration of the integrity of the gastric juice, is an achievement of recent times, due especially to the labors of Leube.

At this place, however, I should like to state that the same nervous states which constitute the prodromata of the dyspeptic condition may also become very prominent during the course of the latter. Not alone are there pains in the head and back, weariness of the limbs, etc., but these patients are very gloomy and pessimistic, worry unnecessarily, and lose what little ambition they still possess. One of my patients complained of a weak memory and inability to concentrate his thoughts; another suffered very severely from vertigo during every exacerbation of his dyspepsia. At the

same time the pulse became small and rapid, the hands and feet were cold and livid, and trembled, there was palpitation of the heart with oppression and dyspnœa, which became worse on getting up or walking; these symptoms increased to a most intense fear of impending death, till suddenly relief was brought by the passage of flatus. Although the patient, who was a well-educated gentleman, moving in the highest circles, knew how the attack would end, he was, nevertheless, utterly unable to overcome the feeling of impending death.

In all these cases I wish to state emphatically that the lesions are dyspeptic conditions upon a neurotic basis, never concomitant symptoms of really demonstrable injuries of the central nervous system—e. g., gastric crises of tabes dorsalis, diffuse and localized cerebral lesions, ailments of the peripheral nerves, etc.; or what may occur as reflex neuroses in chlorosis, menstrual disorders, uterine and ovarian diseases, and intense psychical excitement (when they are manifested as nervous diarrhœa or constipation). As opposed to the chronic and, if I may so express it, the milder character of gastric neurasthenia, these conditions take the shape of acute, rapidly developed attacks, accompanied by very intense symptoms, which may either occur once or return periodically, Such attacks are described in Richter's monograph;* Leyden † has also published a series of very well marked examples. In my opinion the only relation which they bear to neurasthenia gastrica is that they can not be grouped with those forms of psychoses or neuroses in which anatomical lesions of the central nervous system can not be demonstrated with the methods thus far at our disposal.

Although we can not positively say that real pathological anatomical changes are lacking, yet we can usually exclude great alterations in the chemical functions, even though this is not always justifiable. In many cases an indigestion of short or long duration, a mild catarrh, frequently recurring hyperæmia, and the like have surely been the primary cause of the manifestation of the nervous

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* Richter. Ueber nervöse Dyspepsie und nervöse Enteropathie. Berliner klin. Wochenschr., 1882, No. 13.

† Leyden. Ueber periodisches Erbrechen (gastrische Crisen). Zeitschr. für klin. Med., Bd. iv, 1882.

symptoms in the digestive organs. Indeed, such injurious conditions may recur during the course of the disease, and may produce a temporary aggravation thereof, because they are added to the factors already existing. But if we encounter leucorrhœa or dyspeptic disturbances during chlorosis, or if we see retinal changes in Bright's disease, we will never consider these conditions as anything but symptoms of a general malady.

In my opinion, there can be no doubt that these dyspeptic conditions are the manifestations of general neurasthenia. In rare cases this may be developed only in the nerves of the stomach and intestines, and apparently the lesion is in one of the peripheral nerves. In the vast majority of cases these local symptoms are combined with others of a nervous nature, and among which they occupy a pre-eminent place.

For the *diagnosis* of dyspeptic neurasthenia there are no single characteristic symptoms. Therefore it can not be made simply from the results of one examination, and the complaints of the patient at that time; the more so, since not infrequently organic lesions may go hand in hand with neurasthenic conditions. A correct diagnosis is possible only after a prolonged observation of the course of the disease, discovery of the causal factors, the failure of all measures directed toward suspected organic diseases of the stomach and intestines, and a proper estimation of all the signs of neurasthenia which may be present. As Burkart has rightly suggested, particularly great value is to be laid upon the peculiar character of the individual symptoms, on account of their mutual relations to one another, and their changeable occurrence.

I would also like to direct attention to the following: First, the gastralgic pains are, as a rule, diffuse, and do not have that distinct, sharply localized character observed in ulcer or cancer of the stomach. They are also much less dependent upon taking food, although this relation is also very variable in carcinoma.

Secondly, vomiting occurs very rarely in gastric neurasthenia. When it does occur, it consists of mucus mixed with bile and remnants of food in various stages of digestion, but never of bloody or decomposed masses. It is distinguished from hysterical vomiting by the ease and regularity with which the latter usually occurs.

The taste of the vomit is not offensive but bitter; I am inclined to agree with Liebreich that the taste in these cases is due not to bile but to peptones, which are well known to have a very sharp and bitter taste. In belching, with the regurgitation of acrid masses, this is undoubtedly the case.

Thirdly, the stools—of which I have examined a large number in the course of time—have the usual changeable character described by Lambl, and later by Nothnagel.* In no case did I find an unusual quantity of undigested remnants of food or mucus, or even of blood. The form of the fæces is also very variable. I have observed nothing of a typical character, and it was only rarely that I saw the ribbon-shaped stools upon which Cherchewsky lays so much stress.

Concerning the *differential diagnosis*, I shall not speak of the neoplasms, ulcers, strictures, etc., which may be recognized by palpation, inspection, or by very characteristic symptoms, but instead I shall invite your attention to the following points:

Leube has recommended the so-called digestion-test as an aid in the differential diagnosis. According to this writer, in health and in neurasthenia gastrica the stomach should be empty seven hours after taking a simple meal, and the wash-water after lavage should contain no traces of food. I will admit that this rule is true of the majority of cases, but the exceptions to it I have already given (*vide supra*). Leube† himself speaks of two cases out of six examples of dyspeptic neurasthenia in which the stomach-contents were undigested in the seventh hour after eating, and contained no acid. On the other hand, I have found the stomach empty at this time in gastric catarrhs, ulcers, and cancer of the stomach. Therefore, although the empty condition of the stomach after this interval is usually indicative of a normal condition, it by no means gives absolutely certain conclusions.

The same is true of the chemical examination of the contents of the stomach which have been obtained at an earlier period. Even

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* Nothnagel. Beiträge zur Physiologie und Pathologie des Darmes. Berlin, 1884.

† W. Leube. Beiträge zur Diagnostik der Magenkrankheiten. Deutsch. Archiv für klin. Med., Bd. xxx.

in very well marked chronic catarrhs, where there could be no suspicion even of a nervous origin, in ulcer, and also in carcinoma, I have found gastric juices which had the normal percentage of acid and digestive powers, as ascertained with our modern methods of examination. In fact, I am convinced that we should avoid going too far in drawing conclusions from the results of the chemical examination of the gastric juice, and we should always bear in mind that a series of factors participate in the functions of the living organ which we can not reproduce in our crucibles and retorts, and can not recognize with our chemical reagents.

Where the diagnosis is doubtful concerning the possibility of a gastric ulcer, there is an additional factor to which I always pay attention—i. e., for the reasons given on page 260, I am afraid to introduce the stomach-tube, and I thus avoid the risk of causing a perforation for the sake of information which may be doubtful; therefore, it seems much more important to me to treat the suspected ulcer with appropriate remedies, and let the diagnosis depend upon the results of such a course of treatment.

Indeed, we should endeavor to realize the fact that in very many cases it is impossible to recognize a neurosis at the first glance, and that only prolonged observation, a very carefully taken history, and a consideration of the general condition will strengthen the diagnosis and exclude ulcer, primary or secondary engorgement of the liver, and even carcinoma or chronic tubercular processes. Intercostal neuralgia has also given rise to errors; and although I have never met such a case, which must necessarily be rare, it should nevertheless always be borne in mind.

The prognosis and treatment of neurasthenia dyspeptica may almost be inferred from the nature of the affection. It would be easy to subdue the functional anomalies which might be present if they were not always reproduced by their central causes. The *prognosis* is as uncertain here as it is in all neurasthenic affections. Some cases are quite rapidly cured by suitable treatment, and may remain well permanently or temporarily; but there are others which for years resist all the efforts of rational therapeutics. The course which an individual case will pursue can not be predicted in advance. It is natural to suppose that the chances are best where the

symptoms have been mild, and *vice versa;* but on this very point I have repeatedly erred. Apparently very severe cases were cured in a relatively short space of time, while seemingly simple ones persisted for years. In general, only this much can be premised, that at best the trouble is one of long duration, lasting for months at least, and that the external appearance of the patient affords no clew to the severity of the neurasthenic symptoms. I have frequently treated young men who were the picture of health, and whose complaints were therefore ridiculed. There are other cases in which the patients decline very much, emaciate, and become so miserable that some English writers have even described extreme conditions of weakness, with terminal œdema, fever, and death.

IV. Reflex Gastric Neuroses from other Organs.

Under this heading I include palpable changes in organs other than the stomach, whose effects are observed in the gastric nerves; in other words, those morbid manifestations to which, like all other reflex conditions, the axiom *Ablata causa cessit effectus* has a special significance. Too frequently is the cause of the cases sought, not in the real primary area, but incorrectly in the place secondarily involved; therefore, a brief *résumé* of the reflex symptoms known to us may serve to remind you what organs and morbid processes are to be especially considered.

The reflexes manifest themselves as (1) mild disturbances of digestion; (2) gastralgias; (3) vomiting; the latter occurs especially in acute affections, the former in those whose nature is more chronic. But just as these three types may very frequently be interchangeable, and even occur in combination, so may chronic processes give rise to the symptoms of an acute gastric disorder, if they exacerbate suddenly or involve specially predisposed nervous plexuses, etc., in their course. This is well shown, for example, in the crises of locomotor ataxia.

The fact has been repeatedly mentioned that the stomach is the center of a nervous plexus whose branches have very wide connections, and directly or indirectly involve nearly every organ in the body; hence, an irritation which is manifested at any point in this plexus will reach the stomach, just as in any peripheral end-appa-

ratus. Of especial importance are the reflexes from the central nervous system, the great glandular organs in the abdomen, the intestines, genital tract, and, finally, the heart and lungs.

The cerebral disorders — meningitis, hæmorrhages, abscesses, tumors—are usually accompanied by vomiting of a transitory or more permanent character, and frequently by hypersecretion of the gastric juice, as was already known to Andral.* The presence of this abundant secretion of gastric juice during life will therefore explain the rapidity with which post-mortem softening of the stomach may take place in these cases. Vomiting usually occurs during the course of the disease, or it may usher it in and thus cause great misconceptions, as is well known in meningeal inflammation, especially of children, and in tumors. Therefore, every case of long standing, or even unyielding vomiting, must be considered from this standpoint. The vomiting of sea-sickness, migraine, and the beginning of psychical affections, may also be included in this variety of reflex vomiting. Of the latter occurrence I have two examples in which, apparently from a gastric catarrh, very obstinate vomiting was developed, which, after having lasted several weeks, was followed by a psychosis. Lesions in the cervical and dorsal portions of the spinal cord cause gastralgia, sometimes with vomiting, as soon as the centers or nerve-roots concerned are involved. Such "gastric crises" occur not alone in the gray degeneration of the posterior columns (tabes), but also in insular lesions of disseminated sclerosis. Vomiting is also of frequent occurrence in abscesses and calculi in the liver and kidneys, especially when they pass into the excretory ducts and thus irritate their sensory nerves.

I will recall the vomiting of pregnancy not alone to indicate a very common reflex upon the stomach, but also a not infrequent source of diagnostic doubts and errors. How frequently has apparently serious vomiting, which simulated some grave disorder of the stomach, simply proved to be the first manifestation of a pregnancy! It occurs in the early part of gestation, while the uterus is still in the pelvis, since this variety of vomiting is due to the pressure of the enlarged womb upon the sympathetic nerves. The dis-

* Quoted by Budd, *loc. cit.*

order may reach such a degree that all remedies are useless, if the uterus is unusually large or is misshapen, or if its muscular fibers are inflamed, or if it is misplaced. But acute injuries or maltreatment of this organ may also cause vomiting—e. g., snaring a polyp at the fundus uteri preparatory to its removal. Dr. Daumann had such a case in which pain and vomiting set in every time the loop was tightened, while the latter ceased as soon as the ligature was loosened. The same thing has been observed in operations on the bladder, urethra, etc.

Chronic disorders of the female as well as of the male sexual organs may be followed by chronic dyspeptic conditions. I would here remind you that the normal process of menstruation causes retardation of gastric digestion, or even complete absence of free hydrochloric acid in the stomach-contents, as was first demonstrated by Kretschy,* and later confirmed by Fleischer,† and Boas and myself.‡ How much greater reflexes will be referred to the stomach and intestines by amenorrhœa and dysmenorrhœa, the climacteric period and chronic disorders of uterus which are associated with an irritability, or even with a direct excitation of its nerves! Hence we can understand why Kisch# found "dyspepsia uterina" most frequently in retroflexion of the enlarged uterus, then in malpositions in general, myomata, pelvic exudations with traction on the uterus and its adnexa, follicular or carcinomatous ulcers of the cervix, and ovarian tumors; but it was absent in simple and mild endometritis, chronic catarrhs, and *small* perimetric and parametric exudations. Such dyspeptic conditions which may have persisted for years have been cured in a surprisingly short time by appropriate local treatment.

I have recently observed a peculiar and rare example of a reflex of this kind which first involved the salivary glands and indirectly the stomach—i. e., sialorrhœa with dyspepsia resulting therefrom. An unmarried lady, forty-one years of age, was said by her physician to have suffered for two

* F. Kretschy. Beobachtungen und Versuche an einer Magenfistelkranken. Deutsches Archiv für klin. Med., Bd. 18, S. 257.

† E. Fleischer. Ueber die Verdauungsvorgänge im Magen unter verschiedenen Einflüssen. Berl. klin. Wochenschr., 1882, No. 7.

‡ Ewald und Boas. Zur Physiologie und Pathologie der Verdauung. Virchow's Archiv, Bd. 104.

H. Kisch. Dyspepsia uterina. Berl. klin. Wochenschr., 1883, No. 18.

and a half months from loss of appetite, bitter taste in the mouth, constipation, feeling of oppression over the stomach, and for several weeks very severe salivation. She was much emaciated, felt very weak, and had the greatest repugnance toward exerting herself, although she was formerly very active. She lived upon her estate, and had already taken Carlsbad water, condurango, nitrate of silver, and small doses of quinine; cold rubbings and suitable diet had also been tried, but all without success. On the patient's admission to the sanitarium the amount of saliva secreted daily was found to be about two litres [4½ pints]; this was examined in Prof. Kossel's laboratory and found normal. No great changes discovered in the gastric chemical functions; acidity 48. No other anomalies found; the mouth was free from any special disease. Every kind of poisoning by the coating of mirrors, mouth-washes, hair-dyes, and the like, was excluded. After a fortnight's trial of pills of atropine, and hypodermic injections of morphine and atropine, with only temporary effect on the symptoms, I discovered a retroflexion of the uterus. With the introduction of a pessary the obstinate ptyalism and the dyspeptic condition very soon disappeared.

In conclusion, I must mention the reflexes from the intestines, such as are caused by worms, enteroliths, and neoplasms in and about the gut. The parasites, especially, play an important part here. I shall not go into details about the serious disturbances of nutrition which may be caused by the distoma and strongylus varieties, neither shall I speak of the disease of tunnel workmen and brick-burners.* It will suffice to mention the ordinary ascarides and tænia, and recall the fact that many a long-standing "nervous dyspepsia" has been terminated by the expulsion of a tape-worm!

Treatment of the Neuroses of the Stomach.

In all the nervous diseases of the stomach the treatment will depend upon the question whether they are of an irritative or depressive nature.

The conditions of increased irritability must be separated into those in which the hyperæsthesia is local and those which are central in origin.

For local hyperæsthesia, opium and its derivatives—morphine, codeine, and narceine—have been invaluable for ages. In general, morphine is best administered in watery solution, or in bitter-almond

* [The *Tunnelkrankheit* or *Bergkachexie* is a form of anæmia caused by the anchylostomum duodenale. It has also been called Gothard-Tunnel disease. The same parasite is the cause of brick-burner's anæmia.—Tr.]

water, since it is not dissolved in the stomach if given in substance, or has little or no action. The most rapid effects may be obtained by hypodermic injection *in loco affecto;* I usually follow the English custom of adding one tenth part of sulphate of atropine, partly to counteract any possible nauseating effects of the morphine, partly to obtain the relaxing effects of the atropine. This is an excellent combination, which may be very useful in patients who have invariably had nausea and vomiting after the simple morphine solution. For example, in bulimia, Rosenbach has recommended the hypodermic use of extract. opii which has been dissolved in glycerin, filtered and diluted with water; but I have had no occasion to use it. If the general sedative effect on the entire nervous system is desired, and if there are reasons why it should not be given by the mouth, or subcutaneously, it may be administered in suppositories of 0·03 to 0·05 ! [gr. $\frac{1}{2}$ to $\frac{5}{6}$] each, or 0·1 to 0·15 ! [gr. j$\frac{1}{2}$ to ij$\frac{1}{4}$] per day. The action of opium and morphine may be assisted by hydrocyanic acid, in small doses, in the form of aqua amygdalæ amaræ. Hydrochlorate of cocaine may be unhesitatingly given internally, in doses of 0·05 to 0·1 gramme [gr. $\frac{5}{6}$ to jss.]; yet one must not forget that, in some individuals, even the first dose may be followed by unpleasant symptoms of irritation—sleeplessness, restlessness, pulsation of the arteries, and oppression and pain in the head. For prolonged use and where the symptoms are mild, coca wine may sometimes be valuable. As an antispasmodic we may use the preparations of belladonna, either pills of extract of belladonna or atropine, or the tincture.

In hysterical hyperæsthesiæ, gastralgias, vomiting, and even in spasmodic conditions, I have been very well satisfied with the following combination of the remedies mentioned above:

℞ Morphinæ hydrochloratis..	0·2	[gr. iij]
Cocainæ hydrochloratis....	0·3–0·5	[gr. ivss.–vijss.]
Tincturæ belladonnæ.....	5·0–10·0	[f ʒ j$\frac{1}{4}$–ijss.]
Aquæ amygdalæ amaræ....	25·0	[f ʒ vj$\frac{1}{4}$]

M. Sig.: Ten to fifteen drops every hour.

However indispensable morphine may be, the fact of its subcutaneous use being a two-edged sword in all chronic forms of disease is well known; and it is just in neuroses now under discussion that

both physician and patient should always keep before their eyes the terrible dangers of the morphine habit.

This need not be feared with chloral in 3 to 5 per cent solution, sometimes in combination with cocaine, to be taken at one and one half to two hours' intervals; it has a good sedative action. Sulphonal is an excellent hypnotic, but unfortunately it has absolutely no effect on the dyspeptic disturbances. Furthermore, it must not be forgotten that, although it is usually well borne, yet in some persons even small doses of two to three grammes [gr. xxx–xlv] may be followed by severe toxic symptoms. The feeblest and not always reliable analgesics are the preparations of bismuth, either alone or in combination with morphine or extract of hyoscyamus or—in mild cases, and especially in children—rhubarb. Swallowing small pieces of cracked ice with three to five drops of chloroform, may be recommended for rapidly allaying pain; the same is true of chloroform-water, which may be prepared by shaking water with an excess of chloroform, decanting and diluting with half the quantity of an aromatic water; the dose is a teaspoonful at intervals during the day.

Rosenthal, Leube, Vizioli, and Rosenbach have repeatedly observed the lessening and even disappearance of gastralgias by the anodal action of the constant current. A sedative effect is also claimed for the continuous use of the "galvanic chain" (zinc [negative] pole on the lumbar portion of the spinal column, the silver [positive] pole upon the stomach).*

Surprising results may sometimes be obtained by local treatment with the internal stomach-douche, which was first recommended by Malbranc † (Prof. Kussmaul's clinic) (see p. 63). This massage of the stomach seems to exert a quieting influence on the hypersensitive gastric nerves, just as ordinary massage often unexpectedly relieves painful neuroses. Malbranc has formulated Kussmaul's experience and opinion in explanation of the beneficial effects of the

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* [Good results have also been claimed after intraventricular galvanization, the negative pole being in the stomach and the positive over the epigastrium.—Tr.]

† M. Malbranc. Ueber Behandlung von Gastralgien mit der inneren Magendouche nebst Bemerkungen über die Technik der Sondirung des Magens. Berl. klin. Wochenschr., 1876, S. 41.

stomach-douche in the following conclusions, although in the case quoted below only the last mentioned are concerned: (1) Removal of stagnant remnants of food from the stomach; (2) relief from acid, acrid masses (products of decomposition) and mucus; (3) the quieting effect of the warm water bath; (4) stimulation of the peristalsis by the impact of the stream of water; (5) the mildly anæsthetic as well as the stimulating effects on the muscular fibers of the stomach from the carbonic-acid gas; (6) the increase in the peristalsis of the intestines by the last two factors.

As an example of the beneficial effects of the douche I wish to describe the following case which I presented at my lecture on October 7, 1887:

A married woman, thirty-six years old, the mother of one child, came ten days before, complaining of intense gastralgia, complete loss of appetite, and great lassitude. She was of a slight build and her appearance was bad; her eyes especially were dull and languid, as they are after sleepless nights. Her illness began five months previously with cramps in the stomach. For the preceding eight weeks the attacks had occurred several times a day; sometimes they were almost uninterrupted and were present at night quite independently of eating. Nothing abnormal was found in the stomach and abdomen; heart and lungs were normal. While fasting, about 30 c. c. [℥ j] of a neutral turbid yellow liquid, which was not slimy, were expressed from the stomach. This was undoubtedly regurgitated fluid from the duodenum. After the test-breakfast the acidity was very feeble, with only a trace of hydrochloric acid. She had a large batch of prescriptions of various narcotics and sedatives which she had taken without any benefit. The result of four douches was that only traces of the attacks occurred during the daytime; the appetite returned, and greater quantities of food were consumed.

A similar change of tone in the nervous apparatus may explain the effect of the introduction of the stomach-tube and feeding through it in severe reflex vomiting, especially in the vomiting of pregnancy; many successful examples may be found in English literature. On the other hand, I must agree with Oser,* that washing or douching the stomach has no permanent effect in hypochondriacs. They feel well as long as the treatment is kept up, but as soon as the physician or the patient stops it, the old condition again returns.

Among the remedies with a local action are also included moist

* Oser. Wiener Klinik, 1875, S. 257.

compresses upon the epigastrium, either in the form of the simple Neptune's girdle or sedative cataplasms of chamomile, valerian, etc. Mustard papers or poultices, applications of tincture of iodine, and the faradic brush may also be used as derivatives.

The bromides are the most important of the agents which act centrally; we may use either the salts of potassium, sodium, or ammonium, but the dose must be large to obtain a good effect. The limit is about two to three grammes [gr. xxx–xlv] two or three times a day; these doses are usually well borne, although some patients bear even small doses badly; the head is confused, limbs feel heavy; the characteristic smell may be detected in the breath, and sometimes there is even incontinence of urine. It is therefore advisable to begin with small doses; and in every case where the drug has been used for long periods it is wise to make small intermissions in its administration for three to eight days. Erlmeyer's bromide water is also useful here. Antipyrin, phenacetin, salicylic acid, and salol, in doses of 0·5 to 1·0 gramme [gr. vijss.–xv] are beneficial only for the hemicrania occurring among the other gastric symptoms; but otherwise they have no direct effect on the nervous apparatus of the stomach.

Rosenthal employed pilocarpine subcutaneously in the spastic forms of vomiting, inferring this use from the antispasmodic action of this drug in obstinate singultus. From a similar theoretical standpoint we may recommend physostigma, the central paralyzing power of which is well known, and which was recently tried by Riess and G. Meyer. I have seen very favorable results from injections of physostigma in the spastic incoördinated gait of patients with tabes; possibly an analogous good result may be obtained in gastric crises and nervous vomiting.

I may also speak here of the valerianate and the natrio-salicylate of caffeine—in doses of 0·1 [gr. jss.] two to three times daily and of nitroglycerin, which Talma valued so highly. I have no personal experience with the former except in the conditions of migraine, in which it is well known that all remedies thus far recommended have a prompt action at first, but are absolutely useless sooner or later. I have used nitroglycerin only twice, and in both cases the pains in the head and the vascular excitation

were so marked that I have been afraid to try it since. It may be used in doses of 0·5 milligramme [gr. $\frac{1}{120}$] in oil or in tablets.

In nearly all of the conditions under discussion, a general toning of the constitution by improving the metabolism and the composition of the blood is indicated, as well as an excitation or quieting of the nervous system. The preparations of arsenic and iron are the best for this purpose.

Although I formerly used Fowler's solution (i. e., the arsenite of potassium) most frequently, yet now, in accordance with Liebreich's recommendation, I employ arsenious acid almost exclusively, either in solution:

℞ Acidi arseniosi ..... 0·02 [gr. $\frac{1}{3}$]
Aquæ menthæ piperitæ..... 20·0 [f ʒ v]
M. Sig.: Ten drops t. i. d., and increase.

It may also be administered in granules of one milligramme [gr. $\frac{1}{64}$], or in the form of Asiatic pills:

[℞ Acidi arseniosi..... 0·75 [gr. xj]
Pulveris piperis nigri..... 6·0 [ʒ jss.]
Gummi arabici..... 1·5 [gr. xxiij]
Pulveris radicis altheæ ..... 2·0 [gr. xxx]
Aquæ q. s. ut fiat pil. no. c.
M. Sig.: One to three pills t. i. d.]

If the precaution be taken of avoiding any irritation of arsenic upon the mucous membrane by giving it only when the stomach is full, and if the above preparations be employed, then the drug can be used for a long time and in larger doses than is usually possible—i. e., up to 10 to 15 milligrammes [gr. $\frac{1}{6}$–$\frac{1}{4}$] per day—without any bad effects.

The mineral waters of Roncegno and Levico in South Tyrol are excellent means of giving iron and arsenic. Even very weak and delicate persons may continue their use for a long time, provided they begin with small doses—a tablespoonful once daily, half an hour after the midday meal, and gradually increase up to two to three tablespoonfuls.

Iron is also usually well borne when combined with a purgative. I frequently use Dr. Saundby's formula:

℞ Ferri sulphatis..... gr. ij [0·12]
Acidi sulphurici diluti..... ♏xv [0·75]
Magnesii sulphatis..... gr. xj [0·75]
Aquæ menthæ piperitæ..... ℥j [30·0]
M. Sig.: Tal. dos. thrice daily.

If we disregard the iron waters, the best way of administering this metal is in combination with albuminates, as albuminate of iron. Ferruginous preparations are as abundant as the sand on the shore, and every form has found its panegyrist; but the preference of one above the other depends mostly upon individual experience and coincidences. I use almost exclusively the chlorine compounds of iron, to the ease of the absorption of which I have repeatedly called attention—i. e., the tincture of the chloride of iron; the sesquichloride of iron in substance (combined with arsenic or quinine or chinoidin in pills); or liquor ferri sesquichlorati (Ph. G.) [liquor ferri chloridi, U. S. P.] mixed together in 2 to 5 per cent solution, and given in teaspoonful doses with white-of-egg water (1 part of white of egg, 5 parts water). This makes an albuminate of iron which is very well borne, almost without exception, even by very sensitive stomachs, and may replace the expensive liq. ferri album. Drees (Ph. Germ.).* The hæmatogenous remedies may be combined with the so-called tonics, cinchona bark, and the other bitters.

The various hydriatic procedures must be considered among those methods which have a strengthening as well as a soothing influence. These include the methodical use of lukewarm half-baths, washing the whole body with lukewarm sprinkling douches —the so-called Scotch douches†—packing with tepid water, and

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* [Dietterich's liquor ferri peptonati is also a useful preparation; it may be given alone or in combination with Fowler's solution, tinct. nuc. vomicæ, etc. See also Goodhart, Rest and Food in the Treatment of Anæmia and Anorexia Nervosa. Amer. Jour. Med. Sciences, September, 1891, p. 238.—Tr.]

† [The Scotch douche consists of a stream of water, about the size of a finger, which is directed against the epigastrium. The temperature of the water is rapidly alternated, 30° C. (86° F.) and 12° C. (54° F.), every ten to twelve seconds. It lasts two to three minutes, and may or may not be followed by a warm pack. The alternation of heat and cold is very stimulating to the entire neuro-muscular apparatus of the digestive tract. At the same time it causes hyperæmia of the abdominal parietes and viscera. Both of these actions, the stimulating and the vascular, are increased by the mechanical effects of the impact of the stream of water against

cool sitz-baths. I would warn against the use of too cold water, which frequently has an exciting and irritating effect; for this reason cold river and sea baths may sometimes be badly borne. To make an error of this kind in a feeble and anæmic person is of less importance than it would be in the by no means insignificant number of neurasthenics who apparently have, or imagine that they have, a strong constitution, and hence believe that the more the cold water causes them to shiver the greater will be its healing influence.

In a certain group of patients with nervous stomach-troubles, in whom persistent anorexia has led to very profound disturbances of nutrition, marked emaciation, and enfeeblement of the body, the use of the **rest-cure** (*Mast-kur*) is to be recommended. This method, as is well known, was first introduced by Weir Mitchell, and modified by Playfair, of London, and Burkart, Leyden, and Binswanger, in Germany; its object is to introduce and cause the absorption of a quantity of food which the patient under ordinary circumstances is able neither to take nor to assimilate. With this purpose, the treatment consists of two parts—a psychical and a vegetative or dietetic. The object of the former is to remove the patient from the injurious influences which his surroundings and his usual habits of daily life exert upon him, these being adapted to his complaint; therefore, he is kept isolated from these deleterious factors, so that he is completely under the control of his physician, whose orders he must obey even to the smallest, apparently trivial, details. For this, it is absolutely essential to separate the patient from his family and keep him at a sanitarium.

The dietetic measures aim to overfeed him—i. e., at least during the early part of the treatment, to give more nourishment than is required to satisfy his subjective wants Rest in bed is essential to prevent, as far as possible, the conversion of the food for heat production and muscular work; but at the same time the circulation is improved by passive muscular exercise through massage and electricity.

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the skin. Thus, it is a powerful adjuvant to electricity and massage of the abdomen. Ziemssen, Klinische Vorträge, No. xii, 1888. Also, see foot-note, p. 157.—Tr.]

The treatment is carried out as follows: The first step is to isolate the patient and place him in charge of a male or female nurse, whose duty it shall be to manage the feeding and the above-mentioned mechanical procedures; the nurse ought also to have the pleasant quality of not being personally unsympathetic to the patient. For the first few days the cure consists in giving milk in small quantities at two or three hours' intervals, so that one or two litres [quarts] are taken daily; the milk may be raw or cooked, skimmed or fresh from the cow, warm or cold, and may have various additions according to the caprice and taste of the patient. After three or four days the food is made more substantial and is given in small amounts every two hours. This consists of milk, meat, farinaceous food, butter, and coffee or tea; the daily quantity should be about $2\frac{3}{4}$ litres [six pints] of milk, 420 grammes [℥ xiv] of meat, about 150 grammes [℥ v] of vegetables or stewed fruit, and the equivalent amount of wheat bread, toast, and butter. If the stomach rebels against this rigorous diet and reacts with an acute gastric catarrh—i. e., dry, coated tongue, belching, heart-burn, pains in the stomach and head—then it must be suspended for a few days. Great attention must also be paid to the regulation of the stools.

In favorable cases improvement is shown as early as the second or third week. After the third or fourth week the patients may leave the bed, and may attempt to walk. Corresponding to the progressive improvement the massage and faradization are gradually lessened till they may be stopped entirely. If no improvement has been manifested by this time, it is advisable to refrain from carrying this treatment on any further.

Burkart has suggested that the cure should not be tried, or, at all events, should be carried out with very great care in those patients in whom there are conditions of cerebral excitement, and especially where the disturbances of the psychical functions are very pronounced. The best results are obtained in severe cases of hysteria and neurasthenia, in which the activity of the digestive organs is especially involved, and associated with this a marked change in the consumption of food. It is just these extremely emaciated, feeble patients who are pining away so wretchedly, who have the very best chances from this method of treatment.

"I never saw a more rapid restoration of the normal functions of digestion," says Burkart, "than in those digestive disturbances occasionally found in extremely emaciated hysterical subjects, and which stand in some close relation to the abnormal psychical condition." It makes a wonderful impression if one has the opportunity of seeing such cases in which the digestive organs had previously reacted very unsatisfactorily to nourishment, and apparently could only take and digest very small quantities, when, suddenly, after a few days of the Weir Mitchell regimen, immense amounts of food can be consumed without any great difficulty, and sometimes just those articles which have caused the most trouble can be taken without the slightest complaint. This gives a most striking demonstration of the real nature of the functional disturbances in which, unlike organic diseases due to demonstrable pathological tissue-changes, the return to the normal functional activity may be accomplished in a very brief time. Where patients with neurasthenia gastrica have been successfully treated with the Weir Mitchell cure, the normal conditions are restored much more slowly than in hysterical digestive disorders.

During the past few years I have had quite a large experience in this method, at least not strictly carried out as proposed by Weir Mitchell, but in a milder and somewhat modified form. The former I have used very seldom, because I have rarely found myself in such a position that I considered it absolutely necessary, on account of the great expense to the patient, and also, as stated by Burkart and Leyden, because patients are sometimes unwilling to be taken from their homes. However, in one case I not alone carried out the treatment to the smallest details, but also made exact investigations of the metabolism. The result was brilliant. The case was one of hysterical anorexia in a girl, sixteen years old, which had developed after an attack of scarlet fever eight years previously. The patient was emaciated to a skeleton, and suffered from headaches, tinnitus aurium, color-blindness, and photophobia, which was so intense that she had to sit in the dark, and was unable to read a line; great lassitude and trembling after every exertion; incontinence of fæces. At the beginning of the treatment she weighed 25·6 kilogrammes [56·3 pounds]; the conversion of nitrogen as calculated for albumen was

37·19 grammes [573·84 grains]. At first she received as food 114·42 grammes [1765·50 grains] of albumen, which was gradually increased in four weeks to 195·77 grammes [3020·72 grains]. She was kept isolated from December 5th to January 26th; on that day the conversion of albumen was 124·06 grammes [1914·24 grains]—i. e., a gain of 71·71 grammes [1106·48 grains], and her weight was 33·05 kilogrammes [72·7 pounds]—i. e., an increase of 7·45 kilogrammes [16·4 pounds]. I have had the opportunity of watching the patient three months longer; she is with her nurse at the house of her parents, gains steadily in weight, eats well, goes out walking, and is free from her old symptoms! This splendid result was obtained only because during the entire course of treatment she was free from all kinds of gastric and intestinal disturbances, except those of a very slight and transient nature.

However, it seems to me as if we could derive as much benefit from a modified course of treatment in which the patient is not isolated, provided he has a good nurse, as we could expect from a strict observance of the Weir Mitchell cure. The important factors which have already been mentioned above, and which have also been emphasized in the various publications of Burkart (who has undoubtedly had the largest experience in this field of any one in Germany), are the psychical effect on the patient and the latter's firm determination, or at least his consent, in favor of the proposed treatment. If both of these are present, we may dispense with isolation in a hospital, which above all has a psychical effect, provided the patient's family judiciously co-operate with the method. I have frequently and successfully carried out such cures at the patients' homes, and know that others have also done so.

In connection with this therapeutic measure I wish to call attention once more to the importance of systematic weighing in the nervous affections as well as in all lesions of the organs of absorption. Important criteria for judging the course of a disease and the success of our treatment may be obtained by the increase or loss shown by the scales; the latter (loss) must also frequently include a stationary condition of the weight according to the axiom, "Standstill is retrogression." The only precaution necessary is not to be deceived nor influenced by small and inconstant variations in the bodily

weight. After systematic weighing for months of *naked* persons who have been kept on a uniform diet and surroundings, I am convinced that differences of 1 to 1½ kilogramme [2⅕ to 3⅕ pounds], from one day to another, or in the course of a few days, may be considered normal occurrences. Even continuous considerable losses do not necessarily indicate a bad prognosis, at least as long as the correct treatment has not yet been discovered. At all events, it is true that all malignant organic structural changes are also accompanied by constant loss of weight, with possibly small transient fluctuations, and accordingly always have an unfavorable significance; but nervous dyspeptics, neurasthenics, patients with hæmorrhoids, and the like, may lose 15 to 20 kilogrammes [33 to 44 pounds] within a few months. The test of a proper and successful treatment consists in the gradual increase of the bodily weight which is sometimes manifested within a short time after the beginning of the new regimen, but at other times may not begin till after a period of continual loss which may even last three or four weeks. Therefore, the scales play an important part in all kinds of stomach-diseases, but especially in the neuroses, and ought always to be employed. Surely all should imitate the proposition made long ago by the late Benecke, that every one should keep a regular record of his weight. Prof. Thomas tried it practically on himself, with excellent results for regulating his diet.*

Finally, the treatment of the gastric neuroses should include the use of all those adjuvants which improve the general condition and the mind by the effect of a change of climate, the stimulating and quieting influence of the air of mountains and plains, sojourn at the sea-shore, the tonic springs like the alkaline waters of Franzensbad, Ems, and Neuenaar; even the salines, Wiesbaden and Kissingen; the mild chalybeate water of Elster, Franzensbad, Pyrmont, Rippoldsau, and the like; and, last but not least, the mud-baths. Probably these are nowhere better nor more comfortably prepared than at Franzensbad, where, as even Frerichs said, in the last publication which came from his pen, there is an abundant supply of material for their preparation,

* See Transactions of the Naturforscherversammlung zu Berlin, 1887.

which, having been carried on for years, is attended to with the utmost care.

Once more do I warn against the pernicious practice of ordering nervous patients to use the Glauber's salt waters, especially those of Carlsbad and Marienbad, because these waters are very slowly and imperfectly absorbed in these cases—"they lie heavily on the stomach," and exert a decidedly enfeebling effect; the latter is due to the fact that they involve still more the already altered metabolism, that they saturate the blood with neutral salts, which are improperly excreted, and that not alone do they not improve the nutrition of the nervous system, but actually injure it. At the end of every summer I regularly see numbers of such patients who have returned from these springs with a decided deterioration of their condition.

LECTURE XII.

THE CORRELATION OF THE DISEASES OF THE STOMACH TO THOSE OF OTHER ORGANS.—THE PRACTICAL VALUE OF THE MODERN CHEMICAL TESTS.

GENTLEMEN: The relations which exist between the disturbances of digestion and other diseases, as I need scarcely mention, are of the greatest importance. There is hardly any internal disorder in which gastro-intestinal digestion may not also be affected to a greater or less degree; or it may be associated with them by functional disturbances, the treatment of which is to be conducted upon the lines already laid down. However, our subject to-day is not the changes which accompany febrile and afebrile, localized and constitutional processes, but rather those cases of disease which depart from the ordinary course, in which the gastric symptoms are the earliest manifestations, or which, at least on superficial observation, seem to be the prominent features of pathological processes which are situated *outside of* the stomach. Here it is of the utmost importance to discover the real cause of the digestive disturbances, to distinguish the secondary features of the disease from the primary, and to recognize them as such.

The effect of diseases of other organs upon the stomach and their reciprocal action as manifested in structural changes in this organ have been carefully studied by W. Fenwick.* But as these investigations are concerned with the pathological-anatomical changes in the stomach rather than with the clinical features of these processes, I shall here simply state that Fenwick calls special attention to the relation between advanced atrophy of the gastric mucosa and perni-

* W. Fenwick. Ueber den Zusammenhang einiger krankhafter Zustände des Magens mit anderen Organerkrankungen. Virchow's Archiv, 1889, Bd. cxviii, S. 187.

cious anæmia, and also of carcinomatous tumors of other organs, especially the mammary gland and intestines; as, for example, the occurrence of severe anæmia after the excision of relatively insignificant tumors of the breast.* However, as I have already shown in Lecture VIII [page 334], Henry and Osler† and other writers have already called attention to this fact.

W. Fenwick also found more or less marked catarrh of the mucous membrane of the stomach in nearly all the diseases which were studied by him—i. e., diseases of the kidney, pulmonary phthisis, chronic bronchitis, emphysema, various valvular lesions of the heart; it was least marked in acute pneumonia and typhoid fever; and not at all in diseases of the brain (tumor, epilepsy, softening, apoplexy). He also states that Handfield Jones,‡ in a study of over 100 cases of "affections of the glands of the stomach," only once found disease of the brain. If, therefore, the gastric symptoms, and especially vomiting, which occur in diseases of the central nervous system, are manifestly reflex nervous symptoms, then the disturbances of the digestive tract which occur in other disorders must undoubtedly depend upon anatomical and functional changes. The most important of the latter will now occupy our attention.

The most prominent place in the consideration of this subject is occupied by **tuberculosis**, which indeed most frequently gives rise to errors. It is only too well known that the course of phthisis may be marked by dyspeptic symptoms which may vary from a simple loss of appetite to severe anorexia and vomiting, and may go hand in hand with the febrile movement. But, as Louis, Andral, and Bourdon pointed out long ago, there are many cases of tuberculosis in which the first symptom to attract attention is dyspepsia.

Hutchinson# has analyzed a large number of cases and calculated that in 33 per cent dyspeptic symptoms precede the onset of the tubercular manifestations. W. Fenwick found well-marked evidences of gastric catarrh in eleven out of fifteen cases of phthisis—

* Samuel Fenwick. Atrophy of the Stomach. London, 1880, p. 49.

† Henry and Osler. Atrophy of the Stomach with the Clinical Features of Progressive Pernicious Anæmia. American Journ. of Med. Sciences, April, 1886.

‡ Handfield Jones. Diseases of the Stomach.

Hutchinson. The Morbid States of the Stomach and Duodenum. London, 1878.

i. e., 73 per cent. Marfan* considers this figure too high, and quotes the well-known and universally accepted observation of Quenu that many patients disregard the period of short, dry cough which precedes the onset of expectoration, so that the beginning of the disease must be placed at an earlier period than is given by them. In 61 cases he claims to have found only five in which the gastric preceded the pulmonary symptoms. Yet the point at issue is not so much these objections to the patient's previous history as the fact that persons frequently consult us complaining only about their digestion, which they consider the cause of all their troubles; yet careful examination will either reveal the presence of a phthisical process, or will cause us to entertain suspicions of such a condition, the correctness of which is confirmed by the subsequent course of the malady.

As a rule, these patients are delicate and anæmic; they begin to complain of loss of appetite, oppression, and fullness after eating, and irregularity of the bowels; they suffer from regurgitation and a foul taste in the mouth; they feel feeble and languid. For a long time they are treated for chronic catarrhal gastritis; but both physician and patient wonder why all the apparently rational remedies are of no avail; then a careful examination is made, and chronic pulmonary disease is either discovered or at least strongly suspected. A true dullness is not present, yet the apices do not expand properly, or the whole of one side may expand somewhat tardily on inspiration; the respiratory murmur has a soft, moist, interrupted character; the movements of the entire thorax are not sufficiently deep; the manometer shows that inspiration and expiration are feeble; expiration is prolonged. Careful questioning will now reveal that the patient has "hacked" for a long time without paying any attention to it; that he was scrofulous as a child; that he perspired very easily, although there are no true night-sweats; and, finally, that there is a hereditary predisposition. If we can obtain some of the sputum—which, when the expectoration is scanty, the patient frequently disregards or swallows—we may often suc-

* B. Marfan. Troubles et lésions gastriques dans la phthisie poulmonaire. Paris, 1887.

ceed in finding a few tubercle bacilli, and thus at once corroborate our diagnosis. Under these circumstances a diseased condition of the stomach is at all events present, yet it is merely the manifestation of a venous hyperæmia and congestion, which in its turn is due to the disturbance of the pulmonary circulation.

It was, therefore, important to study the chemical processes of the stomach in pulmonary phthisis. Some incidental communications were made on this subject by Edinger, and also by myself; yet systematic examinations were first made by C. Rosenthal,* Klemperer,† Schetty,‡ O. Brieger,# Hildebrand,‖ and Immermann;^ their results, which agree tolerably well, are best expressed in the following propositions, formulated by Brieger:

"In severe cases of phthisis a normal condition was found in only 16 per cent of the cases, in the rest more or less marked insufficiency was found; in fact, in 9·6 per cent of all the cases there was a complete absence of all the normal products of secretion.

"In moderately severe cases the gastric juice was normal in only 33 per cent; in the remainder its strength varied, the disturbance being, as a rule, well marked; while in 6·6 per cent the normal secretory products were absolutely lacking.

"In the initial stages the cases of normal and disturbed secretion were about evenly divided."

Absorption and peristalsis seem to be impaired to a degree corresponding to the disturbance of the chemical functions.

It is self-evident that the above percentages give an approximate and not an absolute idea of the relative frequency of the conditions under discussion. A longer period of observation, a larger number of cases, etc., may easily change them: thus, it happened that Rosenthal's observations at the Augusta Hospital (this report is

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* C. Rosenthal. Ueber das Labferment. Berliner klin. Wochenschr., 1888, No. 45.

† Klemperer. Ueber die Dyspepsie der Phthisiker. Ibid., 1889, No. 11.

‡ Schetty, *loc. cit.*

O. Brieger. Ueber die Functionen des Magens bei Phthisis pulmonum. Deutsche med. Wochenschr., 1888, No. 14.

‖ H. Hildebrand. Ibid., 1889, No. 15.

^ Immermann. Verhandlungen des Congresses für innere Medicin. Wiesbaden, 1889.

merely preliminary) included only patients without free hydrochloric acid; Hildebrand's were those with continuous fever, which never had free hydrochloric acid; while Klemperer and Immermann encountered cases in which this acid was present, and in some of them it was even in excess (in the initial stages of phthisis).

In testing the motor functions Immermann found no marked changes in 53 out of 54 trials—i. e., the stomach was found empty six hours after taking Leube's test-meal; on the other hand, Klemperer used his oil method (page 57), and found a marked enfeeblement of the motility. Furthermore, Immermann states that he found free hydrochloric acid in 38 out of 44 trials, even where the high fever and cachexia of the terminal stages of phthisis were present; Brieger observed it only in 16 to 33 per cent. This discrepancy can be explained by the former having used Jaworski's test-breakfast (the whites of two hard-boiled eggs and 100 c. c. [f ℥ iij ℥ ij] of water), which is notoriously inadequate for this purpose.

After careful study, with reliable methods, Grusdew * and Bernstein † also come to the conclusion that "hydrochloric acid is either absent or reduced to very small quantities."

At all events, the occurrence of gastric disturbances depends on what stage of phthisis may be present. Thus, Hutchinson states that in 9 cases dyspepsia was found after the pulmonary symptoms had begun; in 10 it appeared at the same time, and in 33 it preceded them.

Although all these investigations give us important information, yet their value would have been greatly enhanced had the observers laid more stress on the comparison between the subjective complaints and the results of the objective examinations. It is beyond doubt that the so-called phthisical dyspepsia is not due to a tubercular affection of the gastric mucous membrane, but, as already stated, is only a complication of this disease due to disturbance of the circulation. But it is equally certain that a very large proportion of the successful results of the treatment in pulmonary phthisis depends on the nutrition of the patient and the possibility of maintaining it.

* [Grusdew. Wratsch, 1889, Nos. 15, 16. Centralblatt für klin. Med., 1890, S. 92.—Tr.]

† Iwan Bernstein. Die Dyspepsie der Phthisiker. Inaug. Dissert. Dorpat, 1889.

The French method of overfeeding (*sur-alimentation*)—the experiences of Dettweiler, Peiper, Rühle, Liebermeister, Leyden, and others—are the best proofs of this. Our therapeutic efforts will have a greater effect and will be more certain if we have ascertained the functional activity of the digestive organs by means of a chemical examination independently of any of the patient's subjective complaints. True, it is self-evident that the first object of treatment is the primary disease, with the improvement or cure of which the dyspeptic symptoms will disappear; yet we must not lose sight of the fact that the improvement of the functions of the stomach with the resulting better state of nutrition will react favorably upon the local process in the lungs.

Here it should be observed that the specific stomachics are unsuccessful, if not injurious, for they irritate the already congested mucous membrane, and thus increase the hyperæmia. It would be much more advisable to lessen the irritating effects of the food, as far as possible, by ordering a simple, easily digestible diet, or by giving in each individual case the drugs which may seem to be indicated by the results of the examination of the gastric functions, provided pronounced dyspeptic disturbance should render this necessary. A general rule for these remedies can not be given, as is at once evident after a careful consideration of the changeable factors here concerned. Thus, in a large number of examinations on one patient at the Augusta Hospital, Rosenthal could never find free hydrochloric acid during the summer, yet when he returned to the hospital in the winter it was present in abundance; Hildebrand observed the same thing during shorter periods. Only this much is certain, that the subjective complaints of the patient do not by any means always correspond to the results of the objective examination, and that therefore the former should be investigated before they are allowed to weigh against methods of treatment which (like the *alimentation forcé* of the French) aim to improve the general nutrition by giving larger quantities of food. Concerning the milk diet, we should remember that its power of combining with acids surely comes into play in the cases or stages of hyperacidity which have been mentioned above.

But, to return to the question under discussion, these cases of

pretubercular dyspepsia—if we may use this short but improper expression—may be readily recognized, provided sufficient care be exercised. The diagnosis is not so easy if the dyspeptic symptoms are due to a centrally located miliary tuberculosis with slight febrile movement. If this is associated with a moderate enlargement of the spleen, of recent or old origin, it may readily be mistaken for typhoid fever, especially the ambulant variety. I recently saw an example of this in a gentleman from St. Petersburg, who thought his stomach was at fault. He presented the group of symptoms just described: there was a moderate irregular febrile movement, with slight evening exacerbations, which was said to have existed for some time, since quinine, antipyrine, and hydrochloric acid had been prescribed for him. Inasmuch as he said that he had been suddenly taken ill some weeks previously after a journey in a fever district, and had nevertheless not gone to bed, but instead had attended to his business, I naturally thought of the last stage of a "walking typhoid fever" with an irregular febrile movement; all doubt was dispelled during about the fourth week, when the symptoms of acute miliary tuberculosis became more and more prominent. He died of undoubted pulmonary tuberculosis after having been a few weeks at Görbersdorf.

The changes in the digestive tract in **anæmia** and **chlorosis** are closely allied to the above. They undoubtedly play an important part which, up to the present time, has been very much neglected; hence, in the treatment of anæmia, efforts should first be made to improve the condition of the digestive organs, and then the composition of the blood. As has long been known, and as Hayem,* Gluczinsky,† Pick,‡ and others have shown by direct examination of the gastric juice and the functions of the stomach, a true insufficiency of the latter exists. But some writers, especially Hayem, go too far when they consider that the changes in the stomach and intestines are the primary cause. In my opinion, it is one-sided to

* Hayem. Des altérations du chimisme stomacal dans la chlorose. Bulletin médic., 1891, No. 87.

† Buzelygan und Gluczinsky, Ueber das Verhalten des Magensaftes bei den verschiedenen Formen der Anæmie und besonders der Chlorose. Internat. klin. Rundschau, 1891, No. 34.

‡ Pick. Therapie der Chlorose. Wiener med. Wochensch., 1891, No. 50.

claim that chlorosis can be cured by the relief of these disturbances; for it is by no means certain that these changes in the digestive tract are not secondary, and can only be relieved after the composition of the blood has been improved by appropriate treatment. The histories of many patients attest the truth of this.

The next group of diseases includes **the valvular affections of the heart.** Here, also, the nature of the lesion causes a venous congestion and the symptoms of a chronic catarrh of the stomach. Careful examination is required to reveal incompetency of the valves, enlargement of the heart, latent pericarditis, pericardial adhesions, or chronic myocarditis. In such cases cures can only be effected in the early stages; unfortunately, these therapeutic measures usually afford temporary and not permanent relief; yet sometimes, by using digitalis and other members of this group for a short time, we may succeed in completely removing the catarrhal manifestations, and thus secure a period of relative or absolute relief.

A priori, there can be scarcely any doubt, for the reasons above given, that the secretory activity of the stomach is lessened as soon as compensation is disturbed, not alone in true valvular lesions, but also in other processes which, directly or indirectly, cause functional disturbances of the cardiac muscle. Hüfler * thought that he had proved this, since, in ten cases of the above kinds, mostly valvular lesions, total absence of hydrochloric acid and almost negative digestion of albumen were found nine times, in spite of the fact that most of the patients were still in the clinical stage of complete compensation. In the single patient (moderate mitral insufficiency) in whom hydrochloric acid was present, he is inclined to assume "hyperacidity." But concerning this apparently exceptional case it may be stated that it is by no means certain that congestion of the gastric mucosa and its consequences always occur under these circumstances, for there may also be a compensation in the stomach. Therefore, the assumption of hyperacidity seems unnecessary to me in the explanation of this exception.

But it appears that insufficiency of the gastric secretion is not as

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* Hüfler. Ueber die Functionen des Magens bei Herzfehlern. Münch. med. Wochenschr., 1889, No. 33.

constant as Hüfler supposed; for, in twenty patients with heart disease, Adler and Stern * found that free hydrochloric acid was always present in sixteen, variable in two, and always absent in two cases. Naturally these writers are inclined to believe that this discrepancy is due to the difference in the methods employed, for Hüfler gave Leube's meal in the morning—i. e., a very unfavorable time—while Adler and Stern gave the test-breakfast. However, it is also probable that the degree of compensation is also of importance in this question, for the clinical picture alone does not enable us to judge it properly.

The **diseases of the kidney** also involve the stomach if the excretory products of the metabolism are retained in the organism early in the course of the affection; if excreted in the stomach and intestines, they will irritate these viscera. Such cases are by no means common; the vomiting and other symptoms of disturbances of gastric digestion occur long before the distinct signs of dropsy or other manifestations which would lead to the correct diagnosis; hence, these cases are thought to be independent lesions, whereas they are really only due to chronic uræmia. They may also occur without any disease of the renal parenchyma where there has been a long-standing retention of urine from obstruction of the urinary passages. Fenwick † assumes that the mucous membrane of the stomach can excrete certain poisons, including also urea; the result of this irritation is an acute catarrh of the gastric glands. Degenerative processes, for example, fatty degeneration of the glandular epithelium and amyloid of the mucosa, may also occur, as well as gastritis in the true sense of this term. Biernacki ‡ lays stress upon the retention of metabolic products which lessen the secretion of the gastric juice by means of nervous influences. He has actually demonstrated this in a number of cases of nephritis which were investigated for this purpose. Therefore, he agrees with Ewald # in recommending peptonized milk in these cases. Renal tumors, especially carcinoma of

* Adler and Stern. Ueber die Magenverdauung bei Herzfehlern. Berl. klin. Wochenschr., 1889, No. 49.

† Fenwick, *loc. cit.*

‡ Biernacki. Ueber das Verhalten des Magens bei Nierenentzündung. Berl. klin. Wochenschr., 1891, Nos. 25, 26.

Ewald. IX. Congress für innere Medicin zu Wien, 1890.

the kidney, may for a long time cause only disturbances of digestion, anorexia, vomiting, and emaciation; in fact, in a case reported by Colleville,* up to the patient's death these were the only symptoms. Finally, without suffering any changes in the [renal] secretory capacity, the kidneys may cause disturbances and pain in the stomach on account of their unusual site or mobility; these effects of floating kidneys, etc., have already been considered while discussing gastrectasis and gastralgia.

The liver stands in such close relationship to the stomach that serious functional disturbances of the one are without exception reflected on the other; this close connection, and the fact that so many of the noxious substances introduced from without act on both viscera at once—I will only mention alcohol—render it very difficult to say which is affected first. For example, in the very great majority of cases, cirrhosis of the liver is accompanied by chronic gastritis, yet, even if we observe that the symptoms of a doubtful hepatic cirrhosis have for a longer or shorter time preceded a chronic gastric catarrh, we are utterly unable to tell whether the two stand in a causal relation or are simply coincident. Nevertheless, we should never forget the fact that many cases of hepatic cirrhosis for a long time run their course as chronic gastritis, and that the same is true of cancer of the liver.

Although I have frequently called attention to the relations of the **diseases of the central nervous system** with those of the stomach, yet I must not neglect to take this subject up once more at this place. On account of its great importance, I shall only specially discuss the relation of the gastric disturbances to sclerosis of the posterior columns of the spinal cord (tabes). This includes not only the classical attacks of gastralgia and gastric crises [see page 403] which occur in cases well advanced and recognizable, but also vaguer sensations—slight boring and radiating pains, a permanent feeling of gnawing and burning in the stomach, or even more marked perceptions which occur among the prodromata, or as the first symptoms of locomotor ataxia, but which at the time in question have not yet acquired any typical characteristics. It is self-evi-

* Colleville. Progr. méd., 1883, No. 20.

dent that it is impossible to make an exact diagnosis under such circumstances, and that even if the gastralgia continue for years their true origin would not be recognized. Such a case has been described by Werner;* an induration was found at the pylorus in a patient who had been for a long time considered hysterical; gastro-enterostomy was performed for supposed stenosing cicatrix of an ulcer at the pylorus; but it proved to be simply a muscular hypertrophy. As the operation proved unsuccessful, the ovaries were subsequently removed (Hegar's method); nevertheless, the gastric symptoms, which were chiefly manifested as gastralgia, persisted; and it was only five years later that distinct symptoms of tabes appeared, the existence of which was confirmed at the autopsy. Unfortunately, the early symptoms of tabes do not readily permit a positive diagnosis; thus, for example, the absence of the patellar reflex occurs independently of this disease so frequently that the simple coincidence of this symptom and gastralgia in a suspicious case would not justify a diagnosis of locomotor ataxia.

Among the constitutional diseases **diabetes** gives rise to errors most frequently. For years many diabetics are considered to be suffering from some stomach trouble until the urine is examined, either accidentally or on account of the development of the specific symptoms of emaciation, pruritus, polyuria, ravenous appetite, dental caries, ocular disturbances, [thirst,] etc.

In well-developed cases of diabetes, as shown by Rosenstein† and Gans,‡ the gastric functions are very variable, and stand in no relation to the amount of sugar, acetone, and diacetic acid in the urine. Rosenstein concludes from his investigations that in some cases free hydrochloric acid may be absent; where this is temporary, it is to be referred to a gastric neurosis; but, when it is permanent, the cause is atrophy of the mucosa in consequence of interstitial inflammation.

The relations of **gout** to disturbances of digestion have been

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* G. Werner. Gastrische Krisen als Initialsymptom einer Tabes dorsalis. Inaug. Dissert. Berlin, 1889.

† Rosenstein. Ueber das Verhalten des Magensaftes und des Magens bei Diabetes mellitus. Berlin. klin. Wochenschr., 1890, No. 13.

‡ Edg. Gans. Ueber das Verhalten der Magenfunctionen beim Diabetes mellitus. IX. Congress für innere Medicin. Wien, 1890.

especially discussed in English medical literature. According to some writers, there is a specific gouty disorder of the stomach resulting from the uric-acid diathesis, or from contamination with the products of incomplete metabolism, or their insufficient excretion —i. e., disturbed retrograde metamorphosis. Thus, not long ago, Burney Yeo * claimed that one of the prominent manifestations of this condition was dyspepsia in all its forms. Other authors, like Brinton, Pavy, etc., do not recognize a specific gastric disorder, and may therefore be considered to take a view more closely allied to our own. The same is true of the **rheumatic diathesis,** which has played quite a prominent part in French literature. Although I have not met a single case of true gout with coincident gastric disturbances, yet I have seen numerous such examples in chronic articular rheumatism, in which they were so marked that the pains in the joints were comparatively insignificant.

Whether there is any close connection between these conditions I shall refrain from saying, just as I shall do in the similar relations of **affections of the skin** and the stomach, to which Pidoux † has paid particular attention. Finally, I consider that there is a much better established as well as a more practical connection between the digestive disturbances and the various forms of malaria (i. e., the manifest and especially the latent forms of intermittent fever) and typhoid fever, particularly its ambulant variety.

Malarial poisoning may be manifested as an intermittent cardialgia (Leube ‡) or in the form of the various neuroses of the stomach, which will be characterized by a certain regularity (Rosenthal, Glax #), and which, according to the latter observer, can be relieved only by quinine as long as the patient remains in the malarial district. Kisch ‖ in Marienbad, and Glax in Rohitsch [an alkaline saline spring in Steiermark, Austria], both observed that it was most striking that, after the use of the waters of these places, the

* Burney Yeo. On the Treatment of the Gouty Constitution. British Med. Journal, January 7 and 14, 1888.

† Pidoux. Rapport de l'herpétisme et des dyspepsies. Union méd., 1886, No. 1.

‡ Leube. Beiträge zur Diagnostik der Magenkrankheiten. Deutsch. Archiv für klin. Med., Bd. 33.

Glax. Ueber die Neurosen des Magens. Vienna, 1887, S. 206.

‖ *Loc. cit.*

neuroses first occurred in true intermitting attacks and then finally disappeared altogether. Formerly I not infrequently had the opportunity of treating such cases of marked intermittent dyspepsia. [These various manifestations are quite common in New York, and should always be borne in mind in obstinate cases. In the treatment, Warburg's tincture will be found to be especially useful.—Tr.]

Conclusion.—The Practical Value of the Modern Chemical Tests.—In the course of these lectures I have always brought forward the experiences which have been gained by the new methods of investigation, especially of the chemical functions of the diseased stomach, and I have thus been enabled to combine the old well-known nosological facts with the diagnostic and therapeutic results recently gained. The task still remains to mention what place is occupied by the chemical methods of investigation in the individual affections of the stomach, and how far they warrant drawing sound conclusions upon the nature of the disease under consideration. Do the stomach- and the test-tubes enable us to discover specific, characteristic functional disturbances which belong invariably and exclusively to an individual case, and thus establish the diagnosis like the presence of tubercle bacilli in the sputum and hyaline casts in the urine? Or, are they simply the signs of a more general significance which have nothing to do with a specific morbid process? You know that some recent authors have gone so far as to classify the diseases of the stomach into those with an increase, diminution, and absence of hydrochloric acid, and possibly some of you may have regretted that I "have not followed the fashion" and arranged the subject-matter from this standpoint. I have as remote an idea of doing this as I would have of writing a text-book on special pathology in which the diseases are classified according to the presence or absence of dropsy, jaundice, albuminuria, etc. On the contrary, if we wish to adhere to facts and avoid exaggerations, our present knowledge may be summed up in the following propositions:

There are two great groups of results in the chemical examinations of the gastric juice which differ from the normal: 1. The untimely occurrence of organic acids. 2. The changes in the gas-

tric juice itself (i. e., the secretion of hydrochloric acid, pepsin, and rennet), and the absorption and motility of the organ.

1. The **occurrence of organic acids**, especially lactic acid, during a stage of digestion in which they can not be demonstrated normally by the tests already known to you. This is always characteristic of definite pathological conditions, the manifestations of which are also perceived subjectively by the patient. These acids are due to abnormal processes of decomposition or fermentation, whose causes may be manifold but which are always combined with a morbid state, provided the latter expression be made to include not only an abnormal chemical result, but also more or less well-marked disturbances in the affected individual. This explains the significance of the demonstration of lactic and the fatty acids. The value of these tests is by no means diminished by the fact that lactic acid can be shown to persist throughout the entire course of normal digestion; for the methods employed are complicated and not adapted for general practice. Exactly the same relation exists in diabetes, since the diagnosis of this condition by the detection of sugar in the urine is by no means affected because traces of sugar may also be found in normal urine. Now, since these products of fermentation are always associated with a prolonged stay of the ingesta in the stomach, and usually with an absolute or relative lessening of the secretion of hydrochloric acid, a diagnosis may be ventured in this direction from a knowledge of these facts.

2. Much more complicated are the conditions concerning the significance of **changes in the gastric juice.** Since the secretion of pepsin and rennet goes hand in hand with that of hydrochloric acid—excepting trifling variations which have no practical meaning—what is said of the latter may serve as a statement for all.

In my opinion, increase or diminution in the amount of the hydrochloric-acid secretion is a sign which is related to the various types of disease only in so far that some tend to cause its increase, while others its diminution or even absence; but this depends entirely upon the anatomical or functional disturbances which accompany these morbid types. Naturally, these cause the changes in the production of hydrochloric acid; hence it is their extent in the course of the disease which will determine how much the secretion

of acid will be affected. At all events, we may say that one group will never cause an increased secretion of acid—i. e., all those forms in which an extensive organic destruction or change in the secreting parenchyma has taken place. So far as we know, there is no vicarious increase in the activity of the remaining glandular cells. This group, therefore, includes carcinoma, chronic gastritis and its sequelæ, atrophy of the mucous membrane, mucous degeneration of the gastric glands; possibly, also, certain chronic vascular lesions—as, e. g., amyloid degeneration of the blood-vessels [of the stomach].

It is possible, as some of my experiences seem to indicate, that further extensive examination will reveal that profound anæmia, tuberculosis, cardiac diseases, diabetes, and similar morbid processes may cause the disappearance of free hydrochloric acid. But, if we reverse this statement, and say that certain kinds of disease cause an increased secretion, we would be going too far.

An increased secretion is always functional, a sign of irritation. But, as is well known, every such overproduction may cause exactly the opposite condition; I refer not only to the result of exhaustion following overexcitation, but also to the condition of depression from the very beginning. Thus it may happen that we sometimes encounter an absence of hypersecretion in a condition which is usually accompanied by a strong stimulation of the secreting elements, as gastric ulcer. A neurosis may manifest itself at one time by an overproduction of acid during the period of digestion (hyperacidity); at another time by a continuous secretion (hypersecretion). Other cases also exist in which there is such a diminution in the secretion of hydrochloric acid that the amount is permanently reduced to a minimum. As I know of no such case having yet been published, the details of the following example of this condition may be interesting:

Mr. K., an actor, twenty-eight years old; slender figure. Previous history good; no organic diseases can be discovered. He was always in good health and lived quietly and regularly. In the winter of 1884–'85 he had to play a very exciting part several hundred times in succession at one of the local [Berlin] theatres. He felt exhausted and languid till in the following summer his condition became as follows, to use his own words:

"It seemed to me as if my entire abdomen was constricted with a cord,

so that suddenly I was attacked with a feeling of anxiety; there was also oppression which extended high up into the chest and caused a tormenting dyspnœa. I could not take a long, deep breath, on account of the feeling of undue fullness in the abdomen. This condition persisted even when I had eaten nothing—e. g., on awakening early in the morning. I can not complain of any real pains, yet I have never felt really well ever since. The pressure in the abdomen and the oppression following it continually reminded me that my health was shattered. Although I frequently had a good appetite and relished food, yet not alone after eating, but even during the meal, severe disturbances set in, combined with endless belching and eructation, and great fatigue ; in the beginning there was also vomiting, but after a few times this did not return. At times I was suddenly seized with a ravenous appetite, after the satiation of which the above attacks did not fail to appear.

"The family physician's remedies were all of no avail, and this condition persisted till the winter of 1886. Then the discovery that I had a tape-worm gave me hope that with its removal I would be cured. But, alas! even after that, the old state persisted, and, if anything, became worse. My arduous duties in the winter of 1886–'87 did not cause the trouble to be less marked. Since then every part of my body feels very tired and languid, and in spite of careful rest and forbearance this has persisted up to the present time. The pressure from the distended abdomen, oppression (frequently also stitches in the side), and dyspnœa still persist. In spite of this I still have an appetite, sometimes a very large one ; I usually relish food, but after meals, as a rule, though not always, the unpleasant symptoms make their appearance, and are more marked at some times than at others."

I have now [1889] treated this gentleman about three months, and during this time I have tested his gastric juice for hydrochloric acid nineteen times, at the most varied intervals after the test-breakfast, and also after a more abundant dinner. A small amount of free acid could be detected only three times. Propeptone was always present in relatively large quantities, but the peptone reaction was only faint, and the digestive power of the filtered gastric contents was negative, except in two tests, unless hydrochloric acid and pepsin were added. The rennet-action could be demonstrated in half of the tests, and that, too, in the absence of free hydrochloric acid, but at the same time lactic acid was present ; at other times the tests for lactic acid and peptone were positive, although free muriatic acid, pepsin, and rennet were all absent. Large quantities of mucus were never present in the wash-water except the first time, when the patient had evidently swallowed large quantities, which were due to the irritation of the tube. On the other hand, on two occasions I found small shreds which differed from those usually present in the wash-water, by sinking rapidly in the funnel. They consisted of the adherent epithelial cells of the gastric mucous membrane already described (see Fig. 26, p. 317). Although I consider this pathological, yet such abrasions continually occur in the mucosa of the stomach as well as in other mucous membranes, though they are usually not found, since the acid gastric juice digests them. Strychnine was first given in small doses ; then

later on his stomach was washed out and douched every second day with good results. In this case there was surely no mucous catarrh ; an atrophy of the mucosa was also absent, since this occurs only as the consequence of a long-standing catarrh, or at a much more advanced age. None of the symptoms indicate cancer ; what is, therefore, left but to assume that we are dealing with a neurosis ?

Addendum.—The subsequent course of the case proved the correctness of my diagnosis. The patient went to a well-known establishment for nervous diseases, and then spent a long time in Switzerland. On his return the gastric symptoms had completely disappeared, and in his own eccentric way he could not say too much in favor of his cure.

But he now frequently had attacks of melancholia. The following summer he went to the country near a large lake. One evening he left the house and never returned. His body was found in the rushes at the border of the lake ; he had evidently committed suicide by drowning.

The case was thus a neurosis which had at first attacked the vegetative functions, and finally had involved the mind.

A number of cases which were examined in 1887 by Dr. Wolff, of Gothenburg, and myself, at the *Frauensiechanstalt* of Berlin, to determine the condition of the gastric juice, may also be grouped in this category. To our great astonishment we found a permanent absence of free hydrochloric acid in a number of persons without the slightest stomach complaints. At my request, Dr. Sandberg, of Marstrand, examined these same cases again one year later, but in the majority of them he found no change ; in a few of them, however, hydrochloric acid was detected. A neurosis is out of the question, since there are no indications of such a condition ; but what remarkable and latent disorders can so profoundly affect the functions of the stomach ? We can not assume the existence of severe degenerative processes in the mucous membrane, since free hydrochloric acid could be occasionally detected in some of them ; furthermore, although I have been watching these cases for a number of years, I have seen no gastric symptoms which would necessarily be present in such a serious condition. After making similar observations Dr. Grundzach * has also come to the conclusion that " the mechanism of the stomach performs its functions properly, or is very slightly disturbed, in spite of the complete cessation of this secretion." Moreover, in the course of the experiments on the

* J. Grundzach. Ueber nicht carcinomatöse Fälle von gänzlich aufgehobener Absonderung der Magensäure resp. des Magensaftes. Berl. klin. Wochenschr., 1887, S. 543.

effects of Carlsbad water mentioned on page 358, I had the opportunity of examining for two months a young, robust female nurse, twenty-eight years old, with good digestion; I always obtained an unusually low degree of acidity, so that I should surely have referred to an anomaly of secretion any complaints which she might have made regarding her stomach.*

Finally, one should bear in mind the great differences observed in these investigations in the daily values of the acidity of one and the same person; these can vary as much as 27 c. c. of a deci-normal solution of caustic soda for 100 c. c. of gastric juice. This is due to the incompleteness and coarseness of our present methods, which surely give no information of a number of delicate changes in the chemistry of digestion.

Undoubtedly, the normal process of digestion is accompanied by so copious a secretion of hydrochloric acid that not alone are various combinations formed with the different foods present, but there is also a certain excess of free acid which seems to be indispensable for the completion of normal gastric digestion. But we must not forget, as I showed some time ago in the digestion of albumen,† that peptonization, even though it is slight, may take place without any free acid; that normally, as in menstruation, no free acid, or only a very small quantity, is secreted; and that the human organism manifestly possesses in no insignificant degree the capacity of compensating for an absence of hydrochloric acid, pepsin, and rennet by driving the chyme out of the stomach much sooner, and relegating it for digestion to the intestine.

After all this I think you will agree with me if, in general, I attribute no positive diagnostic value to the simple fact that the acidity is increased or diminished or apparently normal, provided this is referred to no other acids than free hydrochloric acid; and if I consider such results only as a supplementary, although very

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* [It would be well if these important facts were carefully weighed before making the diagnosis of atrophy of the stomach from the simple absence of hydrochloric acid, pepsin, and rennet. That they are disregarded is shown by the surprising number of such cases recently reported in the various medical journals without corresponding constitutional symptoms.—Tr.]

† C. A. Ewald. Ueber den "Coefficient de partage" und über das Vorkommen von Milchsäure und Leucin im Magen. Virchow's Archiv, Bd. 90, S. 349.

important, feature in completing and establishing the entire clinical picture. On the other hand, I do not wish to be misunderstood, and I therefore say emphatically that this statement is in no way intended to detract from the value of our examinations; on the contrary, they are indispensable to us, and in all cases where circumstances will not permit them we feel in doubt and "somewhat at sea."

At every step in the preceding discussions you will have observed the proof of the extent to which our knowledge has been extended and amplified by the new methods of investigation; but, on the other hand, in view of many recent events, I believe it is my duty to warn against a one-sided overestimation of their value. Only the most careful and thorough consideration and weighing of *all the symptoms* which can be obtained *with all the diagnostic resources* will enable us to recognize the existing disease. Not even the most careful chemical examination of the functions of the stomach will put within our grasp the divining-rod which will magically call forth the fountain of knowledge from the adamantine rocks of obscure symptoms! Even to-day the old saying is true that—

"Ubi ratio sine experimentis mendax,
Ita experientia sine ratione fallax."

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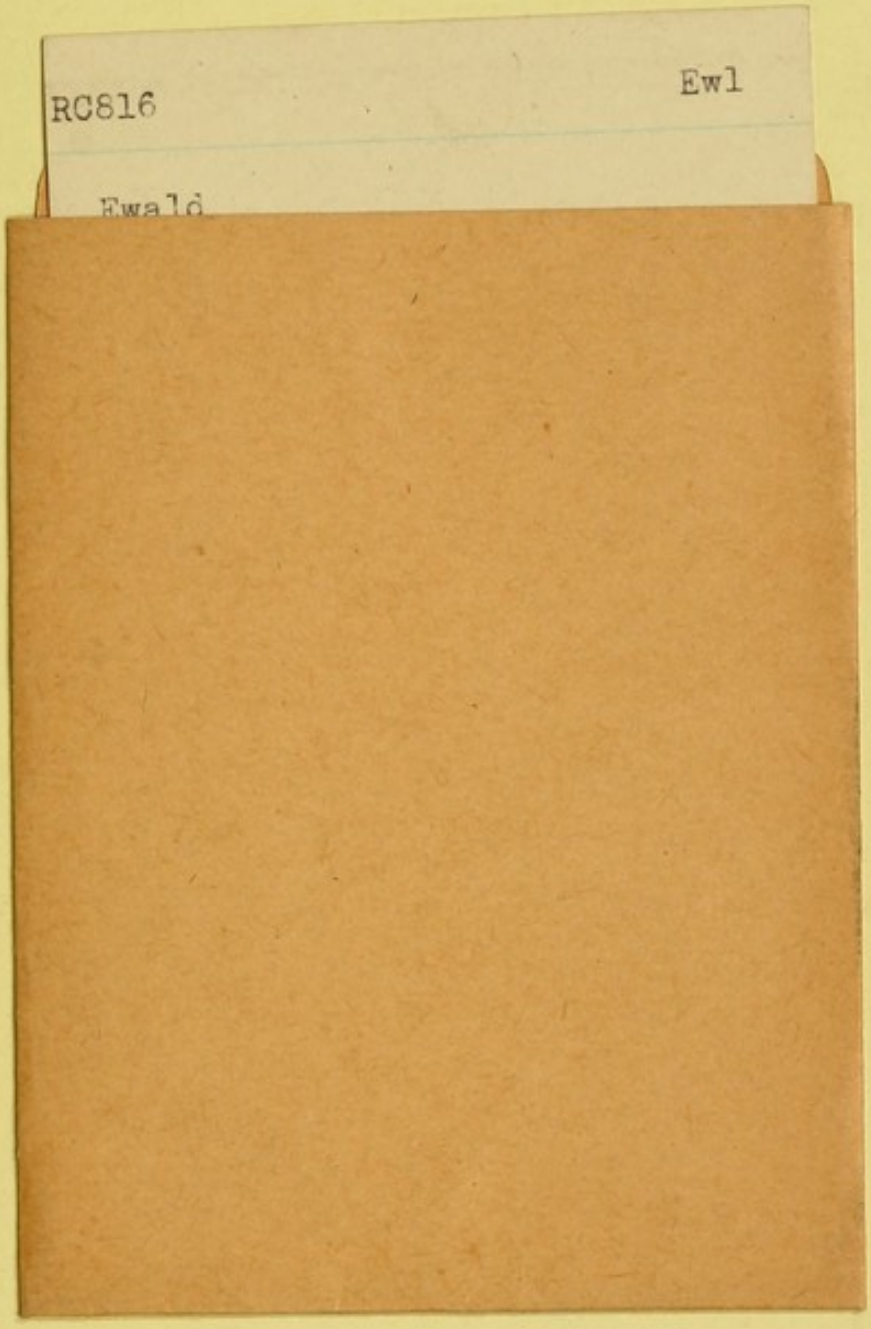
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