The diseases of the stomach / by Dr. C.A. Ewald.

Contributors

Ewald, C. A. 1845-1915.
Manges, Morris.
Augustus Long Health Sciences Library

Publication/Creation

New York : D. Appleton, 1900, ©1897.

Persistent URL

https://wellcomecollection.org/works/ggpek5kz

License and attribution

This material has been provided by This material has been provided by the Augustus C. Long Health Sciences Library at Columbia University and Columbia University Libraries/Information Services, through the Medical Heritage Library. The original may be consulted at the the Augustus C. Long Health Sciences Library at Columbia University and Columbia University. where the originals may be consulted.
This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.

Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
https://wellcomecollection.org

COLUMBIA LIBRARIES OFFSITE
HEALTH SCIENCES STANDARD
HX64131521
RC816 .Ew1 1900 The diseases of the
RECAP

RC 816 E W1
1900

Columbia University
in the City of New York

COLLEGE OF PHYSICIANS
AND SURGEONS



Reference Library
Given by
Dr. William Darrach.

Annex

THE DISEASES OF THE STOMACH

BY

DR. C. A. EWALD

EXTRAORDINARY PROFESSOR OF MEDICINE AT THE UNIVERSITY OF BERLIN
DIRECTOR OF THE AUGUSTA HOSPITAL, ETC.

TRANSLATED AND EDITED, WITH NUMEROUS ADDITIONS, FROM THE THIRD GERMAN EDITION

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

ASSISTANT VISITING PHYSICIAN TO MOUNT SINAI HOSPITAL
LECTURER ON GENERAL MEDICINE AT THE NEW YORK POLYCLINIC, ETC.

SECOND REVISED EDITION

NEW YORK
D. APPLETON AND COMPANY
1900

Copyright, 1892, 1897,
By D. APPLETON AND COMPANY.

PREFACE TO THE SECOND AMERICAN EDITION.

The great progress which has been made in our knowledge of the diseases of the stomach since the appearance of the first edition of this work in 1892 has rendered a new edition necessary. This is based upon the last (third) German edition, which was published in 1893, which, as may be learned from Prof. Ewald's preface, was a complete revision of the earlier work. With few exceptions I have followed the author's text and have everywhere presented his views, even where subsequent investigations have since modified them. The current opinions have been appended, attention being at the same time called to the change. In addition, much new matter has been incorporated into the text and footnotes. Although I have endeavored to render the revision as complete as possible, it is probable that I have failed to include everything which was worthy of notice. The literature on the diseases of the stomach is now so extensive that to have included everything would have been impossible.

New illustrations have been added, so that the present edition contains thirteen figures which are not in the German edition. A number of the other figures has also been redrawn.

All the new matter and illustrations have been inclosed in [ ].

An esteemed reviewer of the first edition has taken exception to the naming of special manufactures of drugs and food products. Although I agree entirely with him on this point, yet this was unavoidable; for it had only been done wherever Prof. Ewald has recommended specific preparations which were unknown to the

majority of American practitioners. I have referred to this detail because the same custom has also been followed in the present edition.

I am indebted to Dr. Albert Kohn for assistance in the preparation of the index.

M. Manges.

941 Madison Avenue, New York, *Aug. 1, 1896.*

PREFACE TO THE THIRD GERMAN EDITION.

The very favorable reception which has everywhere been accorded to this book * has spurred me on to special exertions in writing the present edition. I have therefore not only added considerable new matter, but have also entirely rewritten the work. This was necessary, because, on the one hand, the clarifying process which has been going on in this branch during the past years has enabled us to throw aside much superfluous matter, and, on the other hand, many new facts and observations have accumulated.

The arrangement of the chapters has been somewhat changed, so as to correspond more closely to the development and relation of the various diseases.

I have not refrained from adding many new personal observations and therapeutic experiences, which I trust may be found useful, although they are thus lost to the current literature, which represents only journal articles or abstracts of them.

So far as concerns the general pathological views on which the book is based, there has been little which has required alteration. Taken all in all, my original views have been substantiated by the work which has been done on gastric disorders during the past ten years. It has been demonstrated that, after all, in spite of the stomach tube, miracles can not be performed, and that the physician's general knowledge, perspicacity, and judgment are still of primary importance!

I would also direct attention to the progress made during the past few years in gastric surgery, which has now passed beyond the

* Within a short period three editions have appeared and translations published in England (New Sydenham Society), Spain, France, Italy, and the United States.

stage of a few isolated daring operations. In the discussion of the various diseases I have considered the indications for operative interference, and have presented the pros and cons so far as would be necessary to enable a physician to determine whether in a concrete case the aid of the surgeon might be required. The latter may then consider the indications from the surgical standpoint. To present these details, or to give the technique of the various operative procedures, has been unnecessary, for the operator, be he a surgeon or a general practitioner who is compelled to resort to the knife only occasionally, will not consult a work on clinical medicine for such details.

The present book, based upon lectures which were delivered before practitioners and which were subsequently enlarged, has been designed for general practitioners and students; every part has been considered from this standpoint and represents an extensive practical experience. I wish to contrast it with the recent small manuals on this subject, which are "adapted to the needs of the general practitioner." The thorough and earnest physician wishes to obtain the current general views on the subject, and to get advice in difficult cases. I trust that their needs will be fulfilled in the same increasing degree as the personal experience of the author has grown, and that, in spite of its revision, the book has not lost its original freshness.

C. A. Ewald.

Berlin, *April 15, 1893.*

CONTENTS.

PREFACE TO THE SECOND AMERICAN EDITION iii

PREFACE TO THE THIRD GERMAN EDITION v

CHAPTER PAGE

I.—METHODS OF EXAMINATION.—DETERMINATION OF THE ACIDITY AND ACIDS OF THE CONTENTS OF THE STOMACH 1

II.—METHODS OF EXAMINATION (*continued*).—DETERMINATION OF THE DIGESTION OF ALBUMEN AND STARCH.—ABSORPTION AND MOTILITY.—THE TECHNIQUE OF THE EXAMINATION OF THE STOMACH . . . 60

III.—STENOSES AND STRICTURES OF THE ŒSOPHAGUS AND OF THE CARDIA . 109

IV.—THE GENERAL RELATIONS OF THE STOMACH TO THE ORGANISM.—INFLAMMATION OF THE STOMACH.—GASTRITIS GLANDULARIS ACUTA, IDIOPATHICA ET SYMPATHICA.—GASTRITIS PHLEGMONOSA PURULENTA. GASTRITIS TOXICA 155

V.—CHRONIC GLANDULAR GASTRITIS.—CHRONIC CATARRH OF THE STOMACH . 192

VI.—[MECHANICAL] INSUFFICIENCY AND DILATATION OF THE STOMACH . . 254

VII.—CANCER OF THE STOMACH 313

VIII.—ULCER OF THE STOMACH.—ULCUS PEPTICUM SEU RODENS . . . 377

IX.—THE NEUROSES OF THE STOMACH.—THE PHYSIOLOGICAL RELATIONS OF THE STOMACH 448

X.—THE NEUROSES OF THE STOMACH 473

XI.—THE NEUROSES OF THE STOMACH (*continued*) 501

XII.—THE CORRELATION OF THE DISEASES OF THE STOMACH TO THOSE OF OTHER ORGANS.—THE PRACTICAL VALUE OF THE MODERN CHEMICAL TESTS 563

INDEX 583

LIST OF ILLUSTRATIONS.

PAGE

1. Lower end of Ewald's stomach tube 6
2. Boas's aspirator 13
3. Curling over of flexible tube in the stomach 16
4. Curve showing the course of the secretion of hydrochloric acid . . . 27
5. Curve showing the course of the secretion of hydrochloric acid as calculated according to different methods 58
6. [Microscopical appearance of stomach contents] 74
7. Vertical position of stomach and exposure of body of pancreas . . . 90
8. [Cast of cylindriform stomach in vertical position] 91
9. [Cast of normal stomach] 91
10. [Cast of dilated stomach in normal position] 91
11. [Cast of markedly dilated stomach tending to assume vertical position] . 91
12. Contraction of stomach in a case of cancer and stenosis of œsophagus . 94
13. [Einhorn's gastrodiaphane] 96
14. Gastrodiaphanic picture in normal stomach 97
15. Gastrodiaphanic picture in dilated stomach 97
16. Gastrodiaphanic picture in gastroptosis 97
17. Gastrodiaphanic picture in gastroptosis 97
18. Stand for holding stomach tube 99
19. [Auto-lavage of stomach] 100
20. [Hemmeter's recurrent stomach tube] 101
21. Deglutable stomach electrode 103
22. Cicatricial stenosis of œsophagus in child 115
23. Localized cancer of cardiac orifice of stomach 122
24. Carcinoma surrounding cardia, side view 130
25. Carcinoma surrounding cardia, front view 131
26. Carcinoma of œsophagus just above cardia 137
27. Section of piece of mucous membrane of stomach found in wash-water during lavage of empty stomach 196
28. Section of mucous membrane of atrophic stomach 198
29. Section of mucous membrane of stomach; marked atrophy . . . 201
30. Section of mucous membrane of stomach; cirrhotic atrophy . . . 202
31. Section of mucous membrane of stomach; total atrophic sclerosis . . 204
32. [Turck's gyromele] 237

PAGE

33. [Tumor caused by dilated stomach, front view, showing increased peristalsis] 256
34. [Tumor caused by dilated stomach, side view] 257
35. [Tumor caused by dilated stomach, front view] 258
36. Vascular, polypoid tumor on posterior wall of stomach 270
37. Cancer of pylorus with dilatation of stomach and duodenum . . . 272
38. Cross-section through mucous membrane of dilated stomach . . . 281
39. Total scirrhous cancer of stomach. 326
40. Stomach contents from a case of cancer of stomach 332
41. [Boas and Oppler's long bacilli found in cancer of stomach] . . . 333
42. Colloid cancer of lesser curvature of stomach 341
43. Cancerous cell-nest raised through stomach tube 353
44. Piece of mucous membrane resembling cancerous cell-nest 354
45. Perforating ulcer of stomach 379
46. Sketch of position of viscera in splanchnoptosis 541

DISEASES OF THE STOMACH.

CHAPTER I.

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

The past few years have witnessed such prodigious activity in the study of the diseases of the digestive tract, and more especially of the stomach, that we may now run some risks of being unable to correctly judge what has been accomplished, as we may be unable to separate the wheat from the chaff. Therefore, while pursuing a branch of study the progress of which is so active, it will unquestionably be very advantageous if we pause every now and then to take an account of stock, to appraise what is novel at its true worth, and to rearrange what is old; so that we may retain what has stood the test of experience and discard what has been shown to be mere hypothesis.

It affords me considerable satisfaction to point out that the views which I have repeatedly expressed on former occasions on the advances in our knowledge of gastric disorders have generally been correct. For, unlike many other investigators in this field, I have maintained that we ought not to be too one-sided in laying undue stress upon the newly acquired knowledge of the chemical processes of gastric digestion in health and disease, but that, *so far as possible, we should observe and make use of all the symptoms.* Thus, at the conclusion of the previous editions of this work I always urged that the correct diagnosis of a gastric disorder was possible only after the most careful and complete consideration of *all* the symptoms and the employment of *all* the diagnostic resources. This opinion, which is really self-evident, has been strengthened by my daily increasing practical experience.

As always occurs under similar circumstances, our diagnostic

armamentarium has been strengthened by becoming less complicated. This is especially true of the chemical procedures. Hence many things which were formerly discussed in minute details may now be discarded, or dismissed in a few words. On the other hand, I propose to lay more stress than formerly upon the so-called physical methods of examination and upon the fundamental principles of dietetics.

Before entering into the discussion of my theme, I may be permitted 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 state that not too much stress should be laid upon these procedures as belonging to a specialty. Throughout this work I will be able to show 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 does 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 special-

ist for stomach diseases. In the course of this book it will be seen 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.

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 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.

First of all I shall briefly consider the chemical processes of digestion, since it is obvious that the pathological deviations from the normal can only be recognized and properly treated after the normal conditions have been thoroughly understood. 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 how to obtain the contents of the stomach at any time in an easy and rapid way, which is also safe and convenient 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.

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

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

the crude manipulations of Fabricius ab Aquapendente and Rumsaeus (1659), who invented 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 if they had taken too much, or on the following morning, if they were distressed with the thick phlegm in the throat, after having snored out their intoxication."† In the latter half of the previous century John Hunter introduced catheters 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 meeting of naturalists at Rostock, in 1871, Leube

---

interesting and very complete history of the stomach tube has recently been published by J. C. Hemmeter. New York Medical Journal, December 28, 1895, p. 819.—Ed.]

* [Turck's gyromele is a modern device embodying this idea.—Ed.]

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

‡ 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.

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 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 is now quite universal to employ only soft, vulcanized rubber tubes like Nélaton's urethral catheters. 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 instruments whose solidity 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

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

† 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.—Ed.]

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 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 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. Furthermore, the tubes can

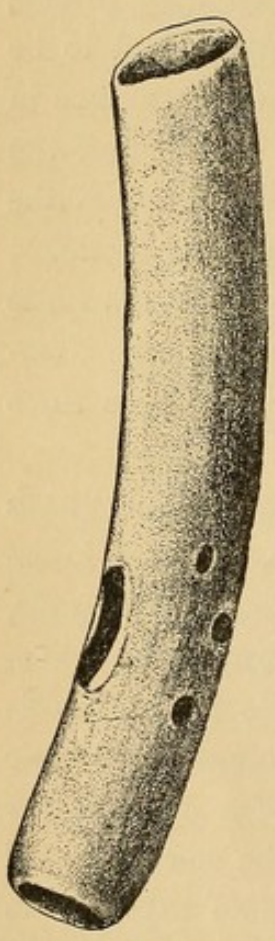


Fig. 1.

* [It is surprising how often the expression, stomach pump, is used by writers where the soft tube is referred to. A very striking example of this fault is afforded by the recently published work of Sidney Martin. (The Diseases of the Stomach, London, 1895). Here the word stomach pump is continually used; only rarely do we encounter the terms stomach tube or siphon, soft tube, etc. This is greatly to be regretted, as such carelessness of expression may tend to keep up the popular dread against the use of all gastric instruments which is now happily disappearing.—Ed.]

be very easily cleansed after having been used. These tubes are everywhere known as Ewald's stomach tubes.*

Tubes made of braided silk varnished over have also been employed; 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. [Such tubes are very delicate, and can be used only a few times before they are ruined].

[Recurrent stomach tubes have been devised by Hemmeter† and others for lavage; the caliber of the outlet tube is usually too small to permit their use for diagnostic purposes.]

It is of the utmost importance that all tubes be kept scrupulously clean, nor should they be used indiscriminately. I cleanse them carefully with hot water after every introduction, and have them washed with it from time to time. They are kept in a large, flat, covered glass dish—like the large culture dishes which bacteriologists use—which contains a solution of borax. This is superior to carbolic acid, thymol, etc., since it imparts no bad taste to the tubes. Tubes which have been used on patients with or suspected of having cancer ought to be specially marked. This can readily be done by branding them with a hot needle. Patients who can afford it, and who require prolonged treatment, may provide their own instruments.‡

---

* Although I had already published an exactly similar description of these tubes in the first edition of this book in 1888, yet Rosenheim, of Berlin, in the Therapeutische Monatshefte, August, 1892, has described, in almost the same words as above, what he calls his own important modification of the "ordinary tubes" for douching the stomach. The only difference is that he has substituted an additional number of smaller openings for the large lateral fenestrum. No mention is made, however, of my tubes. If Rosenheim really intended to construct the best possible sprinkling douche, he ought also to have closed the lower opening, which he undoubtedly refrained from doing for the same reasons as I had. Many years ago I discarded a French tube which had only small lateral openings; and since I have successfully douched the stomach for a long time before Rosenheim, I consider his modification as entirely superfluous for this purpose.

† [Hemmeter. N. Y. Med. Jour., December 28, 1895.—Ed.]

‡ [A very convenient sterilizing apparatus for stomach tubes has been devised by Kutner. An illustration of it may be found in Boas' Magenkrankheiten, 3te Auflage, Bd. i, p. 94, or Therapeut. Monatshefte, 1894, p. 397. I have found that keeping stomach tubes in the solutions recommended by Ewald roughens them after a time, and hence I prefer to keep them dry.—Ed.]

Dangers of Stomach Tube.—It is self-evident that the softer the instrument which is introduced into the stomach and the more rounded the edges of the openings are, the less will be the danger of injuring the mucous membrane. This occurs more easily, and has actually occurred, when rigid instruments and the stomach pump were employed. The tearing off of small pieces of mucous membrane has frequently been reported, as, for example, by Wiesner,* Von Ziemssen,† Leube,‡ Schliep,# and others. Crämer‖ has reported a case where this occurred in a simple lavage of the stomach with the soft tube. This writer seems to be unaware of the fact that Boas△ has carefully described the exfoliation of the mucous membrane which occurs in chronic gastritis, and has employed the microscopic examination of these particles for diagnostic purposes.◊ As I shall show later on, the finding of these bits of exfoliated mucous membrane is by no means infrequent. They are usually imbedded in blood-streaked mucus. No serious consequences, such as bleeding or gastric ulcers, have ever resulted from them. This is probably due to the prompt contraction of the gastric walls, which closes any open vessels and approximates the borders of the damaged area.

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 until quite recently against the internal exploration of the stomach in certain conditions, such as

---

* Wiesner. Ueber der Behandlung der Ectasie mittelst der Magenpumpe. Berliner klin. Wochenschrift, 1870, No. 1.

† Von Ziemssen. Zur Technik des Localbehandlung des Magens. Deutsch. Archiv für klin. Med., Bd. x, p. 66.

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

Schliep. On the Stomach Pump in the Treatment of Chronic Gastric Catarrh. Lancet, December 14, 1872.

‖ Crämer. Die Ablösung der Magenschleimhaut durch die Sondirung und ihre Folgen. Münch. med. Wochenschr., 1891. Crämer erroneously states that Leube is the only author who is quoted on this subject in the newer text-books of Ewald and Rosenheim. All four of the above names were mentioned in the first edition of this work.

△ Boas. Magenkrankheiten, 3te Auflage, Bd. i., p. 225.

◊ [An elaborate paper on this subject has recently been published by Cohnheim, Die Bedeutung kleiner Schleimhautstückchen für die Diagnostik der Magenkrankheiten. Boas' Archiv für Verdauungskrankheiten, Bd. i, p. 274.—Ed.]

cancer and ulcer, where bleeding may readily occur. Regurgitation of food is a very unpleasant complication, as it may even lead to suffocation, aspiration-pneumonia, etc.* This may be guarded against by the local or internal use of cocaine in very nervous patients. The choking sensation is much less marked after the test breakfast (*vide infra*), since its intensity is manifestly regulated by the amount of the ingesta, and the masses raised are smaller and much 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. In most cases, however, the cause is not any irritation of the gastric mucosa, but hyperæsthesia of the pharynx, which gives rise to retching and vomiting, and which may readily be lessened by the local use of cocaine. Finally, when the tube is removed it should be withdrawn as rapidly as possible. If the tube is pinched between the thumb and index finger of the right hand nothing can escape during its withdrawal. In this way we may prevent any aspiration of the stomach contents into the bronchi, and at the same time the physician soils neither himself nor the patient. [Another important reason for pinching the tube during its withdrawal is that we thus obtained an additional few cubic centimetres of stomach contents. Indeed, it not infrequently happens that when we have been unable to siphon any stomach contents, enough may be obtained in this way to make a superficial analysis.]

I personally 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."

Another advantage of the flexible tubes is that, in introducing them, 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.

---

* Emminghaus. Einiges über Diagnostik und Therapie mit der Schlundsonde. Deutsch. Archiv für klin. Med., Bd. ii, p. 304.

† Leube, *loc. cit.*, p. 40.

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 [who is seated in a chair with his head thrown back a little] 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 thousand patients examined by me, I can scarcely recall a case in which I was unable to introduce the tube, provided, of course, that I had the patient's co-operation. 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. I have hardly ever found this necessary, and furthermore avoid it wherever it is possible, on account of some patients' idiosyncrasy toward the drug. 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.

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 lowest point of the greater curvature 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 stopcock, 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 larynx is greatly exaggerated, and the detailed accounts given about it in

---

* These tubes can be obtained at Miersch, Berlin W., Friedrichstrasse 66. [At my request the Davidson Rubber Company have made Ewald stomach tubes with a graduated scale on the tube up to 25 inches; a special mark is made at the 16th inch to show when the tube enters the cardia. These tubes may be had of J. Campbell, 228 Lexington Avenue, N. Y.—Ed.]

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 epiglottis, only the greatest clumsiness will cause the tube to enter the larynx instead of the œsophagus. But even if it should occur, 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 instrument into the œsophagus 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.

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! They all require such an array of bottles and glass tubes as from the very beginning to preclude their practical use.

Aspiration and **expression** are the methods which we now generally employ for obtaining stomach contents. For the purpose of aspiration we attach the upper end of the tube by means of a connecting tube of hard rubber or glass to a pear-shaped rubber bag (like a Politzer bag), which has an upper opening about the size of the little finger. The bag is attached after it has been squeezed together; in expanding, it aspirates the stomach contents so long as subjected to the ordinary atmospheric pressure. This 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 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 pinchcock (Fig. 2). A vacuum is obtained by compress-

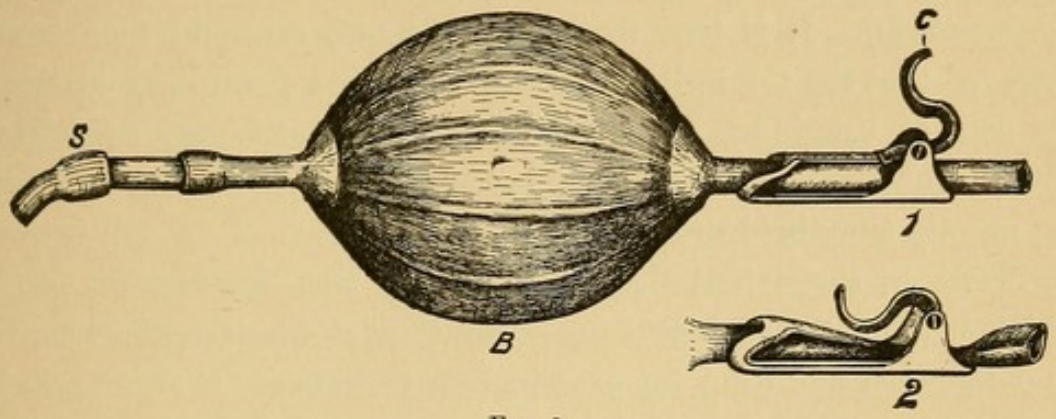


Fig. 2.

ing 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 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. I have not found this instrument as convenient as the Politzer bag, since both hands are needed to open the pinchcock. Both methods are, however, good. [My own experience is, that Boas' bulb is far superior to the Politzer bag. Its manipulation is exceedingly simple and easy; with it we may often be able to start the siphonage where expression fails; and, finally, it is more easily cleaned than the bag can be. Aspiration may also be done by attaching the stomach tube to the vacuum bottle of Potain's aspirating apparatus, but the caution must be taken of using a low vacuum.]

The Expression Method.—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

* I. Boas. Allgemeine Diagnostik und Therapie der Magenkrankheiten. 3te Auflage, Bd. i, p. 128.

sufficiently fluid, so that the lumen of the tube is not occluded.* It is frequently erroneously stated that the physician must press with his hand upon the patient's abdomen. Since then the method has been tried 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.

Martius † states that "Ewald's method was the first one with which, without the slightest danger, sufficient stomach contents could be obtained at any time for examination from every stomach case." In fact, the introduction of the tube for diagnostic purposes is being employed more and more by physicians, and is so well known to the laity, that not infrequently patients in whom the chemical examination of the stomach contents is unnecessary reproachfully ask "whether they will not be pumped out." Indeed, with but very few exceptions I should reproach myself if in any doubtful case I had neglected to employ this method, which, when properly applied, is so absolutely free from danger.

Epstein ‡ has successfully applied the treatment with the stomach tube 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 # and others have used this method for the systematic study of the functions of the stomach in suckling infants, where its employment is so very simple.

By proper use, as above mentioned, I would have understood that *whenever the possibility exists that the use of the abdominal pressure may produce hæmorrhage from, or even tearing of, the gastric or intestinal mucosa*, the tube must not be employed; or, if

---

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

† Martius und Lüttke. Die Magensäure des Menschen, 1892, p. 4.

‡ 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.

it is, *only aspiration after preliminary cocainization* should be resorted to. The diseases in which these rules hold good are ulcerative processes in the stomach, severe organic diseases of the heart, aortic aneurisms, hæmorrhagic diatheses, etc., concerning which I shall speak in more detail later on. Nevertheless here, as in every procedure which is not absolutely a matter of indifference, unfortunate accidents may arise for which neither the physician nor the method ought to be held responsible. Such a case I reported to the Berlin Medical Society ; * a number of others have been published by W. S. Fenwick.† Although such occurrences, which, after all, concern only decrepit patients whose lives hang in the balance, should warn us to be careful at all times, yet they should not make us discard the method, any more than anæsthetics ought to be abandoned because of the occasional deaths under narcosis.

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

---

* Ewald. Ein Fall von Aneurysma Dissecans. Berl. klin. Wochenschr., 1890, p. 694. 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. Slight tenderness on pressure in the epigastrium. Heart and lungs normal. After introducing the tube very easily, the patient was asked to bear down ; at that instant 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 the introduction of the tube had anything to do with the rupture of the aneurism. If we consider all the factors of the act of bearing down, it would appear that it would not produce such a result; however, it would not cause an increase of the blood pressure in the aorta above the semilunar valves, but would rather exert pressure on the exterior of the vessel. At all events the death occurred while the tube was used.

† W. Soltau Fenwick. Some of the Dangers of Washing Out the Stomach; Practitioner, April, 1892. Among other cases, Fenwick also speaks of several fatal cases of tetany which occurred immediately after lavage. Had the stagnating stomach contents been thoroughly removed at an early period, the tetany would have been prevented. Consequently these cases speak more in favor of lavage than against it.

of the mucous membrane, or they may be plugged—both of these occur 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.

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; this is generally due to a hyperkinesis of the muscular fibers, a condition which will be referred to in the discussion of the gastric neuroses.

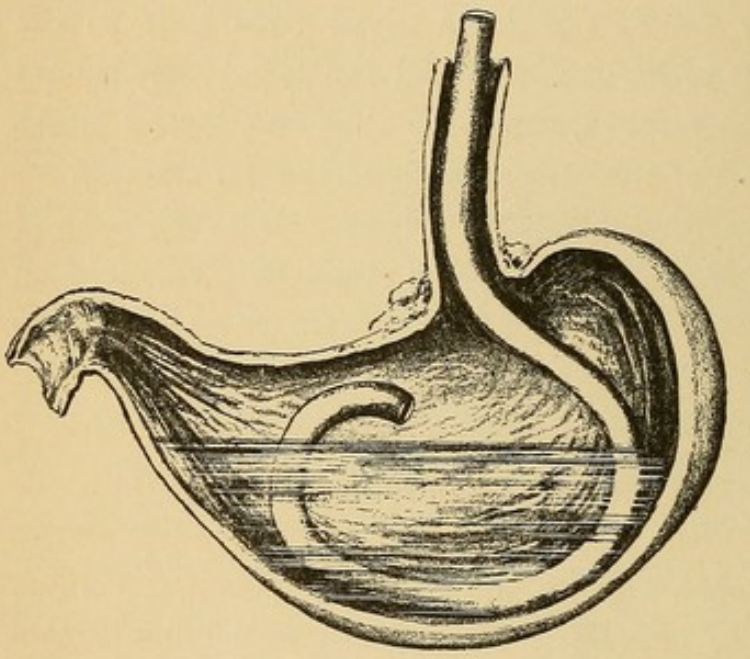


Fig. 3.

Although this method of expression, as I have called it, can usually be carried out very readily after one has acquired a little experience, 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.

I may dismiss with mere mention the various procedures which have been proposed by Spallanzani, Edinger, Späth, Einhorn, and Kornfeld. Small quantities of stomach contents are obtained by having the patients swallow small balls of compressed elder pith,

sponges, or silver buckets which are attached to a string. They have no practical value, because the largest quantities of stomach contents which can be obtained with them are too small for a complete analysis; while, on the other hand, the inconvenience which they cause the patient is scarcely less than that due to the introduction of the tube.

Günzburg* and Sahli† have proposed methods by means of which conclusions as to the completeness of gastric digestion are drawn *in an indirect way* without withdrawing any stomach contents. Some substance, like potassic iodide, which is readily absorbed, is introduced into the stomach during digestion after having been inclosed in a special way in a fibrin capsule. The length of time which elapses until the appearance in the saliva of the potassic iodide which has been absorbed after the digestion of the fibrin capsule is used as a standard for determining the good or bad condition of the digestion *in toto*. It must be apparent that this method can never give any exact information as to the cause of any particular stage of digestion, nor the relation of the different phases; it does not even give any absolute indications concerning digestion in the stomach, as there are no criteria whether the capsule was digested in the stomach or intestines. I shall therefore refrain from giving exact details as to the somewhat complicated methods of preparation of these capsules, which even Sahli himself considers only as complementary to the exact methods of analysis. The employment of potassic iodide capsules for testing the absorptive powers of the stomach will be considered later on.‡

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

---

* Günzburg. Ein Ersatz der diagnostischen Magenausheberung. Deutsche med. Wochenschr., 1889, No. 41.

† Sahli. Ueber eine neue Untersuchungsmethode der Verdauungsorgane und einige Resultate derselben. Schweizer Corresp.-Blät., 1891, No. 3.

‡ [Other indirect methods of studying the changes in the gastric juice have been suggested. These are based upon changes in the acidity of the urine and the amount of indican. See page 163. A good *résumé* of these indirect methods has been given by Boardman Reed, Medical News, January 18, 1896, p. 57.—Ed.]

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 Tiedemann 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 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,

---

* 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.

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 ℥ j ℈] 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. In the cases examined by Kinnicutt,* 2 c. c. of stomach contents containing free hydrochloric acid was found in one case, 10 c. c. in another. Leo,† who found hydrochloric acid "almost without exception" in the stomachs of suckling infants, considers it a residue of the previous process of digestion, while Rosenheim‡ and Kinnicutt agree perfectly with my results 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

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

† Leo, *loc. cit.*

‡ T. Rosenheim. Ueber die Säuren des gesunden und kranken Magens bei Einführung von Kohlenhydraten. Virchow's Archiv, 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 $\frac{1}{1000}$.—Ed.]

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. It is self-evident that patients who are suffering from hypersecretion of the gastric juice, whose stomachs, therefore, are never empty, but always contain a certain amount of secretion, ought not to be employed for such experiments; on the other hand, it is wrong to introduce distilled water into the stomach and then aspirate it, because this produces a more or less energetic secretion of hydrochloric acid. 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.

[There has recently been considerable discussion as to the contents of the stomach while fasting, for the reason that the answer to this question is of importance in the condition known as continuous hypersecretion (see Chapter XI). Probably the best results obtained are those of Martius,* who made experiments on 16 healthy soldiers; while fasting, the tube was introduced and the contents of the stomach were aspirated. In order to eliminate any irritation of the gastric mucosa from the tube the manipulations were performed as rapidly as possible. On an average only 5 seconds were needed to insert the tube and 7 to 8 seconds for aspiration. In all cases Martius obtained stomach contents which contained hydrochloric acid; the quantity of the stomach contents varied from 3 to 30 c. c. (ʒ $\frac{1}{10}$–j); the acidity from 10 to 40 (0·4 to 1·5 per mille HCl). Schüle† experimented on 9 subjects, 6 of whom had previously been trained. In 31 out of 34 trials the stomach contained 2 to 23 c. c. (ʒ ½–vj) of acid fluid. Free hydro-

* [Martius. Ueber den Inhalt des gesunden nüchternen Magens. Deutsch. med. Wochenschr., Aug. 9, 1894, p. 628.—Ed.]

† [Schüle. Berl. klin. Wochenschr., 1895, No. 52.—Ed.]

chloric acid was only present 7 times; mucus, bile, peptones, and pepsin were occasionally found. The cause of the presence of this fluid must be the saliva and pharyngeal secretions which are swallowed during sleep. He concludes that the presence of hyperacid fluid in amounts over 50 c. c. is pathological.]

Test Meals.—For testing the functions of the stomach we give the patients various meals, some of which are simple, others are larger; but, so far as possible, the various meals should be uniformly prepared. The *test breakfast* (*Probefrühstück*) of Ewald and Boas consists of an ordinary dry roll and a definite quantity—$\frac{1}{8}$ litre [f ℥ x]—of fluid, either simply warm water or 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. 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. The test breakfast can be taken by most patients with gastric disorders, many of whom would be unable to eat a larger meal. 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 advantages have caused the method to be very popu-

lar. On the other hand, it must not be forgotten that such a moderate meal makes 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 also to the meal of milk and bread which has been proposed by Klemperer,* and 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 test 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, Germain Sée). The test dinner consists of an ordinary [German] midday meal of bouillon, barley or flour soup, a moderate piece of beefsteak, 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. With the test breakfast digestion is at its height within one hour after eating, and under normal conditions can be evacuated in a liquid condition; but in the large meals either no digestion at all, or very little, will have taken place in that time. One must wait at least two to three, and usually four hours, according to the state of the food, or at times upon the condition of the organ, till all the ingredients are digested sufficiently to pass through the tube; 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 ob-

* Klemperer. Ueber die Anwendung der Milch zur Diagnostik der Magenkrankheiten. Charité-Annalen, Bd. xiv.

† [The normal amount withdrawn one hour after a test breakfast is between 20 to 60 c. c. [℥ ⅔–ij]; quantities much greater than this are pathological.—Ed.]

tained. The longer period of waiting is of less importance, since, after all, we are looking for comparative results, provided the larger meals would yield more information about the nature and course of digestion in pathological conditions; but this is not the case. Einhorn,* Jürgensen,† Loewenthal,‡ and many other writers, have shown that in both methods the variations in the results were only differences in the absolute values, but neither had any special pathognostic advantages. It is undoubtedly true that inspection of the stomach contents obtained after a mixed diet will at a glance show the degree of digestion of the starches and albuminoids, and especially of the meat; yet the digestive capacity may also be determined by the changes in the roll, and whenever it is necessary we can always supplement it with the test dinner. A gastric juice which digests a roll completely will also digest meat; while, on the other hand, any increase in the secretion (hypersecretion and hyperchlorhydria) may be detected with the simple digestive stimuli as well as with the more complicated one. The gastric juice which can not digest a roll will be still more insufficient when mixed diet or meat is taken.

On the other hand, the test breakfast possesses the great advantage that we can at once detect old food remnants, such as fragments of meat, vegetables, etc., which have remained in the stomach. Thus there are many *pros* and *cons* for both methods, and while it must be admitted that the test breakfast is practically the most useful, yet we can succeed with any meal which is known to stimulate the normal stomach sufficiently. However, the advantages of the test breakfast are so great that I usually confine myself to it. It is especially convenient where large numbers of examinations must be made, and hardly anything else could be used in consultation practice, where the patient's general condition is determined on one day, and early on the following morning he may come for the ex-

---

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

† Chr. Jürgensen. Probemittagmahlzeit oder Probefrühstück? Berl. klin. Wochenschrift, 1889, No. 20.

‡ M. Loewenthal. Beiträge zur Diagnostik und Therapie der Magenkrankheiten. Inaug. Dissertation, Berlin, 1892.

amination of the stomach, and thus the inconveniences of the procedure are reduced to a minimum.*

Examination of Stomach Contents.—The filtrate of the stomach contents which is obtained from the test breakfast when digestion is normal, is a clear watery or light to brownish-yellow fluid, which may readily be used for all the various chemical procedures. Upon the filter is left a mushy mass consisting of fine particles of the digested roll, and scarcely any mucus; it should not contain any admixtures, such as old food fragments or blood. At times, when bile has regurgitated into the stomach, the chyme may assume a light-greenish color on standing. If the filtrate contains either the normal or an excessive amount of hydrochloric acid, it will remain as clear as water for days, and during the first few days will scarcely undergo any change in its acidity; but when the amount of hydrochloric acid is subnormal it soon becomes turbid and moldy.

Under ordinary conditions secretion ceases as soon as the chyme has passed into the intestines. The evacuation of the stomach may at times be delayed, and hence the period of secretion may be prolonged. This condition, however, must be differentiated from that of the continuous secretion of gastric juice, since, during the latter, secretion goes on even when the stomach is empty. Various names have been applied to this condition: *gastrosuccorrhœa* (*Magensaftfluss*) by Reichmann, *hypersecretio acida continua* by Jaworski, acute and chronic continuous secretion of gastric juice by Riegel, while I, for the sake of brevity, simply called it *parasecretion* [see Chapter XI]. This classification is thus based upon the time, and not the quantity, of the secretion. Hence *secretion* must not be confounded with *acidity*; the latter may be normal, increased (superacidity), diminished (subacidity), or absent (anacidity). Furthermore, the acidity must be distinguished from the *percentage* of *hydrochloric acid*, which, as we shall see later on, may vary from an excess (*hyperchlorhydria*) to an absence of hydrochloric acid (*achlorhydria*).

Determination of Acidity.—The first thing which must be deter-

* [It is not advisable to depend upon the results of one examination; to be at all certain, at least three test meals should be given at different times.—Ed.]

mined in normal stomach contents which have been removed at the height of digestion is the *acid reaction*; this is due for the most part to the secreted HCl, the balance to other factors, the most important of which are the acid salts which are found in the stomach contents. At this time the acidity is highest; from the beginning of digestion it gradually increases up to this point, and then gradually diminishes. The secretion of HCl begins at the moment when the glandular cells are stimulated to activity by the ingested food; it at once combines with the bases which may be present, and forms inorganic and organic salts. These are neutral salts (chlorides), HCl-albuminates; later on HCl-albumoses and peptones also are formed. Although the combinations of HCl and albuminoids have an acid reaction—i. e., redden litmus—yet the HCl present in them has been deprived of its character of a free acid, and hence the tests for free HCl (which will be described later on) are negative. These HCl combinations, however, are not very stable, since even saturation with calcic carbonate at ordinary temperature will decompose them, and naturally they are destroyed by combustion. We may therefore correctly designate this portion *the loosely combined HCl.*

According to the quantity and quality of its food, these bases which combine with HCl are saturated sooner or later, and thus, since the activity of the glands still continues, *free HCl** appears in the stomach, the quantity of which increases until it reaches its maximum at the height of digestion, and then diminishes; but, as far as our present knowledge will allow us to judge, it persists and can always be demonstrated until the stomach is completely evacuated. To put it in other words, we may say that at the height of digestion the chlorine is present in the following combinations:

---

* Recently the free HCl has been designated as "excessive" (*ueberschüssig*). It seems to me that this term has been poorly chosen, since this would indicate that the combined HCl was the chief factor in the physiological process of digestion, although it is undoubtedly true that the free HCl plays an equally important part in the peptic and antifermentative actions of the gastric juice. Furthermore, the term free HCl has been generally adopted by physicians, and has been accepted in the sense I have defined above. At all events, chemically speaking, the loosely combined and the free HCl—i. e., the total chlorine compounds, with the exception of the chlorides (the ammonia may be disregarded)—may be designated free HCl; but it would only complicate matters and would give rise to many errors if this nomenclature were employed and recommended for general use, as has been urged by Leo.

1. With hydrogen, as free HCl.

2. Combined with organic substances, as loosely combined HCl.

3. Combined with inorganic bases, as chlorides, which have either been introduced with the food or have been formed in the stomach.

Inasmuch as in the various test meals, and especially in the test breakfast, only small and fairly uniform quantities of inorganic chlorides or bases and salts from which chlorides might be formed in the stomach are introduced [i. e. 3], it is evident that the estimation of the chlorine contained in them is of no importance in studying the processes of gastric secretion.

Accordingly, the general course of the secretion of HCl may be represented by a curve which begins at zero, rises to a maximum, and then descends. The first period, which is a small one, including the formation of chlorides and the loosely combined HCl, is that which extends from the beginning of digestion to the occurrence of free HCl; the second and larger period is that of digestion with combined and free HCl. The maximum secretion of HCl occurs in the second period, and varies as to time and amount, according to the food and the digestive power of the individual. On a frugal diet (test breakfast) this is at the beginning of the second hour; the amount of free HCl varies approximately between 1·5 and 2·0 per mille; on an abundant mixed diet this occurs later, as, for example, in Riegel's test meal,* in the third to fourth hour, with values of 2·3 to 3·0 per mille. However, it is natural that these figures are only approximate and not absolutely fixed, and that in each individual patient the general characteristics of the case must be considered in drawing conclusions from these extreme figures. However, results which are much below or above them may at once be considered pathological.

Putting, then, the various possible quantitative changes in the secretion of HCl in an ascending scale, we would have:

1. Achlorhydria.†

---

* [Riegel's test meal consists of a plate of soup, 150 to 200 grammes (5–6½ oz.) of beefsteak, 50 grammes (1¾ oz.) mashed potatoes, and a roll. It is evacuated after three to four hours. Its advantage is that the relative digestion of the starches and albuminoids can be determined at a glance; its disadvantage resides in the plugging of the tube by large fragments of meat.—Ed.]

† Some authors, for the sake of euphony, speak of anachlorhydria—e. g., Lyon,

2. Hypochlorhydria.
3. Euchlorhydria.
4. Hyperchlorhydria.

The curve in the accompanying figure (Fig. 4) may be taken as an example of the course of the secretion of HCl; it was constructed from a patient with a gastric fistula, from whom the stomach contents were taken at first every ten minutes, and later every half hour. Free HCl first appeared at the point marked with a *.

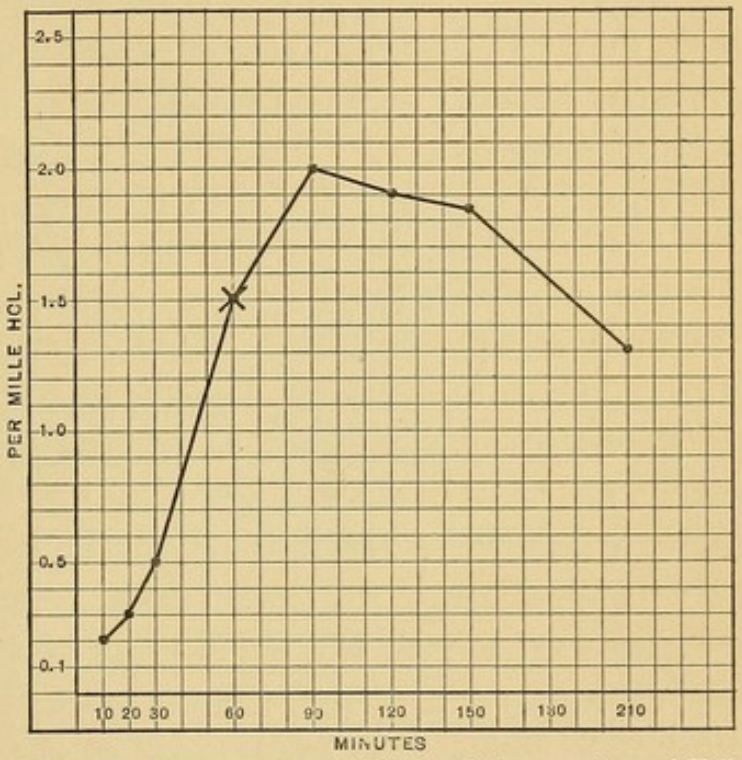


FIG. 4.—Curve showing the course of the secretion of HCl after a test breakfast. The cross indicates the time at which free HCl first appeared.

Although the greater portion of the acidity of the stomach contents is due to HCl, yet the *acid salts*, especially the acid phosphates (sodic and potassic phosphates), which are introduced in variable amounts with the food, also participate in it, although to a lesser degree. As a rule, they are unimportant as compared to free HCl, and their significance has never been exaggerated by German writers, as stated by Hayem and Winter; yet it would be a gross error to simply disregard them in calculating the acidity.

The presence of small quantities of *lactic acid* in the beginning of digestion is an entirely different matter. Small quantities of lactic acid may frequently be found at this time, when the lactic acid bacilli which have been introduced with the food have had an

---

L'analyse de sac gastrique; the grammatical term is that given above. [I have retained throughout this work the term chlorhydria—i. e., amount of HCl—on account of the convenience of its compounds in expressing in one word the differences in amount of HCl.—ED.]

opportunity to thrive. This may occur only in the early periods of digestion, as long as large quantities of HCl have not been secreted; for the conversion of starch into sugar, which is essential for their activity ceases as soon as there is 0·3 per mille HCl.* The formation of lactic acid itself ceases, according to Cohn,† and also Hirschfeld,‡ when the amount of HCl is 0·7 per mille; according to the latter it is markedly lessened when the HCl is between 0·1 and 0·2 per mille. Hence in a normal stomach this can take place only a short time. In a large number of investigations made long ago by Boas and myself,# we found lactic acid so regularly at the beginning of digestion, that we believed its presence to be a constant factor, and accordingly described three stages in the digestion of the test breakfast: the first with lactic acid; the second or intermediate stage with lactic acid and small quantities of free HCl; the third, which occurred toward the end of the first hour and when digestion was at its height, with only free HCl.

Nevertheless, we have always considered the formation of lactic acid an accidental factor which is dependent upon the introduction into the stomach of carbohydrates, especially sugar, and the lactic acid bacilli, although the latter may have already been present in the gastric mucus; for if a roll or bread is broken up in water and kept for a time at the bodily temperature no lactic acid is normally detected.‖ Neither did we assume, as claimed by Martius and Lüttke,△ that HCl is derived from lactic acid. On the contrary, we have shown that no lactic acid is normally formed when pure albumin has been eaten; ◊ yet my present experience convinces me that we had gone too far in assuming that the formation of lactic acid was always the rule after eating bread, and hence also a factor in its

* Ewald. Ueber Zuckerbildung im Magen und Dyspepsia acida. Berl. klin. Wochensch., 1886, No. 48.

† F. Cohn. Ueber die Einwirkung der künstlichen Magensaftes auf Essigsäure. und Milchsäuregährung. Zeitschr. für phys. Chem., Bd. xiv, p. 75.

‡ E. Hirschfeld. Ueber die Einwirkung der künstlichen Magensaftes auf Essigsäure- und Milchsäuregährung. Pflüger's Arch., Bd. xlvii, p. 560.

Virchow's Arch., Bd. civ, p. 271.

‖ Ewald. Ueber Zuckerbildung im Magen, etc., *loc. cit.*

△ Martius und Lüttke. Die Magensäure des Menschen, 1892, p. 24.

◊ "If food be given which contains nothing from which lactic acid may be produced, such as pure egg albumin, only free HCl will be found." Ewald. Klinik, etc., I. Theil, 3te Auflage, p. 86.

peptonization. Although the presence of lactic acid was proved by the formation of lactates, and was also confirmed by all subsequent writers—Cahn and von Mering,* Ritter and Hirsch,† Rosenheim,‡ Leo,# Stintzing,‖ and von Jaksch,^ to mention only the German writers—and although some of these writers have even traced the lactic acid to the end of digestion, yet I have repeatedly seen cases in which this acid was entirely absent throughout the entire course of digestion. That Martius and Lüttke ◊ should have reached the same conclusion did not therefore surprise me; careful investigations with their method (see page 51) showed that the acidity had coincided with that of HCl, and that, so to speak, there was no room for any lactic acid. But I have laid no undue weight upon this fact, which, as stated, was long known to me; first, because, in view of what I have already explained, it was by no means striking; secondly, because it is by no means a constant factor; and, thirdly, and most important for practical purposes, lactic acid is normally always absent at the height of digestion. It is this relation to the typical course of HCl secretion which is of clinical value, and changes in which may indicate pathological conditions. This fact is by no means altered because several of the above writers could with complicated and delicate tests demonstrate traces of lactic acid even at a late stage of digestion.‡ This can not be done in the ordinary lactic-acid tests, such as Uffelmann's (see page 41), which are not so delicate. 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 dis-

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

† Ritter und Hirsch. Ueber die Säuren des Magensaftes. Zeitschr. für klin. Med., Bd. xiii, p. 446.

‡ Rosenheim. Ueber Magensäure bei Amylaceenkost. Virchow's Archiv, Bd. cxi, S. 414.

Leo. Diagnostik der Krankheiten der Verdauungsorgane, 1890.

‖ Stintzing. Ueber den gegenwärtigen Stand der Diagnostik der Magenkrankheiten. Münch. Wochenschr., 1889, Nos. 8 and 9.

^ Jaksch. Klinische Diagnostik, 3te Aufl., 1892.

◊ Martius und Lüttke. *Loc. cit.*, pp. 13 and 156.

‡ I have corroborated this in several cases. See first edition of this work, p. 21.

cussion. I am therefore justified in maintaining the value of this procedure in spite of the objections raised by Martius and Lüttke.*

[During the past few years much has been written † on the subject of the relations of lactic acid, especially since Boas claimed a diagnostic significance for the presence of large quantities of this acid in cancer of the stomach.

By using new methods (*vide infra*) for detecting lactic acid, Boas found that lactic acid is not produced during any stage of digestion, and that bread and all the substances which are usually given in test meals contain lactic acid or lactates; he therefore proposed that in all tests for lactic acid the test meal given should consist of an oatmeal soup or gruel, which is made by boiling a tablespoonful of oatmeal flour with a quart of water, the only addition being a little salt. The stomach contents obtained after this gruel contain no lactic acid. On this point, however, Boas has gone too far; for it has been shown by many observers that the amount of lactic acid or lactates in the roll of a test breakfast is so insignificant that it may practically be discarded, since, as he himself admits, in all cases in which lactic acid has any significance it must be present in such large quantities that Uffelmann's test will give us sufficiently reliable results.]

The practical outcome of these considerations is, that the simple fact that the stomach contents are acid does not indicate upon what the acidity depends. It is simply a sum total which must be resolved into several factors, in doing which we must always remember that the height of the acidity does not necessarily coincide with the height of the secretion of HCl, and that *secretion*, *acidity*, and *chlorhydria* must be carefully distinguished from one another. Furthermore, under pathological conditions, the acidity is also dependent upon the products of fermentation of the carbohydrates and fats—i. e., lactic, acetic, and butyric acids, and even alcohol. Nevertheless it is always important to ascertain how acid the stomach contents are—i. e., to test the acidity with volumetric solutions and the *burette* (titration).

---

* *Loc. cit.*, p. 56.

† [The full literature on this subject may be found in elaborate papers by Langguth, Boas' Archiv, Bd. i, p. 355, and De Jong, ibid., Bd. ii, p. 53. Also see

Tests for Total Acidity.—This is ascertained by adding to the stomach contents a sufficient quantity of an alkaline solution of definite composition which will neutralize all the acid contained in them.

The question at once arises whether we should employ *filtered* stomach contents, as has been done heretofore, or whether we should follow the suggestion of Martius and Lüttke to use them *unfiltered*. It is self-evident that different results will be obtained according as we make use of the one or the other. But the above-mentioned writers have neglected one very important fact, that in either case *absolute* values are never obtained, but only *relative* ones. Absolute values are never obtained, because in determining the acidity by titration very different results are found with the various indicators employed; and we must never forget that in all these procedures we are dealing with certain signs whose nature and usefulness consist in the fact that they may be compared with one another. In measuring unfiltered stomach contents the results will vary with the quantity of larger or smaller fragments of food contained in them, and the titrimetric error will be much greater because the unfiltered stomach contents must be strongly diluted in order that they may be used for titration. Experiments with such a complex mixture as the stomach contents differ radically from those with pure solutions. The fact that *we estimate all results by percentage instead of by absolute values* has this advantage, that it suffices to determine the proportional values. It is self-evident that in the unliquefied fragments of food a certain amount of HCl has been imbibed, the absolute amount of which may be determined if we use unfiltered stomach contents. But inasmuch as the course of digestion is such that a corresponding amount of HCl is also in solution (free, or combined with the dissolved albumin), then the estimation of the latter will also give us indications of the amount of the former; in other words, the amount of work accomplished by the stomach. And that is the very thing which we wish to ascertain. But since it is much easier and more convenient to use filtered stomach contents, and since filtration at the same time also offers certain other diagnostic data, I believe that I am justified in adhering to the old method of studying the chemical changes with filtered chyme.

The same is true of the suggestion of Geigel and Blass *—to discuss this point at the same time—that we should estimate the total quantity of acid which is present in the stomach at that particular period in order that we may use this as a means of estimating the functional activity of the organ. Concerning this I would say the following:

The advantage of percentage estimations is this, that they give us results which are independent of the total quantity and which may be used

---

Friedenwald. N. Y. Medical Journal, March 23, 1895; and Stewart. Medical News, February 16, 1895.—Ed.]

* Geigel und Blass. Procentuale und absolute Acidität des Magensaftes. Zeitschr. für klin. Med., Bd. xx, Heft 3. Geigel und Abend. Die Salzsäuresecretion bei Dyspepsia nervosa. Virchow's Archiv, Bd. cxxx, Heft 1.

in comparing different cases. In order to draw general conclusions from a number of details—and it is our task to deduce general laws from the mass of confusing details—it is of no value to know in each individual case the total amount of secretion, which varies every minute; on the contrary, it is much more important to know the relation of the case in point to some absolutely fixed standard of comparison. If the grade of a street or railroad is 15 per cent, the relation to all other roads is known, no matter what the absolute length, elevation above the sea level, etc., may be.

The results of the very numerous examinations which have been made in the past have convinced me that percentage values remain uniform when the conditions are unchanged, or, to put it in other words, they change in a corresponding manner. They may therefore be employed in estimating the functional powers of the stomach. *À priori*, it is evident that the percentage value and the absolute amount of the secretion neither can nor must always agree, since both factors are entirely differently influenced by absorption, transudation, emptying of the stomach, etc. Naturally the absolute amount of HCl will vary with the quantity of the chyme; and also, as I have shown elsewhere,* it may happen that the percentage will remain uniform while the total amount of HCl will vary from minute to minute on account of the evacuation of large quantities of chyme into the intestines. Hence from moment to moment during the course of digestion varying absolute values would be obtained which bear no direct or absolute relation to the total quantity secreted by the mucous membrane. Consequently the determination of normal and pathological conditions would be made much more difficult, instead of being simplified. Our knowledge of gastric disorders has been much advanced, and is dependent upon the estimations by percentages; while on the other hand, so far as I know, no new diagnostic facts have been gained by the other method. It is therefore advisable to adhere to the old procedures, and the more so because the method of Geigel and Blass is so complicated as to be useless for practical purposes. However, it is not denied that it may be of some interest to know the absolute amount of secretion at any given moment.

[These remarks may also be applied to the various methods † which have been suggested to determine the absolute quantity of stomach contents at the time of their withdrawal. These procedures are all too complicated for clinical use, nor are the practical results obtained worth the trouble.]

Titration ‡ is most conveniently performed with a deci-normal solution of caustic soda, the end reaction being determined with phenol-phthalein. Should the reaction of the stomach contents be

---

* Ewald. Zeitschr. für klin. Med., Bd. xx, Heft 4–6.

† [They are described in Boas, *loc. cit.*, Bd. i, p. 139. Riegel. Erkrankungen des Magens. Nothnagel's Encyclopædia, 1896, Bd. xvi, II. Theil, p. 88.—Ed.]

‡ [The description of the technique of titration and other strictly chemical procedures lies beyond the province of this work. Those who desire further informa-

alkaline, the degree of alkalinity may be determined with a deci-normal acid solution. Normal caustic soda solution contains 40 grm. to the litre, so that 1 c. c. deci-normal caustic soda solution is equivalent to 0·003646 grm. HCl or 0·009 grm. lactic acid. Phenol-phthalein, a derivative of benzol, 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 [one per cent] alcoholic solution of phenol-phthalein 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. This indicates the moment when all the acids are saturated or neutralized, or, to put it more exactly, it denotes that the reaction has just turned alkaline. The number of cubic centimetres of the solution in the burette which have been used represents the acidity of the quantity of stomach contents which have been employed. 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-phthalein gives a slightly milky appearance to many stomach contents.† As a rule, the acidity of

---

tion 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. —Ed.]

* Where titrations are not made daily, Kleinert's burette will be found very convenient. This burette differs from the ordinary form with glass stopcock 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 stopcock is open. By closing the latter the atmospheric pressure will keep the column of fluid in the burette. To titrate, we simply turn the stopcock above instead of below, as usual. After use, the lower extremity is closed with the well-greased glass cover. In this way we avoid the annoying drying of the stopcock, 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.

† In the text I have only described titration with phenol-phthalein. It is a well-known fact, to which Lippmann (Ueber den Säuregrad des Mageninhaltes bei An-

10 c. c. of stomach contents obtained one hour after the test breakfast ranges between 4 to 5 or 5 to 6 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. Let us take an example: 6·1 c. c. of deci-normal soda solution had to be added to 10 c. c. of stomach contents until the end reaction appeared. One cubic centimetre deci-normal soda solution being 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 are neutralized; this will give the percentage of HCl in the stomach contents under examination. Thus in the example 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. Take a small quantity of the reagent and add a few drops of dilute HCl (containing about 0·05 per cent pure HCl); the solution at once assumes a deep dark-brown color. If some acid sodium

---

wendung verschiedener Indicatoren. Inaug. Dissert. Neuwied, 1891) has again directed attention, that the various indicators, rosolic acid, cochineal, fluorescin, litmus, curcuma, etc., give very different values for the so-called point of neutralization. Thus the acidity of a specimen of stomach contents was 65·8 with phenol-phthalein, 54·6 with rosolic acid, and 51·8 with litmus. An interesting discussion of this subject has been published by Spitzer (Ueber die Benutzung gewisser Farbstoffe zur Bestimmung von Affinitäten. Pflüger's Archiv, Bd. iv, p. 551). Hence it is necessary to always employ the same indicator.

phosphate is added to the tropæolin solution, the color turns not brown, but a light straw yellow. When free acid and acid salts are both present, a turbid, dirty brown color will be obtained according to which of these predominates. 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.

Methyl violet is another dye which may be mentioned; it 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 is a different color than the original, as can readily be determined when both tubes, before and after adding the stomach contents, are held up to the light.

In these tests, as well as in 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. We may also pour a little of the dye upon a white porcelain capsule, spread it out in a thin layer by shaking the capsule from side to side, and then add a few drops of the filtrate at the edge of the layer. [The color reaction will then be seen at the place of contact.] Or we may dip ordinary filter paper into a solution of the dye, allow it to dry, and cut it up into narrow strips. [A strip is dipped into the specimen of stomach contents; the moistened place will then assume the characteristic color. Such test papers may be also prepared with many of the dyes to be mentioned later on. This is the most convenient way of employing these tests.] These are all merely modifications of the same thing. It is to be observed that the test papers are somewhat less delicate than the freshly prepared solutions, and they become even less delicate after they have been kept for some time. Thus Boas and

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

myself found that the lower limit of delicacy of Congo paper was 0·1 per mille, which is ten times greater than that of the solution of the dye. The delicacy of tropæolin paper which is a year old is much diminished.

The delicacy of all these reactions is markedly affected by the presence of salts and albuminoids, especially albumoses and peptones. 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 whether we are dealing with free acid or acid salts, and can obtain a rough idea of the amount of free acid by the intensity of the reaction.

For example, test whether the specimen, whose acidity is 61 per cent (=0·2 per cent HCl), contains free acid. 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 the above-mentioned dyes are of little use, because the reaction of these aniline dyes toward hydrochloric acid is somewhat uncertain, since 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 is also true here. They either simulate or prevent the change of color. There has been much discussion on this point, and the attempt has been made to use this as a criterion for the usefulness of the various reagents. The truth is that they all react only to free acid, and it depends upon the delicacy of the various

reagents toward the latter whether the reaction will occur in the presence of a definite amount of albumen, etc.; or, in other words, whether enough free acid will be left over to give the reaction after all the compounds have been formed which the acid may enter into in such a mixture.

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. 38) 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.

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." 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.#

Nevertheless, the value of these dyes as reagents for HCl is less-

---

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

† Krukenberg. Ueber die diagnostische 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.

A number of other reagents for free HCl, like Mohr's, Reoch's, Kahler's, etc., have also been published, which I have described in former editions, but have now omitted because they have only a historical value. Mohr employed the reaction which occurs on the addition of free HCl to a 10 per cent solution of sulpho-

ened, especially since the reagents proposed by Günzburg * and Boas † do not labor under these disadvantages. Both methods have therefore been universally adopted, and are indispensable for the practical, qualitative testing of free HCl.

Günzburg's Reagent.—The principle of the reaction, which has long been known to chemists, 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 ʒ 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. Test papers may be prepared by soaking strips of ash-free filter paper in the reagent and drying them. A drop of stomach contents is placed upon the strip; on

---

cyanide of potassium and acetate of iron; a peach-red precipitate of sulpho-cyanide of iron is thrown down. Reoch used tartrate of sodium ferric oxide for the same purpose. Kahler proposed ultramarine and zinc sulphide.

* Günzburg. Neue Methode zum Nachweis freier Salzsäure im Mageninhalt. Centralblatt für klinische Medicin, 1887, No. 40.

† Boas. Ein neues Reagens für den Nachweis freier Salzsäure im Magensaft. Centralblatt für klin. Med., 1888, No. 45. [Friedenwald, N. Y. Medical Record, October 6, 1894.—Ed.]

heating this in a porcelain capsule a distinct reaction may be obtained (Boas). But not even this is necessary. It will suffice to take the minute quantity of stomach contents which is held in the eye of a piece of wire which has been bent over into a loop the size of a pin's head. Rub this upon a porcelain capsule or upon the tip of a porcelain spoon, and add an equal quantity of reagent; on heating, a distinct reaction will be obtained. The reaction has this great advantage over all others, *that it is only produced by HCl* and not by organic acids, and 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. It is sufficiently delicate, since a distinct reaction may be obtained with even 0·05 per mille [1 : 20000] HCl.

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.

Boas's Reagent consists of

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

The reaction is carried out in the same way as with Günzburg's reagent; the color produced is the same, but it is slower in making its appearance, and, in heating, greater care must be taken lest the charring of the sugar lessens the cleanliness of the reaction. The rose-red colored spot which appears on heating the test paper is not decolorized by ether.

[The only advantages which Boas's test has over that of Günzburg are that it is much cheaper and more stable. It may be kept unchanged for a very long time.]

[*Töpfer's Test.*—Töpfer * has recently proposed a test for free HCl which is exceedingly delicate, and which has the additional advantage that it may also be used in quantitative analyses for the various combinations of HCl (see page 47). His reagent is a one-half-per-cent alcoholic solution of dimethylamidoazobenzol, which turns red even in the presence of $\frac{1}{40}$ per mille (1 to 40,000) HCl. It may be used either in solution or as a test paper, the latter being less delicate than the former. It is used as follows: To a few cubic centimetres of filtered stomach contents in a test tube or beaker add one drop of the test solution; if free HCl is present it will turn red. The test papers are prepared by dipping strips of filter paper into the test solution; on drying they turn yellow. On dipping the test paper into stomach contents with free HCl a red color appears.

Töpfer and Friedenwald claim that this reagent responds only to free HCl, and not to combined HCl or organic acids. It has been shown, however, by Strauss † and Einhorn,‡ that it also responds to moderately concentrated solutions of acid phosphates and solutions of lactic acid in the concentrations in which it occurs in the stomach. Einhorn believes that if lactic acid is shown to be absent by Uffelmann's test we have an excellent means of determining the amount of free HCl.

For the use of this test for quantitative work, see page 48.]

The Tests for Organic Acids,—i. e., lactic, acetic, and the true fatty acids, especially butyric acid—must now be considered. I have already discussed the occurrence of lactic acid in the earliest stages of digestion. But it is pathological if it or other organic acids are found in such quantities that they may readily be detected by the ordinary tests. It is characteristic of these acids that they are derivatives of the substances which occur normally in the chyme—i. e., starches, sugars, fats, and proteids—and that they are produced

---

* [Töpfer. Zeitschr. für physiolog. Chemie, Bd. xix, Heft 1. Friedenwald. N. Y. Medical Record, April 6, 1895.—Ed.]

† [Strauss. Deutsch. Arch. für klin. Med., Bd. lv.—Ed.]

‡ [Einhorn. N. Y. Medical Journal, May 9, 1896, p. 602.—Ed.]

from them by fermentation. So far as we know, the only one which is not so formed is sarcolactic acid, which is dissolved from meat in which it is always present.

Tests for 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 or *greenish* yellow in the presence of lactic acid.* If some ferric chloride solution is diluted till it is almost colorless, and a trace of lactic acid is added, a canary-yellow color will 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 by adding one or two drops of pure carbolic acid to the above solution ; or a few c. c. of a dilute carbolic acid solution, say 10 c. c. [ʒ ijss.] of a 2 to 5 per cent solution of carbolic acid—the exact proportions are not essential—are mixed with one or two drops of ferric chloride solution and diluted with water till the solution assumes a beautiful amethyst-blue color. The addition of lactic acid changes the color to the same canary or greenish yellow described above, and a good contrast is thus obtained. 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]. The reagent soon decolorizes, and hence must be

* [All recent writers lay great stress upon the greenish color of the reaction ; when in doubt as to the exact color it is wise to add a drop of lactic acid to a small quantity of Uffelmann's reagent in a test tube and to use this as a standard for comparison.—Ed.]

freshly prepared each time before using it. I have found, however, that it may be kept unchanged for some time by adding about 5 per cent chloroform and preserving it in dark bottles.

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. Thus, a drop of Rhine wine will give a decided yellow color, and even the ethereal extract of a tablespoonful of Rhine wine or claret will do the same. We must therefore be careful to ascertain whether the patient has taken any wine or alcohol before making the test. If to Uffelmann's reagent we add some phosphate, as, for example, a little phosphate of soda in solution, its color will change to canary-yellow 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. Take some gastric juice with an acid reaction, which gives a marked yellow color with Uffelmann's reagent, and which shows no reaction for free acid with Günzburg's test or tropæolin, but which does give a reaction with Congo red; 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 5 to 10 c. c. [ʒ j¼ to ʒ ijss.] of the stomach contents in a medicine bottle with alcohol-free 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 to 60 c. c. [f ʒ j-ij] 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. The residue after evaporation was acid, and gave a distinct Uffelmann reaction. Since in this experiment no reaction for free acid was obtained with tropæolin, it will show how much more delicate Uffelmann's reagent is than tropæolin. The latter gave no reaction for free acid because it was masked by acid salts, and because only minute traces of lactic acid were present; yet the Congo-red test for free acid was positive, and the Uffelmann test showed that this was lactic acid.

[In spite of all the work which has recently been done on the tests for lactic acid, it is generally conceded that, after all, Uffelmann's test is sufficiently reliable for practical purposes, since the quantities of lactic acid which have any pathological significance must be so large that they can readily be detected with this reagent. Several useful modifications have been proposed. Thus Fleischer* does not evaporate the ether, but adds the freshly prepared Uffelmann reagent to the mixture of ether and stomach contents, and shakes vigorously; if lactic acid is present a yellow zone appears at the bottom of the test tube.

Strauss† has devised a special separatory funnel which is graduated at 5 c. c. and 25 c. c. Five cubic centimetres stomach contents are poured in, and then add 20 c. c. ether; shake well, then allow 20 c. c. to run off by opening the stopcock at the lower end of the funnel; dilute the remaining 5 c. c. by adding 20 c. c. distilled water; then add 2 drops of a 10 per cent aqueous solution of ferric chloride; shake well, and an intense greenish-yellow color will be observed.

---

* [Fleischer. Quoted by Penzoldt, Deutsch. Arch. für klin. Med. Bd. ii, p. 544, —Ed.]

† [Strauss. Berl. klin. Wochenschr., 1895, No. 37.—Ed.]

Boas's qualitative test* for lactic acid is too complicated for clinical purposes; its principle is the oxidation of the lactic acid into aldehyde, which is then detected by Nessler's reagent.†

The diagnostic significance of lactic acid will be discussed in the chapter on Cancer of the Stomach.]

The **fatty acids,** and especially **butyric acid,** decolorize Uffelmann's reagent; 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. Large quantities of fatty acids in the chyme may be recognized by the characteristic acrid, rancid odor.

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 Lieben iodoform reaction in the distillate of the stomach contents; but we must be certain that the patient has not taken alcohol for some time, either in beverages or medicines (tinctures, fluid extracts, etc.). The demonstration of alcohol has no practical value, hence I shall omit giving exact details of the method.

[A number of other substances which are the result of abnormal fermentations and putrefaction of the carbohydrates and albuminoids when there is marked stagnation of the stomach contents are

---

* [See Boas, *loc. cit.*, or Friedenwald, *loc. cit.*—Ed.]

† [An excellent critical *résumé* of the various tests for lactic acid has recently been published by De Jong. Boas' Archiv, Bd. ii, Heft 1, p. 53.—Ed.]

acetone, methane, sulphureted hydrogen, and ammonia. The cause is usually bacterial.

The fermentation of carbohydrates produces lactic, butyric, and acetic acids, and possibly also hydrogen; furthermore, as the result of yeast fermentation, alcohol and carbonic acid are produced. The putrefaction of albuminoids results in ammonia, sulphureted hydrogen, and methane.

Rosenheim and Strauss * have shown that traces of ammonia may occur normally in the stomach; carbonic-acid gas may also be regarded as a normal product in the stomach.

The relations of *sulphureted hydrogen* have been studied by Boas and Zawadski.† Boas claims that this gas occurs especially in dilatation of the stomach due to benign stenoses, and that it is not found when the cause of the pyloric stenosis is malignant. It occurs even when HCl is present in normal amounts. Zawadski only found it when the stomach contents had stagnated over 24 hours. It may readily be detected by its characteristic odor of rotten eggs, and also by the blackening of a strip of filter paper moistened with alkaline sugar-of-lead solution, which is hung in a well-corked test tube containing some of the stomach contents.

The occurrence of this gas and of *methane* will be discussed in Chapter VI, where the subject of fermentation and putrefaction will be considered in detail. It is to be noted that Betz and Senator have found H_2S in acute gastric catarrh, and Emminghaus has observed it in a case where there was a communication between the stomach and the perforated intestines.

Acetone has also been found in stagnating stomach contents by Von Jaksch and Lorenz; ‡ these writers also claimed to have found it in other conditions. Penzoldt and Savelieff # maintain that they have never been able to find it.

Ptomaines have also been extracted from stagnating stomach con-

---

* [Rosenheim. Centralblatt für klin. Med., 1892, No. 32. Strauss. Berl. klin. Wochenschr., 1893, No. 17.—Ed.]

† [Boas. *Loc. cit.*, part i, p. 209. Zawadski. Centralblatt für innere Medicin, 1894, No. 50.—Ed.]

‡ [Von Jaksch. Zeitschr. für klin. Med., Bd. viii, p. 36. Lorenz. Ibid., Bd. viii, p. 36.—Ed.]

[Savelieff. Berl. klin. Wochenschr., August 13, 1894.—Ed.]

tents in gastrectases due to benign and cancerous pyloric stenosis.* Ptomaines seem to play an important part in the causation of tetany (see Chapter VI).

Strauss † has recently reported a case in which both sulphureted hydrogen and *indol* were found; he was able to cultivate the bacillus coli communis from the stomach contents. In cultures this bacillus produced H_2S.]

The Quantitative Determination of Acidity.—*The quantitative determination of the amount of HCl secreted* must determine two things: (1) The amount of free HCl; (2) the amount of HCl which, as explained above (page 25), has combined with bases and organic substances. The sum of (1) and (2) will give the total amount of HCl secreted. This value, however, can only be determined if we introduce food into the stomach which is totally free from chlorides, or if the amount of chlorides which has been introduced is exactly known. Both of these procedures would be very difficult, and would scarcely be feasible for ordinary practical work; and, furthermore, for the following reasons they are unnecessary. It is true that with the test dinner, and especially with the test breakfast, we introduce a certain quantity of chlorides and bases, the latter of which are converted into chlorides by the HCl which is secreted; yet we have at present no simple method with which we can distinguish the chlorine of the chlorides which are introduced into the stomach and those which are formed there. On the contrary, in the ordinary methods of analysis the chlorine of the total chlorides is ascertained and is calculated as HCl. But the chlorides which have been introduced do not interest us. The chlorine which they contain has nothing to do with the work of the stomach, and is a variable factor which differs in the various cases, which, for example, varies if the bread or the dinner which is eaten contains more salt than usual. At all events, the bases and weaker salts are converted into chlorides by the secreted HCl, and thus take up a certain quantity of the secreted HCl; yet this is only a very small fraction of the total amount of HCl. Now, as the

* [Kulneff. Berl. klin. Wochenschr., 1893, No. 17. Turck. Toxines of the Stomach, N. Y. Medical Journal, February 22, 1896.—Ed.]

† [Strauss, Berl. klin. Wochenschr., May 4, 1896.—Ed.]

amount of bases which are introduced with every test breakfast is about the same, and at all events differs to a much less degree than the chlorides, and especially sodium chloride, we may once for all, without committing any great error, eliminate this factor and restrict ourselves to the estimation of the amount of HCl combined with organic substances. This is the more justifiable because the HCl which has combined to form chlorides has been lost for actual digestive purposes. Our task is therefore simplified by having to estimate only the amount of *the free HCl, and of the HCl which has combined with organic bodies*—i. e., *the physiologically active HCl.*

I believe the views which have just been enunciated will dispose of the demand made by Martius and Lüttke,* that the unfiltered and not the filtered stomach contents be employed; for, as already explained on pages 31 and 32, we are always only dealing with relative values, in which, for practical diagnostic purposes, it makes very little difference whether they are absolutely or approximately estimated. Also in the method of these two writers, as will be shown later on, the chlorine which has combined with the bases is neglected, and therefore no attempt is made to calculate the absolute quantity of HCl secreted, even if we disregard the fact that this method also gives by no means accurate results.

In order to simplify matters I shall follow the suggestion of Mintz, and designate and tabulate the various factors under discussion as follows, because, as shown by the literature of the past few years, there has been much confusion on this subject, not alone among general practitioners, but also among writers.

A = Aciditas = Total acidity.

L = Acid. hydrochlor. liberum = Free HCl (or the chlorine contained in it).

C = Acid. hydrochlor. combinatum = Loosely combined HCl (or the chlorine combined with organic bodies).

F = Chlorum fixum = Chlorides (or chlorine of the mineral salts).

T = Chlorum totale = Total chlorine.

The Estimation of Free HCl (L).—This is best made with *Mintz's*

---

* *Loc. cit.*, p. 30.

method; * deci-normal soda solution is added [from a burette] to 10 c. c. of stomach contents till Günzburg's or Boas'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.† If Günzburg's test is used, as described on page 39, the amount of stomach contents used in testing is exceedingly small, even if repeated tests be made, for each time we need only as much as is taken up by a small loop of wire. ‡

As soon as the point is reached where Günzburg's test is negative, a few drops of phenol phthalein solution may be added to the filtrate of the stomach contents, and, as already described, the total acidity may be determined. Thus we may at once determine both the amount of free HCl (L) and the total acidity (A).

[The amount of free HCl and the total acidity may also be determined with Töpfer's reagent (see page 40). At the same time we can also ascertain the amount of loosely combined HCl and that due to the organic acid + acid salts. This is accomplished by means of various indicators.

---

* 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.—Ed.]

‡ Boas (Diagnostik und Therapie der Magenkrankheiten, 2te Aufl., Bd. i, p. 168) has proposed the opposite method, namely, of titrating with deci-normal HCl, to determine the value of the combined HCl. But, disregarding the fact that Mintz has proposed his method only "for the HCl, which is not demonstrable with Günzburg's reagent," A. Meyer (Inaug. Dissert., Berlin, 1890) has already shown that the combined HCl can not be determined in this way.

The method is as follows: The reagents required are deci-normal soda solution, phenol-phthalein solution, Töpfer's reagent, and 1 per cent aqueous solution of sodium alizarin sulphonate.

Place 10 c.c. of the stomach contents in three beakers, A, B, and C. To beaker A add two drops of the phenol-phthalein solution and determine the total acidity by adding deci-normal soda solution until a permanent red color is obtained. To beaker B add three or four drops of the alizarin sulphonate solution and add deci-normal soda solution until the first appearance of a distinct violet tint. All the factors of the acidity excepting the loosely combined HCl act on alizarin. Hence the difference between B and A = loosely combined HCl. To beaker C add three or four drops of Töpfer's reagent and add deci-normal soda solution until the last trace of red has disappeared, leaving only a yellow tint. This gives the amount of free HCl. By subtracting the results of the free and loosely combined HCl from the total acidity we will obtain the acidity due to the organic acids and acid salts.*]

Estimation of the Loosely Combined HCl (C).—A great many tests have been proposed for this purpose, of which Martius and Lüttke have enumerated and carefully described no less than twelve.† The principle of all these methods is to ascertain the total quantity of

---

* [Leo's Diagnostik der Krankheiten der Bauchorgane, 2te Auflage, p. 319.—Ed.]

† In addition to those which will be described in the text these may be briefly recapitulated as follows:

1. *Bidder and Schmidt's method* for the determination of the total HCl. See Ewald, Klinik, etc., Bd. i, 3te Auflage, p. 81.

2. *Hehner and Seemann's Method.*—Incineration after adding enough alkali to neutralize (*a*); estimation of acidity of the ash (*b*). Then $a - b$ = free + combined HCl. Zeitschr. für klin. Med., Bd. v, p. 272.

3. *Braun's modification* of this method, described by Leube. Spec. Diagnostik, etc., 2d edition.

4. *Cahn and Von Mering's Method.*—After the HCl has been combined with cinchonin, it is separated and the amount of chlorine contained therein is estimated. Deutsch. Arch. für klin. Med., Bd. xxxix, p. 293.

5. *Hoffmann's Method.*—This is based on the inverting action on sugar of HCl solutions. Centralbl. für klin. Med., 1889, No. 46.

6. *Jolles's Method.*—The spectra of watery solutions of eosin have two absorption bands which disappear when free and combined HCl are present. One fifth normal alkali is added to the stomach contents until the absorption bands appear; the HCl is calculated from the amount of alkali used. Wiener med. Presse, 1890, No. 51.

7. *Sjöqvist's Method.*—By incineration with barium carbonate the free and combined HCl are converted into barium chloride, which may then be calculated according to different methods. Zeitschr. für physiolog. Chem., Bd. xiii, p. 1. See also Katz. Wiener med. Wochenschr., 1890, No. 51. Von Jaksch. Klinische Diagnostik, 3te Auflage, 1892. Fawitzki. Virchow's Arch., Bd. cxxiii, p. 307; and Bourget. Arch. de méd. Expérim., 1889, No. 6, p. 844.

8. *Winter and Hayem's Method.*—Incineration (after the addition of soda) and estimation of the chlorine with deci-normal silver nitrate with three portions of

the free and loosely combined HCl (L + C), and then by ascertaining and subtracting the amount of free HCl to obtain the quantity of the loosely combined HCl. The sum L + C is estimated either by direct analysis or by first obtaining the total amount of chlorine (T) and then subtracting the chlorine in the chlorides (F). I have studied and employed all these various methods, but consider it superfluous to enter into a detailed criticism of them; instead, I shall confine myself to a description of two of them, which, on account of their simplicity, may be recommended for practical use. Although they are not free from sources of error, yet their results are sufficiently accurate for practical purposes. If we will only consider upon how many uncontrollable factors the amount of HCl secreted at the time of our examination depends, we will, I believe, refrain from demanding of our analytical procedures a delicacy which can only be deceptive and which leads to false conclusions when the methods are put to practical use.

Leo's Method.—This method is based upon the fact that calcium carbonate ($CaCO_3$) at ordinary temperatures is converted into calcium chloride ($CaCl_2$) by free and combined HCl, whereas it is not changed by acid phosphates. The difference in the acidity before and after adding $CaCO_3$ will therefore give the amount of physiologically active HCl (L + C), provided no other free acids are present, or if they are there, have previously been got rid of. The acidity after the addition of $CaCO_3$ represents the amount of acid salts present. As it has been found that the same quantity of bi-acid-phosphate requires twice as much alkali for neutralization in the presence of $CaCl_2$ as it does when the latter is absent (on account of the formation of monocalcium phosphate), and as $CaCl_2$ is

---

stomach contents by which (*a*) the total chlorine, (*b*) the loosely combined and fixed chlorine, and (*c*) the fixed chlorides are ascertained.

All the procedures, especially Nos. 7 and 8, have been frequently discussed, and have given rise to many controversies which need not be discussed here. Critical discussions of them may be found in Martius and Lüttke's monograph, and also in Kossler (Zeitschr. für physiolog. Chemie, Bd. xvii, p. 91). It has been shown by a number of observers, but especially by Martius and Lüttke and also by Sansoni (Berl. Klin. Wochenschr., 1892, No. 43), that the relation between free and combined HCl is uncontrollably destroyed by evaporation and incineration. Moreover, F. A. Hoffmann (Schmidt's Jahrbücher, Bd. ccxxxiii, p. 268) maintains *all methods for estimating HCl which necessitate evaporation* are to be avoided because the decomposition produced in the fluid by evaporation can not be calculated.

formed in the reaction, it is necessary to have an excess of $CaCl_2$ during all the titrations.

The method is carried out as follows: After removing and estimating any organic acids which may be present (*vide supra*), 5 c. c. of a concentrated $CaCl_2$ solution are added to 10 c. c. of filtered stomach contents, and the acidity determined [with deci-normal caustic soda solution and phenolphthalein]. Then some chemically pure * powdered $CaCO_3$ is thoroughly rubbed up with 15 c. c. filtered stomach contents which have been poured into a dry glass beaker; the mixture is then passed through a dry filter. Ten c. c. of the filtrate are measured off, air is blown through to drive off the CO_2 which is formed,† 5 c. c. $CaCl_2$ solution are added, and the acidity is again determined. The difference in the results of the first and second titrations represents the physiologically active HCl.

The fundamental principle of this method—i. e., that the phosphates are not acted upon by calcium carbonate—has been verified by many observers, among whom are A. Meyer,‡ Hoffmann and Wagner,# and Leo and Friedheim.‖ Langermann^ has compared this test with several others, and has obtained fairly good results. Later investigations of Kossler◊ have shown that the experimental error with solutions of HCl-peptones and of albumen, and with the small quantities of phosphates which are present in the stomach contents, are very slight (between 1 to 3 per cent. HCl), and that the results obtained are sufficiently accurate for clinical purposes. I fully agree with Kossler, since for practical purposes it is immaterial whether, in a given case, we find 2·5 or 2·58 per mille HCl, which is what an error of +3·24 would be equivalent to.

Lüttke's Method.—This is based on Volhard's well-known method, the principle of which is that all combinations of chlorine are converted by silver nitrate into silver chloride. The latter is titrated according to the usual methods. Therefore, if the total

---

* $CaCO_3$ is chemically pure when red litmus is not blued, after rubbing some of it up with water, and when the addition of sulphuric acid to a solution of it in HCl does not cause a precipitate.

† This is best done with the double bulb of a spray apparatus. We detach the double bulb and the rubber tube, and insert a small piece of glass tubing into the open end of the latter.

‡ A. Meyer, Ueber die neuesten Methoden, etc. Inaug. Dissert., Berlin, 1890.

Hoffmann and Wagner. Centralblatt für klin Med., 1890, No. 40.

‖ Leo und Friedheim. Pflüger's Archiv, Bd. xlviii, p. 614.

^ Langermann. Virchow's Archiv, Bd. cxxviii, p. 408.

◊ Kossler. Zeitschr. für physiolog. Chemie, Bd. xvii, p. 91.

chlorine is first determined, and then the amount of chlorine after incineration, the difference in the results of the two estimations will give the amount of physiologically active HCl (L + C). If L has been determined according to Mintz's method, then (L + C) − L = C —i. e., the loosely combined HCl.

For the method the following solutions are needed:

1. Deci-normal silver nitrate solution, 17 grammes $AgNO_3$ to the litre, and containing an excess of nitric acid, so that 1 c. c. exactly equals 1 c. c. deci-normal HCl solution—i. e., 0·00365 HCl.

2. Liquor ferri tersulphatis (U. S. Ph.).*

3. Deci-normal ammonium sulphocyanate solution, containing 7·6 grammes of the salt to the litre.†

The silver which is left over after the formation of silver chloride forms silver sulphocyanate on the addition of the ammonium sulphocyanate solution. As soon as all the silver sulphocyanate has been formed, the solution assumes a blood-red color, due to the iron sulphocyanate.

(*a*) *Estimation of the Total Chlorine.*—The procedure is carried out as follows:

Ten c. c. of the well-shaken unfiltered or filtered stomach contents are poured into a graduated 100 c. c. flask; the small flask in which the stomach contents have been measured must be washed out with water once or twice. Then 20 c. c. of the deci-normal $AgNO_3$ solution are added; the mixture is shaken and allowed to stand for ten minutes.

The addition of 5 to 10 drops of potassium permanganate solution (1 to 15) will decolorize the stomach contents if they are strongly tinged; but this is unnecessary in the majority of cases. The permanganate is not to be added until all the chlorine has combined with the silver, otherwise it will act upon the HCl so that the free chlorine will be set free, which will then evaporate and render the results of the analysis doubtful.

If the decolorization has been effectual water is added up to 100 c. c., the mixture is shaken, and filtered through a dry filter into a dry vessel. Fifty c. c. of the filtrate are then titrated with deci-normal ammonium sulphocyanate solution.

The total chlorine is calculated as follows: The number of c. c. of ammonium sulphocyanate solution used is multiplied by two, and the sum is subtracted from the number of c. c. of silver used (20 c. c.).

(*b*) *Estimation of the Chlorides.*—Ten c. c. of the well-shaken or filtered stomach contents are evaporated to dryness in a platinum dish over a water bath. Instead of a platinum dish we may use an asbestos plate

---

* 17·5 grammes $AgNO_3$ are dissolved in about 900 c. c. 25 per cent. nitric acid solution, and 50 c. c. liq. ferri tersulphatis are then added; water is then added up to one litre, and is *exactly* adjusted to deci-normal HCl solution.

† Eight grammes ammonium sulphocyanate are dissolved in one litre of water, and the titration point adjusted to the above-described silver solution. Thus, for example, if 9·7 c. c. ammonium sulphocyanate solution were used for 10 c. c. silver solution, then 970 c. c. of this solution must be diluted to 1,000 c. c.

which is not too thick, and which is heated by a gas flame or alcohol lamp. In this way the evaporation takes place quickly, care being taken that there is no loss of the fluid by splashing.

The residue left after evaporation is burned over an open flame until the residue no longer burns with an illuminating flame. Too strong and too prolonged burning is unnecessary, and is to be avoided because the chlorides are volatilized by too high a temperature.

The residue left after combustion is rubbed up with moistened charcoal by means of a glass rod, and is then dissolved out with about 100 c. c. of water, and the fluid is then filtered. Experience has shown that this amount of water is sufficient to completely dissolve out the charcoal. But if we are in doubt whether all the chlorides have been washed out we may add a drop of silver solution to a few drops of the last portion of the filtrate. Any turbidity will indicate the presence of chlorine, and will necessitate further washing.

The total filtrate is then poured into a beaker, 10 c. c. deci-normal silver solution are added, and titration carried out with the deci-normal ammonium sulphocyanate solution.

The amount of the combined chloride is obtained by subtracting the number of c. c. of ammonia sulphocyanate solution used from the amount of silver solution employed (10 c. c.).

The difference, $a-b$, multiplied by 0·0365, will give directly the *percentage of the physiologically active HCl.*

But even this method, which at first glance seems perfect, is not infallible, in spite of the fact that Volhard's method, which is much simpler and rapid than would appear from the above description, has been shown by chemists to be absolutely reliable. Kossler * has called attention to the fact that in the presence of calcium and phosphorus compounds, the amount of chlorides (F) must be too low, because in the decomposition † free HCl, which is volatilized during the evaporation, is set free. The amount of physiologically active HCl will therefore be too high, because calcium and phosphorus compounds are always present in the stomach contents after the test breakfast. Another source of error may arise from the presence of ammonium chloride (NH_4Cl) in the stomach contents. Even Bidder and Schmidt found as much as 0·47 per mille NH_4Cl in the gastric juice (containing no saliva) of dogs, although they state that there is no NH_4Cl in the gastric juice

---

* *Loc. cit.*

† $CaCl_2 + KH_2PO_4 = CaHPO_4 + KCl + HCl$. And $3CaCl_2 + 2KH_2PO_4 = Ca(PO_4)_2 + 2KCl + 2HCl$. Kossler's experiments show that this loss may amount to about 25 to 40 per cent.

(containing no saliva) of human beings.* Leo † also found only traces of ammonia in human stomach contents with tests made for this purpose with Schlösing's method; but Rosenheim ‡ states that with this method he could demonstrate ammonia in such quantities that about 10 per cent of the HCl present in the filtrate of the stomach contents examined must have been thus combined. Inasmuch as ammonia does not occur preformed in the food, its presence can only be traced to the secretion of the rennet glands or to putrefaction of the albumens. At all events, the formation of NH_4Cl renders part of the physiologically active HCl inert, which, as may be readily perceived, would be considered active in Lüttke's method—i. e., the factor C would be about 10 per cent too high.

These reasons may perhaps explain why in Martius and Lüttke's analyses the amount of HCl coincides so surprisingly frequently with the total acidity; this would leave no room for other acids or salts which in my experience are always found in the stomach contents.

However this may be, it is evident that Lüttke's method is not free from objections; furthermore, another disadvantage is that it needs too many titrations and also combustion. As in the method of Leo, the free HCl must be determined by a separate analysis with Mintz's method. Nevertheless Lüttke's method is to be recommended because of its relative simplicity and the reduction of errors to the lowest possible degree.

Quantitative Estimation of Lactic Acid.—After having ascertained the acidity of 10 c. c. of stomach contents they are repeatedly shaken up with a large quantity (100 to 150 c. c.) [℥ iij–v] of ether, and the acidity of the residue left after the removal of the ether is determined. Multiplication of the difference of the two results by 0·09 will give the approximate percentage of lactic acid which is sufficiently accurate for practical purposes.

To carry out this test it is essential that volatile fatty acids, especially butyric acid, be absent. Their presence may be ascertained by pouring some stomach contents into a test tube or a small flask,

* See Ewald. Klinik, etc., I. Theil, 3te Auflage, p. 81.
† Leo. Deutsch. med. Wochenschr., 1891, No. 41.
‡ Rosenheim. Centralbl. für klin. Med., 1892, No. 39.

a piece of moistened sensitive blue litmus paper being placed in the neck of the tube. On heating, if volatile fatty acids are present, they will escape with the watery vapor and will redden the litmus paper. If any fatty acids be found they must be removed by a preliminary boiling; the boiling is kept up until the litmus paper is no longer reddened, the water lost by evaporation being replaced.

[Boas * has given us what are undoubtedly the most accurate methods for both the qualitative and quantitative tests of lactic acid; but for clinical purposes they are too delicate, since it has been shown that even some of the reagents employed may simulate the reaction given by decomposition products of lactic acid.†

The principle of the tests is this: When lactic acid is slowly and carefully heated with oxidizing agents, it splits up into formic acid and acetic aldehyde. The presence and amount of the latter substance can be ascertained by many tests, of which the iodoform test is the best both for qualitative and quantitative purposes. The oxidizing agent used is potassium permanganate and sulphuric acid. If the aldehyde is then conducted into an alkaline solution of iodine, iodoform is formed. Under proper precautions a given quantity of aldehyde decomposes a given proportion of the iodine solution, and hence the amount of the former can be determined. Ketone and alcohol, which give the same reaction, are removed by boiling the fluid to be examined to a sirupy consistency. Carbohydrates heated with oxidizing agents also give off aldehyde, so that the lactic acid must first be extracted with ether. The test meal used for this method is Boas's oatmeal soup.] ‡

Quantitative analyses of the fatty acids will scarcely ever be required in ordinary practice. They can only be performed after repeated extraction with ether or by distillation.

Quantitative Estimation of Acid Salts.—This is obtained by subtracting from the total acidity the acidity which is obtained in Leo's method after adding $CaCO_3$. Inasmuch as most of the acid

* [Boas. *Loc. cit.*, p. 179. Friedenwald. *Loc. cit.*—Ed.]

† [Langguth. *Loc. cit.*—Ed.]

‡ [Boas's oatmeal soup consists of a tablespoonful of oatmeal to a quart of water which is boiled down to a pint. Salt may be added to suit the taste. The advantage of this meal is that it does not contain any lactic acid or lactates.—Ed.]

compounds consist of phosphates the difference must be divided by two (see p. 50).

From the methods of analyses described above we may construct the following **schema for the routine quantitative examination of stomach contents:**

Stomach Contents obtained One Hour after Test Breakfast.—Color, light yellow; on filtration, a clear yellow filtrate is obtained; a homogeneous residue is left upon the filter.

Reaction to litmus, acid.

Tropæolin test, dark brown.

Congo-red test, blue.

Günzburg's or Boas's test, carmine red.

Uffelmann's test, doubtful.

Butyric acid, negative.

Estimation of HCl, Leo's method.

1. Total acidity (A) = 55.

2. Acidity after extraction with ether (the ethereal extract gives a positive reaction with Uffelmann's test) = 46. Lactic acid therefore = 0·018 per cent.

3. Acidity after adding $CaCl_2$ = 56.

4. Acidity after adding $CaCO_3$ = 16—i. e., corresponds to acid salts.

5. Therefore acidity due to free acids = 40.

From this subtract the amount represented by lactic acid 1) — 2) —i. e., 55 — 46 = 9. Therefore

6. Acidity of physiologically active HCl (L + C) = 31 = 0·113 per cent HCl.

7. Acidity of free HCl (L) by Mintz's method = 14 = 0·05 per cent HCl. Therefore combined HCl (C) = 0·063 per cent.

It is self-evident that if we only care to ascertain the amount of HCl the method may be much simplified by adding the $CaCO_3$ directly to the residue left after the extraction with ether. Furthermore, when fatty acids are present, they are to be removed as already stated, the acidity must be determined after their removal, and the amount subtracted from the results obtained in 5).

It will thus be seen that an exact quantitative analysis of the

stomach contents requires quite a little time and work. The question naturally arises, do the results obtained pay one for his trouble, or, in other words, could we not obtain practical results for clinical purposes in some simpler way? Disregarding all abnormal mixtures of acids, we may encounter one of two varieties of cases: in the one free HCl has been secreted and we may do what was formerly generally done—namely, convert the total acidity clinically into that of the physiologically active HCl; we need only bear in mind that this is absolutely too high on account of the presence of the acid phosphates. In the other case no free HCl has been secreted; here large quantities of organic acids are usually present, and the question arises whether any HCl at all has been secreted. For this purpose we must resort to one of the above methods, which, for this purpose, are much simplified because it is unnecessary to estimate the quantity of free HCl, and because it is immaterial whether the analytical error of a few milligrammes or centigrammes is made. We only want to know whether the mucous membrane is still able to pour forth any secretion, and, if so, to gain a rough idea to what extent.*

Hence my own opinion is that Leo's method is the best one for clinical purposes. [Töpfer's method also promises to be valuable

---

* An approximate estimation of the loosely combined HCl may also be relatively easily and rapidly obtained with Sjöqvist's method. Ten c. c. gastric juice are evaporated after adding a tip of a knifebladeful of barium carbonate and incinerated, care being taken lest the temperature be too high; the ash is extracted with water and filtered. To the filtrate, which is as clear as water and which contains any HCl which may be present as barium chloride, a few drops of concentrated soda solution are added. If the fluid remains clear, HCl is absent; if it is present, the fluid will assume a whitish turbidity or will throw down a white precipitate of carbonate of baryta, from the amount of which we may at once infer what the quantity of the loosely combined HCl might be.

If it could be proven that after a definite test meal of constant weight the amount of loosely combined HCl would always be uniform, we could follow a suggestion of Biedert (quoted by Langermann, *loc. cit.*), to add deci-normal HCl until free HCl appears; then by subtracting the amount of deci-normal HCl used from the known amount of HCl necessary for saturation of the definite test meal, we could estimate the amount of loosely combined HCl. But it is evident that such a constant value does not exist, because the quantity of swallowed or secreted mucus in the stomach is always variable, and, furthermore, because the quantity of HCl combined with albumen, albumoses, and peptones must then always be constant, and these latter substances must always be present in that amount at a definite period of digestion.

where the saving of time is important. Hoppe-Seyler, De Jong and Friedenwald * commend it highly.]

For the sake of comparison I have charted a series of curves (Fig. 5) of the total acidity calculated as HCl, the total HCl according to Leo's method, the total HCl according to Lüttke's method, and the free HCl according to Mintz's method. They were ob-

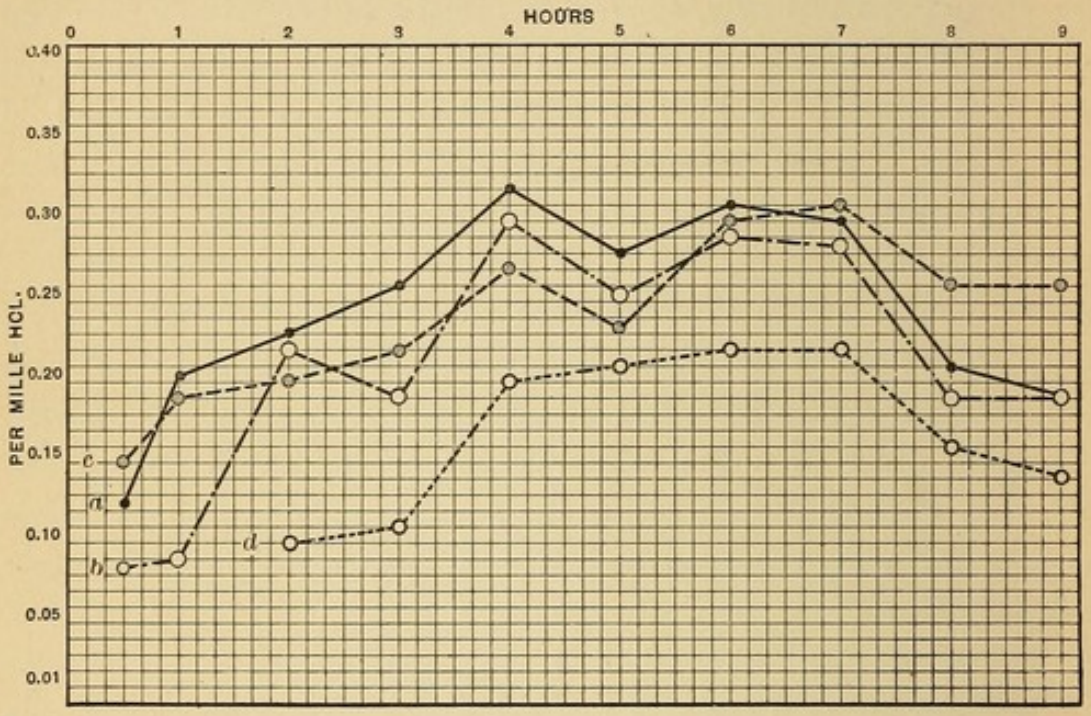


FIG. 5.—*a*, HCl calculated from acidity; *b*, total HCl calculated according to Leo's method; *c*, total HCl calculated according to Lüttke's method; *d*, free HCl calculated according to Mintz's method.

tained from the stomach contents of a woman upon whom gastrostomy had been performed on account of a cicatricial stenosis of the œsophagus after an ulcus œsophagi; hence at any time stomach contents could be readily obtained through the gastric fistula.† The stomach was affected only in so far that if food remained unduly long in it hyperchlorhydria would occur; this very fact enables us to follow the course of the secretion of HCl unusually well. The meal given for these experiments consisted of 500 c. c. [O j] tea, two eggs, two zwieback, 200 c. c. [f ℥ vj ⅔] milk, and 50 grammes [℥ j ⅔] meat powder. Free HCl did not appear till after one hour and a half. Lactic acid was only present in traces at the beginning.

* [Hoppe-Seyler. Münchener med. Wochenschr., 1895, No. 50. De Jong, Boas's Arch. Bd. ii, Heft, i. Friedenwald, N. Y. Med. Record, Apr. 6, 1895.—ED.]

† Ewald. Zeitschr. für klin. Med., Bd. xx, Heft 4–6.

These curves show, as has already been said, that the total acidity may be calculated as HCl without any great error, especially if at the same time the quantity of free HCl has also been determined. The differences in the two results would then about represent the combined HCl, provided, of course, that the quantity of acid salts is small and organic acids have been removed. Rosenheim * has also urged that the determinations of the total acidity and of the amount of free HCl are perfectly sufficient for all practical purposes. I would like to erase the word "perfectly" from this sentence, because the numerous cases without free HCl would then be insufficiently regarded; yet for general use in *all* cases where free HCl is present this simplified procedure will suffice, for in the majority of these cases the estimation of the quantity of the loosely combined HCl is relatively unimportant. Thus in the great majority of cases the elaborate quantitative determinations of acidity would be reduced to a few titrations which take up very little time.

---

* Rosenheim. Ueber die practische Bedeutung der quantitativen Bestimmung der freien Salzsäure im Mageninhalt. Deutsch. med. Wochenschr., 1892, Nos. 13 and 14.

CHAPTER II.

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

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 given an exact description of these changes, and now I shall restrict myself to the practical deductions from the facts known to us. It is well known 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, 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

* Ewald. Klinik der Verdauungskrankheiten, I. Theil, 3te Auflage, p. 93, etc. [See also Chittenden's Cartwright Lectures on Digestive Proteolysis, New Haven, 1895. This work contains an elaborate and masterly description of this entire subject.—ED.]

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. To a solution of peptone add some caustic potash, and then a little dilute cupric sulphate; a deep purple-red color will be obtained 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 can be shown with a solution of meat peptone. When the quantity of peptone or propeptone is small, the copper solution must be diluted to a very pale blue and must be added drop by drop; a rose-red zone will appear about the drops as they fall into the solution; this color will then gradually diffuse through the solution.

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 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. — Precipitated by saturated solution of sulphate of soda or common salt and acetic acid, cold or warm.
  - 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. — Precipitate peptone.
  - Phosphotungstic acid. — Precipitate peptone.
  - Phosphomolybdic acid. — Precipitate peptone.
  - Tannin. — Precipitate peptone.
  - 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 mixture 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. I shall, 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 that portion of propeptone which is precipitated by rock salt and acetic acid is absent in the digestion of meat, but is present in the digestion of plant albuminates and pure egg albumen. On an ordinary mixed diet the amount of propeptone which is precipitated, as above stated, bears some relation to the activity of digestion, so that from the precipitability and amount of propeptone approximate conclusions may be drawn as to the digestive process. It would be much better if this could be determined from the quantitative analysis of the peptones, to which there are two objections. One is that we do not at present possess any convenient and sufficiently accurate method for estimating the quantity of peptones, since, as has been already shown, the intensity of the biuret reaction is of no use, because it responds to both peptone and propeptone. Secondly, as some investigations of my own † have shown, digestion in the human stomach produces only a very small proportion of true peptone, the greater portion of the albumen being converted into propeptone and the albumoses of Kühne. Hence under the term "peptone" are included those products of proteid digestion which are not precipitated by ammonium sulphate in neutral solution, rock salt (or concentrated sodium chloride solution), or a saturated solution of common salt in acetic acid; which give the biuret reaction; which remain in solution at any temperature, and are only precipitated by mercuric chloride, tannin, phosphotungstic acid (phosphomolybdic acid), picric acid, and mercuric iodide and potassic iodide solution.

Hence it is of considerable value to determine and approxi-

---

* I. Boas. Beiträge zur Eiweissverdauung. Zeitschr. fur klin. Med., Bd. xii, Heft 3.

† Ewald und Gumlich. Ueber die Bildung von Pepton im menschlichen Magen. Berl. klin. Wochenschr., 1890, No. 44.

mately estimate not alone the end products of proteid digestion, but also the intermediate bodies.

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 that portion of propeptone which is precipitated by concentrated NaCl solution and acetic acid 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, we not infrequently encounter cases in which a positive biuret reaction is obtained, although no free HCl can be demonstrated. Further analysis will also demonstrate the absence of propeptone (as defined above); in other words, this will show that the proteid digestion is well advanced. How can this be explained, since we know that peptone can only be found in the presence of pepsin and HCl? There are two possible explanations.

---

* On the addition of caustic potash many stomach contents turn yellow. Spitzer has separated from this a yellowish-brown amorphous substance which assumes an onion-red color on the addition of alkalies. Centralblatt für klin. Med., 1891, No. 9.

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

One is that all HCl is not absent, but only the free HCl, and further analysis will reveal the presence of loosely combined HCl. But, as was demonstrated many years ago (1882) by me,* and later on also by Salkowski and Kumagawa,† loosely combined HCl and pepsin can peptonize albumen, although the action is a very feeble one. The other possibility is that when all HCl is absent, large quantities of lactic acid are always present; in such cases the lactic acid takes the place of HCl in the peptonizing process, provided pepsin is still secreted. Although the presence of HCl always indicates that pepsin will be found, yet conversely the absence of HCl does not prove that pepsin is lacking. For it has been proved by the physiological experiments of Cahn ‡ and by an observation of my own # that the secretion of pepsin, at least in small quantities, may be independent of HCl. The presence of peptone in the stomach contents can thus be explained when there is no physiologically active HCl (L+C), and when the peptones have not been regurgitated from the intestines.

Hence, for the reasons given above, the estimation of peptones with the biuret reaction is always doubtful, and it is much more advisable to determine the digestive power of the gastric juice by the rapidity with which coagulated albumen is liquefied (proteolysis).

Digestion Tests.—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

---

* Ewald. Virchow's Archiv, Bd. xc, p. 333.

† Salkowski und Kumagawa. Virchow's Archiv, Bd. cxxii. See also Rosenheim. Centralblatt für klin. Med., 1891, No. 39; and F. A. Hoffmann, ibid, No. 42.

‡ Cahn. Die Magenverdauung im Chlorhunger. Zeitschrift für physiol. Chemie, 1886, Bd. x.

Ewald. Ein Fall von Atrophie der Magenschleimhaut. Berl. klin. Wochenschr., 1886, No. 32.

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 a warm chamber kept at about 100° Fahr.; from time to time we [shake the tubes and] 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. [Pieces of Merck's fibrin may be used instead of the disks of albumen.] 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 degree of concentration of its contents; hence all our tests are fundamentally deviations from Nature, and are thus to a certain degree pathological.

The question naturally arises, Is it necessary to resort to these somewhat inconvenient digestion tests, and will it not suffice to simply employ the acid tests, since the rule is that the secretion of HCl and pepsin run parallel courses? Any one who has done much work in stomach analysis will answer this question in the affirmative, since there are many stomach contents in which the amount of free HCl does not stand in a direct relation to the peptic power, and, as has been shown above, proteolysis may occur even in the complete absence of free HCl. Consequently, as has also been stated by

* [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.—Ed.]

Tschlenoff,* the digestive powers of such stomach contents can only be ascertained with the digestion tests.

[For quantitative estimation of pepsin Hammerschlag † employs Esbach's tubes (such as are used for quantitative estimations of albumen in the urine). Take three portions, 10 c. c. (ʒ ⅓) each, of a 1-per-cent solution of albumen, which is prepared by dissolving the albumen in a 0·4-per-cent HCl solution; to the first portion add 5 c. c. (ʒ ⅙) gastric filtrate; to the second the same and also 0·5 grammes (gr. vijss.) pepsin (this is the standard solution); to the third only 5 c. c. water. Three Esbach tubes are respectively filled with a portion of each solution up to the U mark on the tube, and placed for an hour in a thermostat at 98° F. Then Esbach's reagent is poured into each tube up to the R mark, and the albumen precipitated as usual. After standing 24 hours the amount of precipitated albumen is read off the scale on the tube. The difference between the first and third tubes will give the amount of digested albumen.

When we wish to be absolutely certain about the absence of pepsin and pepsinogen we may use the method proposed by Jaworski.‡ Into the empty stomach about 200 c. c. [ʒ vjss.] of deci-normal HCl solution are poured through a stomach tube, and aspirated after 30 minutes. If the fluid obtained contains no pepsin we may be certain that no ferments are secreted by the stomach (Leo).

These pepsin tests are only of value in diagnosticating total atrophy of the stomach, which is the sole condition in which the ferments are absent.#]

The gastric glands secrete not alone pepsin but also **rennet ferment** (*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

---

* Tschlenoff. Acidität und Verdauung. Schweizer Correspond. Blät., 1891, No. 22.

† [Hammerschlag. Internat. klin. Rundschau, 1894, No. 39.—Ed.]

‡ [Jaworski. Verhandlungen des VII. Congresses für innere Med., 1888, p. 272. —Ed.]

[Oppler (Centralblatt für innere Med., February 1, 1896) has carefully studied the relations of pepsin in different diseases of the stomach. He concludes that the quantitative estimations of pepsin are unnecessary.—Ed.]

of carefully neutralized filtered stomach contents; the mixture is then placed in a warm chamber 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 unncessary. Raw milk is used because it coagulates 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. Coagulation by rennet produces 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 such a 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.†

---

* [Leo. Diagnostik, etc., 2te Aufl., 1895, p. 328.—Ed.]

† 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. xiv, 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.

[Boas* has devised tests for the quantitative testing of both rennet ferment and zymogen. "To test rennet ferment a portion of the gastric filtrate is exactly neutralized, and portions are diluted with distilled water ($\frac{1}{10}$, $\frac{1}{15}$, $\frac{1}{20}$, etc.); 5 c. c. of each of these portions are placed in beakers and 5 c. c. of milk added to each. The mixtures are then placed in the thermostat. It can easily be determined at what dilution the ferment is no longer active.

"Rennet zymogen is tested in a similar way. A portion of the gastric filtrate is made slightly alkaline and portions diluted ($\frac{1}{10}$, $\frac{1}{15}$, $\frac{1}{20}$, $\frac{1}{25}$, etc.). To 5 c. c. of each of these portions 1 c. c. of a 1-per-cent solution of calcium chloride and 5 c. c. milk. The mixtures are placed in the thermostat and the point at which the rennet zymogen is no longer active can then be determined."

Friedenwald† concludes that normally rennet ferment may be present in dilutions up to $\frac{1}{40}$, and the zymogen up to $\frac{1}{150}$. The estimations are of no value when HCl is present, but may be important when free HCl is absent in differentiating cases of anachlorhydria due to severe chronic gastritis or cancer from the cases of nervous anachlorhydria.

Diastase (ptyalin) is another ferment which is constantly present in the stomach contents; it is derived from the swallowed saliva or regurgitated intestinal contents. Its presence may be determined by neutralizing free gastric filtrate and adding a few c. c. to an equal quantity of a thin starch solution. The mixture is placed in the thermostat for 1 or 2 hours. The addition of dilute Lugol's solution will show whether all the starch has been converted into sugar, or whether the intermediate dextrins are present.]

Digestion of Starch and Sugar.—It will be remembered 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 ferment 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

* [Boas. *Loc. cit.*, part i, p. 187.—Ed.]

† [Friedenwald. Medical News, June 22, 1895.—Ed.]

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.# The two important varieties of dextrin are erythrodextrin and

---

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

† According to O. John, Ueber die Einwirkung fetter Säuren auf die Stärkeumwandlung durch den Speichel. Inaug. Dissert., Berlin, 1890. The action of ptyalin is completely checked when lactic acid is 0·5 per cent and butyric acid 1·2 per cent of the total mixture.

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

See Ewald. Klinik, etc., I. Theil, 3te 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.

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 ℥ vj ℥ 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. It seems that a deficiency in the saccharification power of the saliva never occurs. 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. At my request Schlesinger* has made investigations to fill this gap; he made quantitative analyses of the action of the saliva in twenty-five pathological cases, and compared his results with those obtained in healthy persons. He found that the maximum action in health and in disease was about the same; but the minimum action was higher in healthy individuals by about 50 per cent. At all events, it seems that the saliva does not lose its ferment, although pepsin may occasionally be completely absent from the gastric juice, as occurs in the cases of atrophy of the gastric mucosa.

[Kellogg has carefully studied the digestion of starch in the stomach by the determination of the relative amounts of maltose, dextrin, and soluble starch found in the stomach contents. He has found that the average amount of conversion of starch into maltose is 80 per cent, the balance of 20 per cent including dextrin and soluble starch. Much higher percentages of maltose are found in hypochlorhydria than in hyperchlorhydria. His results also agree with those of Ewald, already stated, that the activity of the saliva does not differ in hyperchlorhydria and hypochlorhydria, and hence the differences in the amount of starch conversion are due to differences in the gastric juice. In anachlorhydria starch digestion is usually complete.

The relations of starch digestion are of interest in cases of so-called "buccal or salivary dyspepsia." The name is poorly chosen, but it emphasizes the necessity of attending to the proper mastication of food in many cases of dyspepsia.†]

---

* A. Schlesinger. Zur Kenntniss der diastatischen Wirkung des menschlichen Speichels. Virchow's Archiv, Bd. cxxv und cxxvi, p. 354.

† [Further details may be found in Kellogg's papers in Modern Medicine, February, March and April, 1896.—Ed.]

According to Wright * and Sticker,† the cessation of the action of the saliva upon the stomach is followed by a diminution or stoppage of the secretion of gastric juice; consequently the digestion both of starch and also of albumen suffers on this account. Biernacki ‡ has attributed this to the carbonic acid and carbonates which are present in the saliva and which have a slight stimulating action on the gastric mucosa. It has long been known that reflex relations exist between mastication and the gastric functions; nevertheless numerous cases of gastrotomy after total cicatricial closure of the œsophagus (as, for example, the well-known case of Richet #) prove that the secretion of gastric juice may occur independently of any action of the saliva.

Sugar may always be found in the stomach contents after the various test meals, since a certain amount is contained in them.

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. It is to be noted that stomach contents containing a large amount of HCl which have been taken from the stomach while fasting often have a greenish color, yet no biliary pigments can be demonstrated with the ordinary reagents. [Trypsin, urea, blood, pus, and mucin are also found in the stomach contents.]

[All of the various procedures ought to be done with the stomach contents which are obtained after test meals. To depend exclusively upon vomited matters is often very misleading, and they should only be employed when for various reasons test meals can not be given.

At times important data can be obtained by the *passage of the stomach tube while fasting.* What the stomach contains at this

* Wright. The Physiology and Pathology of the Saliva. London, 1841.

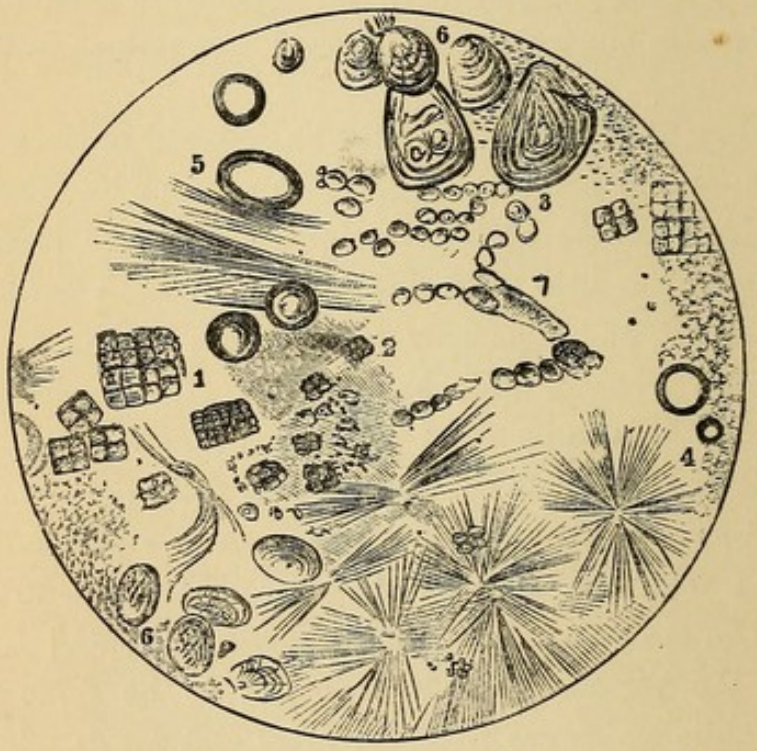
† G. Sticker. Wechselbeziehungen zwischen Speichel und Magensaft. Volkmann's Vorträge, No. 297.

‡ Biernacki. Reviewed in Virchow-Hirsch Jahresber., 1891.

Ewald. Klinik, etc., I. Theil, 3te Auflage, p. 114.

time has already been discussed (page 18). Indeed, the diagnosis of continuous hypersecretion and the prognosis of many cases of lessened motility of the stomach are directly based upon what is obtained by the passage of the tube while fasting. The presence of large quantities (over 60 c. c.— ℥ ij) would seem to be pathological. Occasionally intestinal contents may be found in the stomach while fasting; under these conditions the stomach contents may even be alkaline in reaction.]

[**Microscopic Examination of the Stomach Contents.**—This ought not to be omitted, although the results are very varying and often of no great diagnostic value; yet we may derive benefit from it when least expected. We observe food fragments, starch granules,



[Fig. 6.—Microscopic appearance of stagnating stomach contents. 1 and 2, sarcinæ ventriculi; 3, yeast cells; 4, fatty acid needle crystals; 5, fat droplets; 6, starch granules; 7, partly digested meat fiber. From Riegel.]

plant cells, fat cells, muscular fibers, elastic fibers, and connective tissues; various forms of flat epithelial cells of the mouth and œsophagus; less frequently cylindrical cells from the stomach and leucocytes (Fig. 6). A few red blood-cells are not pathological. Pus cells may also be observed. Parasites are frequently found; these include yeast cells, mold fungi, sarcinæ, bacteriæ, and micrococci. Among the bacteriæ the most important are the lactic acid

bacilli and Oppler's long bacilli, the latter of which seem to occur very frequently in cancer of the stomach.

The exact details of the microscopical appearances in the various disorders of the stomach will be found in the chapters on these diseases.

At times *bacteriological examinations* of the stomach contents may be of service.* Under normal conditions, after giving sterilized food no bacteria will be obtained.]

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 [on an empty stomach] 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.

These statements were first tested and in general confirmed by Boas, and later on by Zweifel ‡ and Haeberlein.# However, Boas ‖

---

* [Turck. N. Y. Medical Journal, November 23, 1895; ibid., February 22, 1896; Medical News, April 4, 1896. Kaufmann. Berl. klin. Wochenschr., 1895, No. 6. —Ed.]

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

‡ Zweifel. Ueber die Resorptionsfähigkeit des menschlichen Magens, etc. Deutsch. Arch. für klin. Med., Bd. xxxix, p. 349.

Haeberlein. Ueber neue diagnostische Hülfsmittel bei Magenkrebs. Deutsch. Arch. für klin. Med., Bd. xlv, p. 347.

‖ Boas. *Loc. cit.*, p. 179.

correctly objects that this test has no specific, differential diagnostic value, as, for instance, between ulcer, cancer, and dilatation of the stomach. The same is true of Sahli's potassium iodide fibrin capsules, described on page 17. At all events, when the absorption is delayed for 60 to 90 minutes some pathological condition must exist. The method therefore enables us to determine gross changes in the absorptive powers of the gastric mucosa.

[Very little practical importance can be placed upon the results of the potassium iodide test, since it has been shown that the results vary when the capsules are taken on an empty stomach or even during various stages of digestion. The brilliant experiments of Von Mering * have shown that gastric absorption is a very complex process, for all substances are not equally rapidly absorbed in the stomach; on the contrary, some substances cause the fluids to move in the opposite direction—i. e., excretion. Thus he has found by experiments on animals with duodenal fistulæ that as much or even more water flows out of the fistula as was given by the mouth and therefore concludes that water is not absorbed by the stomach. These experiments were confirmed by Moritz.† Von Mering also found that alcohol, peptones, sugar, dextrin, sodium chloride, and carbonic acid are absorbed. The amount absorbed increases with the concentration of the solution, but along with the absorption of these substances there is a more or less active excretion of water into the stomach, the amount of which increases with the quantity of these substances absorbed. The excretion of water into the stomach occurs when the presence of HCl in the stomach can not be demonstrated. Thus, unlike what occurs in the intestines, absorption in the stomach seems to be a process of diffusion.

These results are of the utmost importance in the treatment of dilatation of the stomach.

This subject has also been recently studied by Meltzer,‡ who shows how little understood these processes are. His experiments

---

* [Von Mering. Therapeutische Monatshefte, 1893, p. 201.—Ed.]

† [Moritz. Münch. med. Wochenschr., 1893, No. 38; ibid., 1894, No. 41. —Ed.]

‡ [Meltzer's paper, which was read before the May (1896) meeting of the Association of American Physicians, has not yet been published.—Ed.]

demonstrate that the absorptive powers of the stomach have been greatly overestimated.]

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, because the timely evacuation of the chyme into the intestines will compensate for a deficiency in the gastric digestion, while, on the other hand, any lessening of the motility gives rise to a series of well-marked disturbances, the nature of which we will discuss later under motor insufficiency of the stomach.

To show how completely the absolute absence of any true gastric digestion may be compensated by means of good motor functions, I shall cite the following examples:

I had under my observation for four years a gentleman, whom I have since lost track of, whose stomach contents I examined several times yearly, and yet was never able to detect free hydrochloric acid and pepsin. He went to Kissingen every summer, felt tolerably well, ate large dinners, and pursued 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. I have also had a similar experience in a female patient upon whom gastrotomy was performed for carcinoma of the œsophagus. I have published another case which I had watched for three years, and had repeatedly examined at different times after giving various kinds of food. At all times, physiologically active (free and loosely combined) HCl, pepsin, and rennet were absent. In spite of this he felt very well under the systematic use of HCl and gained 46 pounds.

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 the pancreatic juice; albumen may be peptonized at two places, the

* 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; ibid., 1892, No. 26.

stomach and intestines; and fats may be emulsified by the pancreatic juice and bile. The intestines are 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 storeroom and warming place where the food may enter and be admitted to the intestine as through a sluice. Bunge * has also gone too far in asserting that the HCl acts only as an antiseptic, and has no peptic powers in digestion. 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.

The most positive means of determining how soon the stomach evacuates its contents—i. e., the estimation of the propulsive powers of the stomach—are still the methods by which we determine the *duration of digestion*. The best is *Leube's method*, in which we give his test dinner and pass the tube 6 or 7 hours later, when normally the stomach ought to be empty; or, according to Ewald, the stomach ought to be found empty 1¾ to 2 hours after the test breakfast. However, ignoring the fact that the introduction of the tube is necessary, the method is nevertheless not absolutely reliable, because the physiological evacuation of the stomach is subject to many variations, and therefore, at best, we can only use the longest periods as standards. Furthermore, we can never be absolutely certain that the stomach is empty unless after repeated washings, since, as is well known, large residues of food may not infrequently be raised just at the conclusion of prolonged lavage. Finally, absorption as well as motility is involved in this test.

Salol Test.—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

* [Lehrbuch der physiol. und patholog. Chemie, 2te Auflage, pp. 143 *et seq.* Although some of the statements made in this chapter are very radical, they will well repay perusal for the comparative chemistry of the gastric juices in the different species.—Ed.]

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

the pancreas and the intestinal bacteria into salicylic acid and phenol. Dr. Sievers, of Helsingfors, and myself undertook a series of observations which showed that salol is decomposed by relatively feeble alkaline fluids—for example, the saliva—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. This fundamental principle I have again demonstrated recently upon a patient with a gastric fistula, who had a mild degree of hyperchlorhydria, and into whose stomach at the height of digestion salol was introduced through the fistula. Consequently, the statements made to the contrary by Reale and Grande * may be attributed to faulty methods. On the other hand, the question arises whether salol may not be directly absorbed by the gastric mucous membrane and subsequently split up in the tissues. According to experiments made by Stein,† in which salol was introduced into the stomach after double ligation of the pylorus from the duodenum, this may occur when the salol is retained in the stomach for many hours. My experiments, which were not repeated by Stein, and in which the relations of the salol were studied only for the first two hours, showed the contrary. Consequently, the splitting up of salol into 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.

Salol is a white, tasteless powder, which is best given in capsules to prevent any action of the saliva; one gramme [15 grains] is given in three capsules, preferably at the height of digestion. Salicyluric acid is easily recognized in the urine by the violet color produced on the addition of neutral ferric-chloride solution. A simple method is to place several drops 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.

---

* Reale and Grande. Sulla scomposizione del salolo nello stomaco. Rivista clin., October, 1891.

† Stein. Ueber die Verwendbarkeit des Salol zur Prüfung des Magens. Wiener med. Wochenschr., 1892, No. 43.

In the great majority of cases this reaction occurs 60 to 75 minutes after taking the salol. 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. Hence the time of the reaction is subject to variations which some observers consider to be so great as to render the method useless.

Huber * has therefore proceeded in the reverse direction, and 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. Silberstein † experimented with this method on 26 cases of gastric dilatation and 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. [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.]

It is self-evident that the objections which may be raised against the original method also apply to Huber's modification. In my opinion, demands have been made upon the method which are impossible, and which Sievers and myself never claimed for it, since it will only indicate gross changes in the emptying of the stomach. In the experiments of Wotitzky,‡ the average reaction time in gastric disorders was 132 minutes; in various other diseases 69 to 90 minutes. For this purpose it is amply sufficient, and on account of its

---

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

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

‡ Wotitzky. Ueber der diagnostischen Werth des Salols. Prager med. Wochenschr., 1891, No. 31.

simplicity is preferable to Leube's method and Klemperer's oil test.*

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 ℥ 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. Under certain conditions this test may even do harm, since it can not be a matter of indifference to inflict so large a quantity of fat upon a diseased stomach or intestine. [Recently Matthieu ‡ has proposed a modified oil test. Ten grammes of an oil emulsion are given with a test breakfast, the amount of oil obtained after a definite interval being determined by extracts with ether and weighing. The process is too complicated for clinical use.]

[It is no exaggeration to say that the examination of the motor functions of the stomach is equally as important as the testing for HCl. In the zealous pursuit of tests for the latter the motility was much neglected up to a short time ago, when it was recognized how essential it was to know exactly the peristaltic powers of the stomach. The motility may be lessened, as occurs in atony and dilatation of the stomach; or it may be increased, as shown in peristaltic unrest and in hyperkinesis (see Chapter XI). In the former the emptying of the stomach is delayed for varying intervals; in the latter the food leaves the stomach unduly early, the stomach being often found empty three hours after Leube's test dinner.

The general concensus of opinion to-day is that the salol tests

---

* [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.—Ed.]

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

‡ [Matthieu. Boas's Archiv für Verdauungskrankheiten, Bd. i, p. 345.—Ed.]

are too unreliable, and that the best method is that of Leube. Boas has modified this for determining various degrees of stagnation of the stomach contents in atony and dilatation. After cleaning the stomach he gives his *test supper*, which consists of some cold meat, wheat bread and butter, and a large cup of tea. Normally, on passing the tube early the next morning the stomach ought to be empty.

In testing the motility, it is equally important to ascertain the *tone of the muscular fibers.* This may be accomplished with Dehio's method for determining the size of the stomach (*vide supra*); the successive areas of dullness reach down lower than normal on successively percussing the greater curvature (in the upright position) after successively drinking two to three glasses of water (Riegel). In lavage, the force with which the water is expelled or the rapidity with which the fluid enters the stomach is also a good criterion.*

To determine the actual peristaltic power of the stomach, Einhorn has devised his *gastrograph*,† an instrument which is not adapted for clinical use and the utility of which the future can alone determine, as the observations thus far published by Einhorn are not yet sufficient to allow one to draw any conclusions.

The same may be said of Hemmeter's intragastric bags ‡ for obtaining records of the motor functions of the stomach on the kymographion.]

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. I shall refrain from entering into the elementary rules for determining the topography of the stomach, since they may be found in every text-book on physical diagnosis. Moreover, in the description of the various diseases, I shall have many opportunities to speak of percussion, auscultation,

---

* [A good discussion of this subject will be found in Kaufmann, N. Y. Medical Journal, March 28, 1896.—Ed.]

† [Einhorn. N. Y. Medical Journal, September 15, 1894; Zeitschr. für klin. Med., 1895, Bd. xxvii, p. 242.]

‡ [Hemmeter. N. Y. Medical Journal, June 22, 1895.—Ed.]

inspection, etc., so that I shall now restrict myself to the following points:

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. 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 very gently 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 know, 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.

I also wish to direct attention to two points which may easily lead

to doubt and error, and upon which, so far as I know, sufficient stress has nowhere been laid. The first point is concerning *palpation of the pancreas.* Normally, the pancreas lies behind the stomach, being covered by the lesser curvature, above which it projects a little. Usually, and especially when the stomach is filled with food, it can not be palpated. It is different, however, when the abdominal parietes are emaciated and relaxed, the stomach empty, and its walls thin. Then an indefinite tumor may be palpated in the epigastric region; it may be differentiated by a very careful determination of the borders of the liver, by its absolute immobility, by its deep situation, by its flat and extended shape, by distending the stomach, and by the absence of any symptoms which might indicate a neoplasm. Its recognition is much more difficult when the stomach is dislocated downward, as occurs in gastroptosis; here the pancreas lies uncovered to a greater or less extent *above the lesser curvature.* After distending the stomach, the suspected tumor may be demonstrated above the lesser curvature in the hollow formed by the inner half of the right costal border, the ensiform process, and the lesser curvature; it may be felt much more readily as the latter sinks more and more toward the umbilicus, the level of which it actually reaches in extreme cases. Under these circumstances we feel a smooth, transversely situated, immovable band, which feels like a piece of contracted gut lying transversely over the vertebral column, and which is tender on pressure, evidently the result of irritation of the nervous plexus. But careful exploration and a knowledge of the pathological conditions will prevent any errors.

The second point is the following, which may at times cause much more confusion. *A lymphatic gland* lies at about the middle of the greater curvature, not in the wall of the stomach, but in the gastro-colic ligament. In inflammatory conditions within or about the stomach this gland enlarges and may become palpable, especially when the stomach, as the result of an axial rotation, is pressed more closely than usual against the abdominal parietes. It may then at times be palpated as a small, movable tumor, about the size of a hazelnut or walnut, and which can be shown to belong to the stomach by inflation of the latter (or at times the colon). It disappears or becomes less distinct when the stomach sinks backward, when

the patient lies on his back, or when the intestines rise in front of the stomach. Furthermore, it may become smaller when the original inflammatory process abates and can then no longer be palpated. I must confess that, until I had convinced myself of these conditions at autopsies, I have been very much worried by certain obscure cases and have occasionally made an incorrect diagnosis of carcinoma. Hence the importance of laying stress upon this point.

On the other hand, I need scarcely caution against the error which is not infrequently committed by novices, of mistaking for a tumor the pulsating aorta which often seems to lie just under the abdominal parietes, when the latter are much sunken in and the vertebral column somewhat arched forward; in such cases it has been supposed that the pulsations are due to transmission to the suspected tumor from the underlying aorta, whereas it was only the vessel itself which was felt. [See also beginning of Chapter VI.]

2. **Distention of the Stomach with Carbonic-Acid Gas or 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 and Rosenbach).† 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. [A teaspoonful of sodium bicarbonate

---

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

† Schnetter. Zur Behandlung der Darmverschliessungen. Deutsch. Arch. für klin. Med., Bd. xxxiv, S. 638.—Rosenbach. Berl. klin. Wochenschr., 1890.

and three quarters of a teaspoonful of tartaric acid are each dissolved in half a tumblerful of water; the tartaric-acid solution is given first, and immediately after it the sodium bicarbonate. Riegel, Osler, Meinert, and many others have never seen any bad effects from this method, which certainly has the great advantage of dispensing with the stomach tube. Should the results be unsatisfactory we can always resort to the inflation of air.] For these reasons it is better to use the method 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 bulb 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 correctly: "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

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

† Oser. Die Neurosen des Magens. Vienna, 1885, S. 10.

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. Inflation of the stomach and intestines may be combined. Behrens ‡ has 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 and stenoses of the lower portion of the intestine, the air is soon expelled, together with foul-smelling gases. This feature I have repeatedly found in cases of compression of the descending colon by a neoplasm. If we auscultate the abdominal walls, preferably with a binaural stethoscope, while the air is being pumped in, we can accurately follow the advance of the air in the various portions of the intestines.

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.,

* 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.

Penzoldt. Die Magenerweiterung. Erlangen, 1877.

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. [Chapter VI]. In this connection I wish to make some remarks upon **the determination of the situation and size of the stomach.**

A sufficiently good guide for the *situation of the stomach* is the greater curvature; normally, in men, when the stomach is moderately distended, it crosses the median line at about the beginning of the lower third of the xipho-umbilical line—i. e., the distance between the xiphoid process and the umbilicus; in women, it crosses at the middle of this line; * in either case it is above the umbilicus. It is immaterial whether this is determined by inflating the stomach with air or carbonic-acid gas to map out the area of tympanitic resonance, or by gradually filling the stomach with water to obtain the lower zone of dullness which separates it from the air-filled transverse colon; it is also immaterial whether these procedures are carried out while the patient is recumbent or standing up (preferably with the body bent forward), or whether ordinary or auscultatory percussion is employed.† The differences which are obtained with these various methods are always less than the great individual variations in the situation and size of the stomach; it is sufficient to remember that the greater curvature ought to lie above the umbilicus. In a careful study of 81 persons, in which, unfortunately, those having gastric disorders have not been separately classified, Pacanowski ‡ found that the distance of the lower border of the stomach above the umbilicus in the left parasternal line was 3 to 5 centimetres [$1\frac{1}{5}$ to 2 inches] in men and 4 to 7 centimetres [$1\frac{3}{5}$ to $2\frac{4}{5}$ inches] in women; when the stomach was moderately distended with carbonic-acid gas the distance between the highest and lowest point in the zone of tympanitic resonance was between 11 to 14 centimetres [$4\frac{2}{5}$ to $5\frac{3}{5}$ inches] in men and only 10 centimetres [4

* H. Pacanowski. Beitrag zur percutorische Bestimmung der Magengrenzen. Deutsch. Arch. für klin. Med., Bd. xl, p. 342.—P. Predazzi. La percussione dello stomacco. Rivista clin., 1890, No. 1.—G. Kelling. Ueber die Ermittelung der Magengrösse. Inaug. Dissert., Leipzig, 1890.

† Obrastzow. Zur physikalischen Untersuchung des Magens und Derms. Deutsch. Arch. für klin. Med., Bd. xliii, p. 417. See Chapter VI for discussion on changes in the percussion in displacements of the stomach (Kernig).

‡ *Loc. cit.*

inches] in women; the greatest width of the tympanitic zone was 21 to 18 centimetres [$8\frac{2}{5}$ to $7\frac{1}{5}$ inches] respectively. On the other hand, the greater curvature was several centimetres below the umbilicus in a case of gastrectasis and one of atony, and consequently the results were different from the figures given above.

My own observations agree quite well with these results, although, on an average, I have found the distance between the greater curvature and the umbilicus to be somewhat less—i. e., usually between 2·5 to 4 centimetres [1 to $1\frac{3}{5}$ inches]. At all events, it may be accepted as a rule that pathological conditions exist when the greater curvature lies at or below the umbilicus. The same is true of the method proposed by Pradezzi and others to use the intersection of the ninth rib and the left mammillary line as a guide for the greater curvature, as it is claimed that it is normally subject to fewer variations.*

Downward displacement of the lower border, however, does not necessarily indicate an increase in the size of the stomach, since the same thing occurs in downward dislocation of the stomach (*gastroptosis* or *descensus ventriculi*) or when the stomach assumes a more or less vertical position, so that the course of the greater curvature is almost parallel with the left border of the body.

Both of these conditions will be revealed by distention of the stomach. In gastroptosis the organ looks like a distended air cushion which lies across the middle of the abdomen. Superiorly it is flattened out on a concave line which represents the lesser curvature; above this, in the epigastric region, there is a depression which gives a dull note on percussion, and in which, as stated above, the

---

* As the result of a series of very careful investigations, Obrastzow (*loc. cit.*) comes to the conclusion that the situation of the lower border of the stomach is directly dependent upon the build and general nutrition of the individual. The better these are, the higher will the greater curvature lie; while the poorer these are, and the older the individual, the nearer it will approach the umbilicus. In men as well as in women it may usually be found in the lower third of the xipho-umbilical line. It is displaced downward by pregnancy, diseases in which the diaphragm is pushed downward (emphysema, pleuritis, and pneumothorax), and enlargement of the liver and spleen. The reverse is true of the diseases which lessen the capacity of the abdominal cavity. *Acute and chronic diseases of the stomach* (excepting gastrectasis from whatever cause) *have no influence upon the situation of the lower curvature.*

pancreas may at times be palpated. Inferiorly, the greater curvature may be distinguished below the umbilicus as a curved line with its convexity downward. Transillumination of the stomach (*vide infra*) will corroborate this. In gastroptosis, the volume of the stomach, as a rule, remains normal; but, according to my experience, when the stomach is vertical a dilatation is always present. This is well shown in the accompanying drawing (Fig. 7). In such

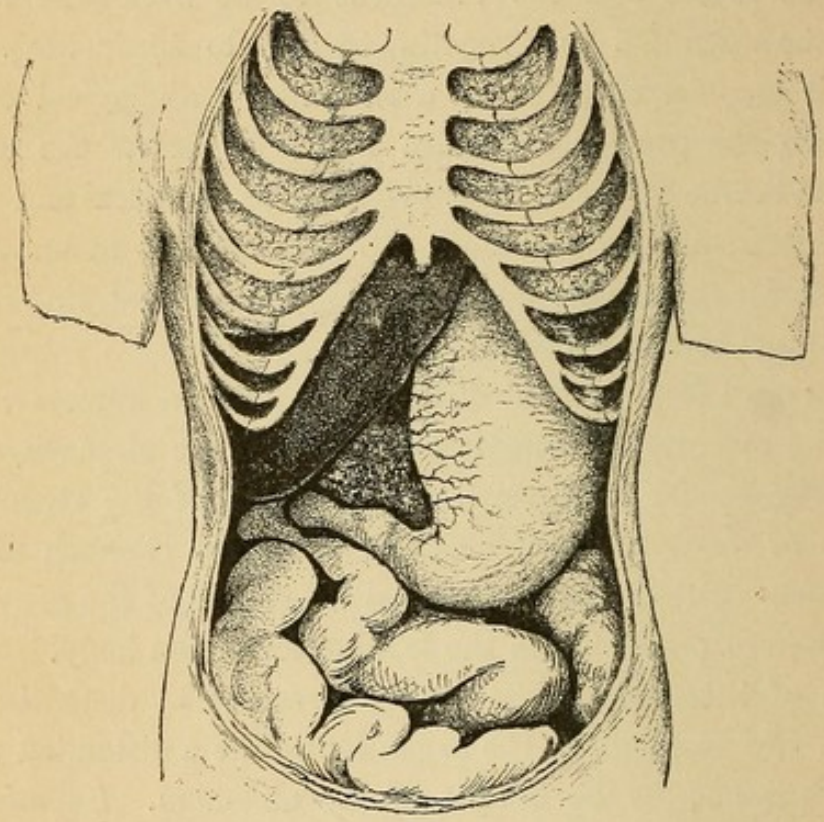


Fig. 7.—Vertical situation of stomach and exposure of the body of the pancreas. In this case the dilatation is only moderate; in other cases it may be so marked that the greater curvature reaches the symphysis.

cases the lesser curvature may be seen near the middle line, or even to the left of it, while the zone of gastric tympanites may fill the entire left side of the abdomen; consequently there can be little doubt as to the size and situation of the viscus.

The absolute size of the stomach is subject to very great differences, even under normal conditions, which are independent of the height of the individual.

I have 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.*

One can most thoroughly be convinced of the well-known fact of the variations in form and size of the stomach by noting that

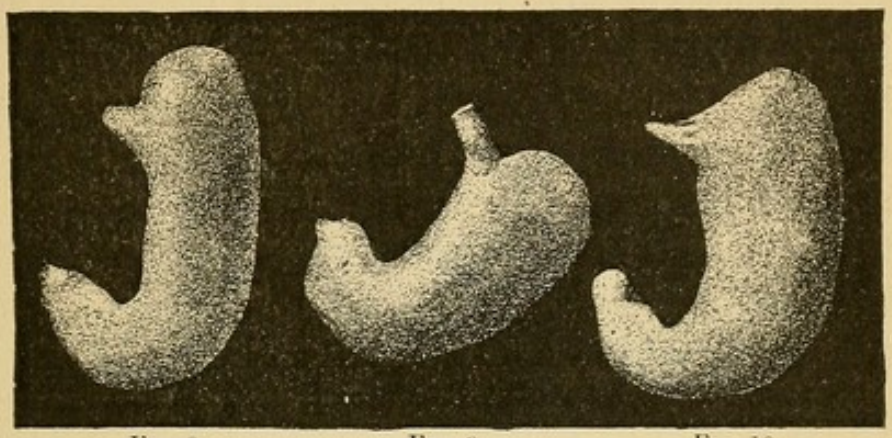
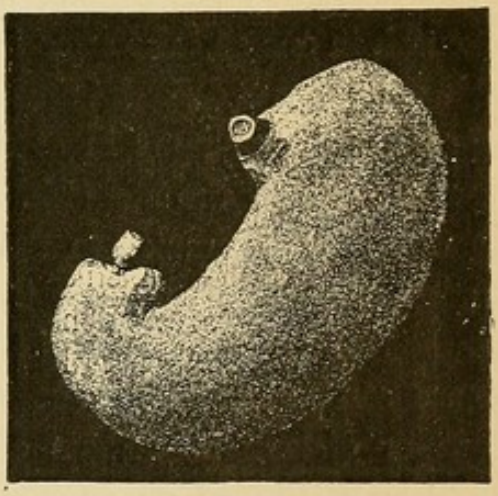


Fig. 8. Fig. 9. Fig. 10.

[Fig. 8.—Cast of cylindriform stomach in vertical position. Female. Ziemssen.]
[Fig. 9.—Cast of normal stomach. Female. Ziemssen.]
[Fig. 10.—Cast of dilated stomach in vertical position. Female. Ziemssen.]

eight or ten other models differ a great deal, although all of them were made 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, indeed, 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 portion lying below the pylorus) [see Fig. 10, *a*] has almost caused the viscus to assume the shape of an hourglass. 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



[Fig. 11.—Cast of a markedly dilated stomach tending to assume vertical position. Female. Ziemssen.]

* [Figs. 8, 9, 10, and 11 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.—Ed.]

stomach held 1,680 c. c. [f ℥ xlvj],the smallest only 250 c. c. [f ℥ viij]; between these limits we find all possible variations.

From this it can be inferred 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*, so that clinically one can only speak of a dilatation under the restrictions to be mentioned later on [see Chapter VI].

But it is very easy to determine the capacity of the stomach in the living subject and without distending it with water; it may be done at the same time when we inflate the stomach with air to ascertain its situation. We first learn the size of the compressing bulb of the double bulb of a spray apparatus,* and then count the number of times we must compress the bulb until the patient indicates that the pressure of the air upon the gastric walls is painful, and can thus easily calculate the volume of air which has been inflated.

Unfortunately, however, researches which have been made under my direction by Dr. Kelling have shown that the capacity of the stomach in one and the same individual is subject to quite considerable variations at different times; or, in other words, varying amounts of air must be pumped in at different times to produce the same pressure within the stomach. This may easily be ascertained by attaching a manometer to the stomach tube and double bulb by means of a T tube; we can thus determine in each case how much air had to be pumped in in order to obtain the same pressure, or we can ascertain at what pressure each patient complained of pain or distention. These experiments, which it is self-evident must be performed on an empty stomach, have naturally had very varying results, because the factors upon which they depend—

* This calculation is most readily made thus: A tall, graduated cylinder of about 200 c. c. [℥ vjss.] is filled to the edge with water, is covered air-tight with the palm of the hand, and is inserted in a vessel of water. The tube of the double bulb is placed under the inverted cylinder; on compressing the bulb, the air will rise in the cylinder and will displace as much water as represents the capacity of the compression bulb. This simple procedure can be carried out at any druggist's shop. The bulbs which I usually employ hold about 150 c. c. [℥ v].

namely, the tone of the gastric muscular fibers, the situation and fullness of the intestines, the tension of the abdominal walls —are different at different times.* However, the results obtained with inflation will always enable one to determine whether the stomach is small or large or abnormally large, or whether it is at the same time displaced. [For further details, and exact methods as to size and situation of the stomach, see Chapter VI on Dilatation of the Stomach, and Chapter XI on Gastroptosis.]

Finally, the stomach may be so small that it may not be demonstrable, and may eventually completely disappear behind the costal border or left lobe of the liver. This may occur either in total carcinomatous degeneration of the stomach, which may be so extreme that the organ looks like a loop of intestine, or in obstruction of the œsophagus when the stomach does not have the normal stimulation from the food, and hence contracts itself as much as possible. The accompanying figure (Fig. 12) is a typical example of this condition which was found in a case of œsophageal carcinoma.

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

---

* [These results have been disclaimed by Kelling. Volkmann's Sammlung klinische Vorträge, No. 144, February, 1896, p. 29.—Ed.]

† Ewald. Klinik der Verdauungskrankheiten, I. Theil, 3te Auflage, pp. 67–70. [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.

These sounds were first mentioned in 1864 by Natanson, and were carefully

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

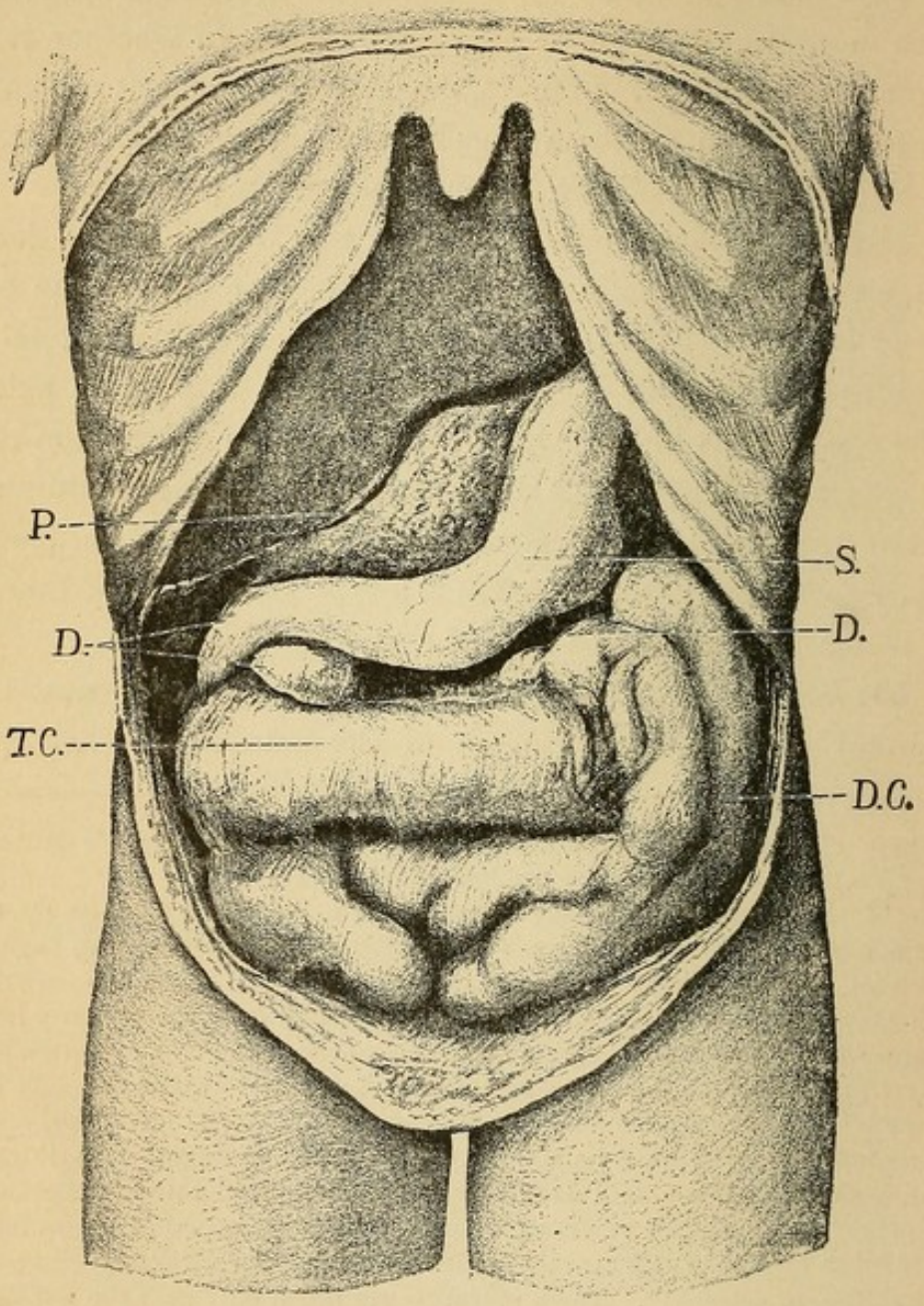


Fig. 12.—Contraction of the stomach in a case of cancer and stenosis of the œsophagus.

cardia, and occurred as a specific symptom of old syphilis, phthisis accompanied by mild vomiting, neuroses of the cardia, etc. The

studied by Zencker and also by Meltzer. The literature of the subject may be found in Ewald, *loc. cit.*, p. 92.—Ed.]

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

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 [and Rosenheim]—**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 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.

---

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

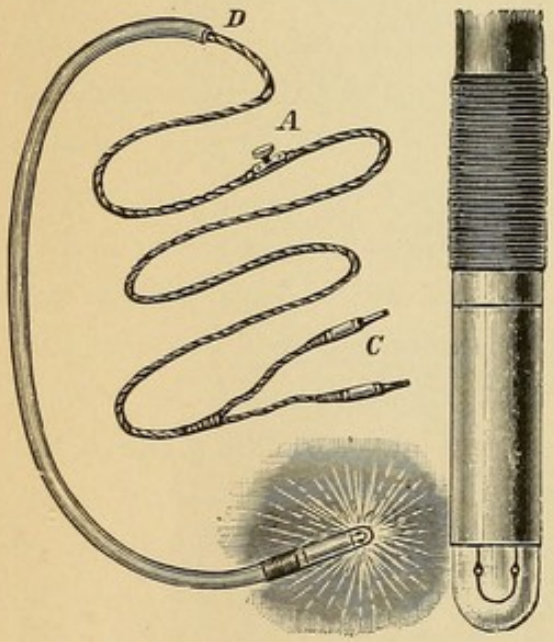
† Wiener med. Wochenschrift, 33te Jahrgang, S. 748.

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

[Rosenheim * has devoted much time to perfecting the gastroscope, and has devised two instruments for this purpose. He claims that this method is of great service in the early diagnosis of cancer; but, as he himself admits, this method is adapted only for few cases, as much experience and time are required to use the instrument.

It may be of interest to note that the interior of the stomach has also been photographed by Kuttner.†]

6. The **gastrodiaphane,** which was first suggested by Einhorn,‡ and later by Heryng and Reichmann,# is an entirely different instrument from the gastroscope, since the main object of the procedure is to transilluminate the gastric and abdominal walls. This is most readily accomplished with Einhorn's instrument [Fig. 13], which consists of a flexible rubber stomach tube, at the end of which is a small Edison incandescent light about the size of a small hazelnut. The conducting wires run through the tube and are connected with a switch after they leave it; the lamp is made of strong crystal glass. There is little danger of overheating the lamp, as the stomach must contain some water before the instrument is introduced, and, furthermore, the current need be turned on but for a very short space of time. [The instrument should be introduced on an empty stomach, or the stomach should be washed out if it contains food. One or two glasses of water are taken before inserting the



[Fig. 13.—Einhorn's gastrodiaphane.]

* [Full details on this subject will be found in Rosenheim's Krankheiten der Speiseröhre und des Magens, 2te Auflage, 1896, pp. 559–578.—Ed.]

† [Kuttner. Deutsch. med. Wochenschr., 1891, p. 1311.—Ed.]

‡ Einhorn. Ueber Gastrodiaphanie, N. Y. med. Monatschr., 1889; Berl. klin. Wochenschr., 1892, No. 51.

Heryng und Reichmann. Ueber electrische Magen- und Darmdurchleuchtung. Therap. Monatshefte, March, 1892.

instrument. Kuttner and Jacobson recommended taking 2 to 3 pints.] The examination is best conducted in a darkened room [and in the standing position]. If *the abdominal walls are sufficiently translucent*—which, unfortunately, is too frequently not the case—brightly illuminated or rather transilluminated areas will be seen upon the abdominal walls. These areas have various sizes and situ-

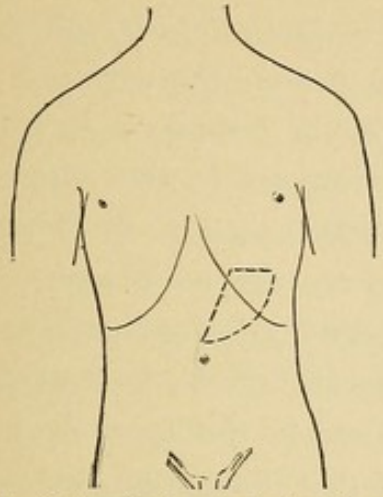


Fig. 14.—Gastrodiaphanic picture in normal stomach.

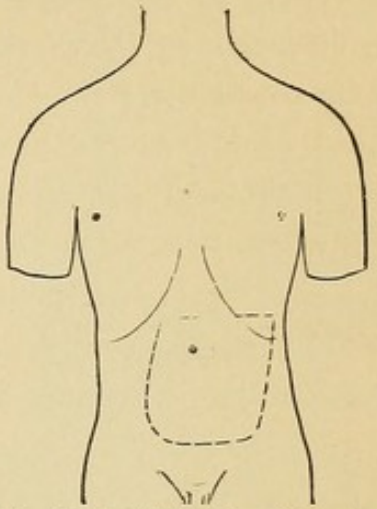


Fig. 15.—Gastrodiaphanic picture in dilated stomach.

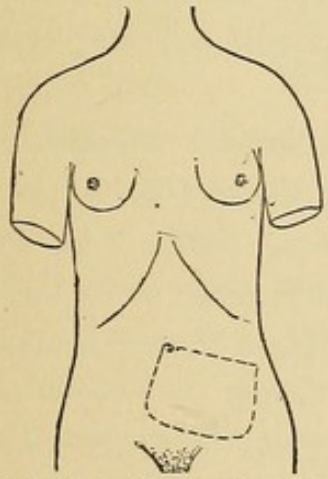


Fig. 16.—Gastrodiaphanic picture in gastroptosis.

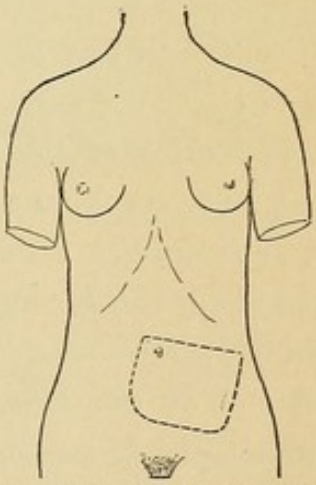


Fig. 17.—Gastrodiaphanic picture in gastroptosis.

ations, as may be seen in the accompanying figures (Figs. 14 to 17), which have been reproduced from Einhorn's paper, and may have some diagnostic value.

An extended use of this method will be precluded by the difficulties incidental to the nature of the apparatus and obtaining the requisite electricity, and especially by the fact that these diagnostic results may be reached by our ordinary methods.

[This method has been carefully studied by Kuttner and Jacobson, Pariser, Meltzing, Martius, Meinert, and Kelling.* Kuttner and Jacobson claim that the form and situation of the transilluminated area is not alone sufficient to make a differential diagnosis between dilatation and displacement of the stomach. They lay stress upon the absence of respiratory changes in diagnosticating the latter. This is denied by Meltzing; this observer also found that the size of the stomach as shown by transillumination is larger than is shown by percussion; thus he claims that even the empty stomach may reach as low as the umbilicus. Kelling shows that the illuminated area need not necessarily correspond to the part of the stomach which it overlies, for it may be too small if filled coils of intestines intervene, or if the lamp is too far removed from the abdominal parietes; or it may be too large if adjacent empty coils of intestines are also transilluminated. He also shows by experiments on the cadaver that the light may penetrate the transverse colon obliquely, and thus lead one to suppose that the empty stomach was at the umbilicus, while in reality it was behind the liver.

Furthermore, the diagnosis of tumors in the anterior wall of the stomach, as claimed by Einhorn, is considered doubtful by Riegel † and others.]

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

* [Kuttner und Jacobson. Berl. klin. Wochenschr., 1893, Nos. 39 and 40.—Pariser, ibid., 1892, No. 32.—Meltzing. Zeitschr. für klin. Med., Bd. xxvii, Heft 3 und 4.—Martius. Centralbl. für innere Med., 1895, No. 49.—Meinert, ibid., 1895, No. 49.—Kelling. Volkmann's Sammlung klinische Vorträge, No. 144, February, 1896, p. 16.—Ed.]

† [Riegel. Krankheiten des Magens, 1896, p. 37.—Ed.]

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 Rosenheim's douche, described on page 7, or 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. 18) on the floor 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. The water escapes from the various openings in the tube as from a sprinkler, so that, by

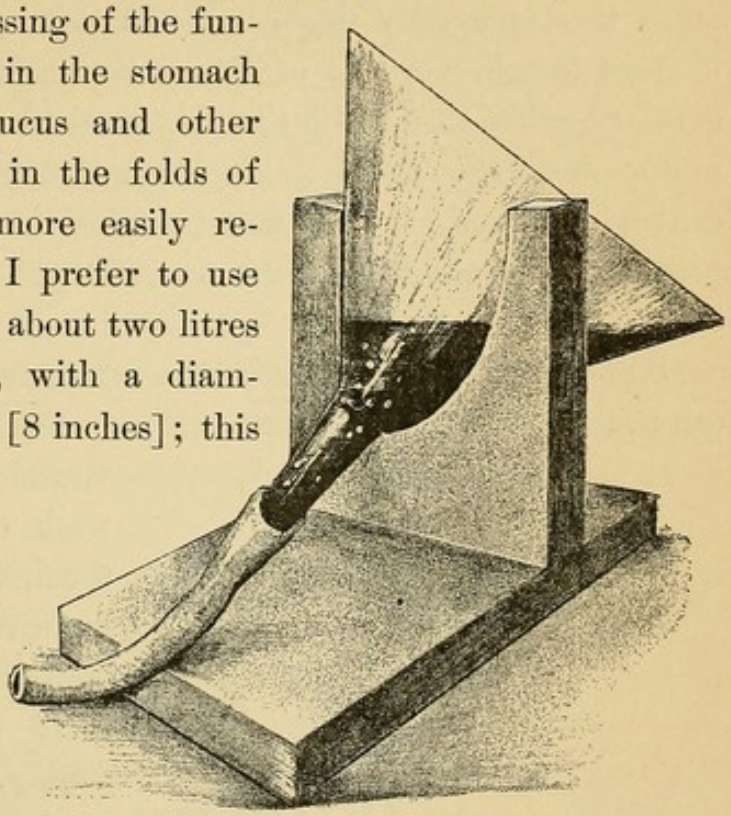


Fig. 18.—Stand for holding funnel of stomach tube.

* [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. It is quite important to select the proper rubber tubing for this purpose. The best kind is pure gum tubing, the caliber of which is slightly larger than that of the stomach tube. The advantages of this tubing are, that by stripping the tube outward we may obtain sufficient aspiration to start the siphonage; or, if the tube is plugged, we may often dislodge the obstruction by stripping the tube in the reverse direction. These minor but nevertheless important details of the use of the tube I have discussed in the Technique of Obtaining Stomach Contents, New York Polyclinic, August, 1894.—Ed.]

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. [To allow the fluid to accumulate in the funnel before throwing it away into a pail is a point that is usually neglected. In this way exfoliated pieces of mucous membrane, bits of tumor tissue, blood clots, etc., may be obtained, when under the ordinary method they would doubtlessly escape observation]. 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. 19] 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 stopcock * 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

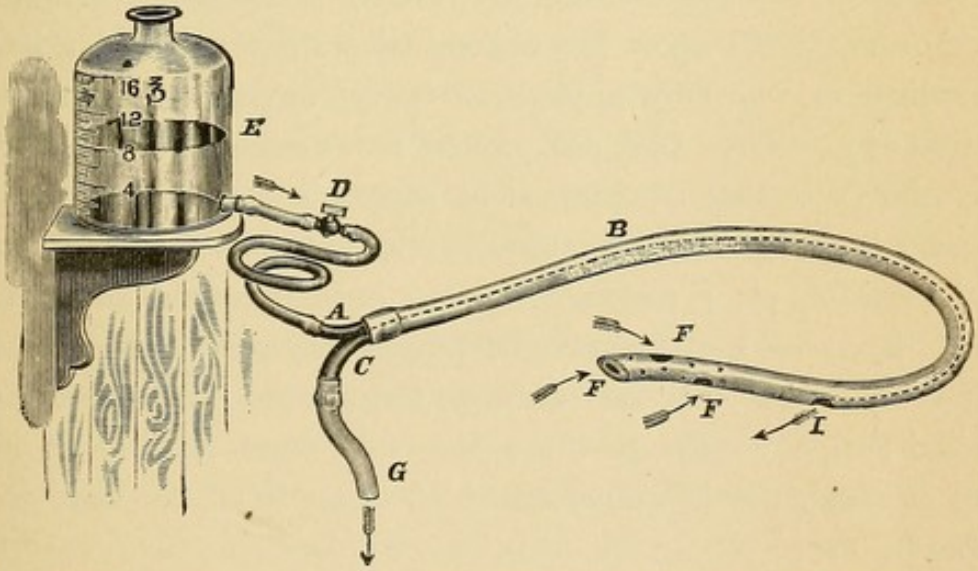


[Fig. 19.—From Pepper's System of Medicine (after Leube).]

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

has previously been filled and placed at a suitable height; the tube is introduced into the stomach while the stopcock 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 stopcock 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 stopcock 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. Numerous cases of this kind can be found reported, especially in French literature.

[Recently a number of instruments have been devised for lavage of the stomach. Of these I shall only mention Hemmeter's recurrent tube* and Turck's "pneumatic force irrigator."† Hemmeter's



[Fig. 20.—Hemmeter's recurrent stomach tube for continuous lavage.]

apparatus (Fig. 20) consists of a large glass jar, *E*, which is connected with the stomach tube by means of a hard-rubber attachment, *A* being the inlet and *C* the outlet. The stomach tube consists of one tube within the other, the inlet tube being shorter than the outlet tube. The water flows along *B* and enters the stomach at *I*; it

* [Hemmeter. N. Y. Medical Journal, December 28, 1895.—Ed.]
† [Turck. Medical News, March 21, 1896.—Ed.]

escapes by a number of openings at *F*, and is conducted to a pail by *G*.

Turck's instrument is a complicated apparatus for using hot and cold water alternately as a needle douche for the stomach.]

If one desires to *spray* the interior of the stomach in the hope of thus getting special results, Einhorn's gastric spray* may be used. It consists of a specially constructed recurrent stomach tube with a spray tip, which is attached to the hard rubber tube of the spray apparatus. It is to be introduced into the empty stomach. I fail to see how any special benefits can be obtained from it. [Einhorn uses this instrument for producing disinfection, astringent effects, and analgesia. Benedict† uses a menthol spray through the stomach tube in fermentative, painful, or catarrhal conditions.]

Electricity may be applied to the stomach either by placing 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. It is not proven that contraction of the gastric muscular fibers may be obtained by percutaneous faradization. The immediate effect is only a contraction of the abdominal muscles, the recti, obliqui, etc.; pressure is thus exerted upon the stomach, which, however, would hardly be interpreted as a true contraction of the stomach. On the contrary, the gastric contents are compressed; this occurring while the sphincters are closed might even produce the injurious effect of distending the walls of the stomach.

Hence it is much better to stimulate the gastric muscular fibers directly. The old stomach electrodes had the disadvantages of being difficult to introduce, and of causing the patient much discomfort if they were kept in place for a long time. Einhorn# has

---

* Einhorn. N. Y. Medical Journal, September 17, 1892.

† [Benedict. International Medical Magazine, September, 1894.—Ed.]

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

Einhorn. New Method for Direct Electrization of the Stomach. N. Y. Medical Record, May 9, 1891, p. 530. [Also, Therapeutic Results of Direct Electrization

partly remedied these defects with his deglutable electrode. It consists of an ovoid perforated hard-rubber capsule about the size of an almond; within is a button electrode of copper or brass which is connected with a very delicate wire covered with a fine rubber tube. The accompanying drawing (Fig. 21) represents 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 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, the walls of which are 1½ millimetres [·06 inch] thick, something like a Nélaton catheter, No. 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.

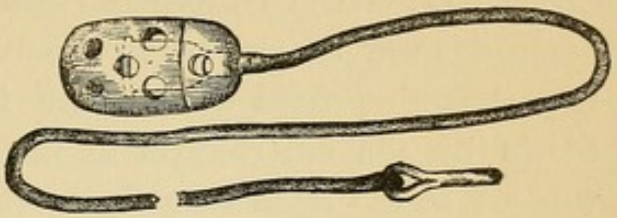


Fig. 21.—Deglutable stomach electrode.

[Although Einhorn in his various papers states that he has absolutely no trouble in introducing his electrode, yet I must confess that my experience agrees with that of Ewald. My own method of overcoming the difficulty is to take a braided silk œsophageal bougie, No. 10 or 12 F., cut off the top, and draw the insulated wire through the hollow bougie after having flattened the connecting end piece of the electrode. Such electrodes are very readily introduced and are easily borne by the patients. It is very important to ascertain beforehand whether the capsule is firmly attached to the electrode, since the conducting wires are so thin that they break very readily. It has once happened to me that the capsule broke off inside the stomach. No harm was

of the Stomach, ibid., January 30 and February 6, 1892. N. Y. Medical Journal, July 8, 1893.—Ed.]

done, as the capsule was passed in the fæces on the following day.

Stockton * has devised a very useful gastric electrode. Turck † has modified his gyromele so that it may be used as a bipolar gastric electrode. Wegele's electrode ‡ is a thin spiral wire tipped with a small knob; it can be introduced through an ordinary stomach tube.]

In this way we can at any moment ascertain whether the current is passing from the stomach to the abdominal parietes, as shown by the contractions of the latter. The only question is whether at the same time there are also active contractions of the stomach. I have recently made experiments on a woman with a gastric fistula to demonstrate this. A small electrode and the tube of a manometer were introduced into the fistula, and the current closed by placing an electrode on the sternum. Each time the current was closed the fluid in the manometer rose, proving that pressure had been exerted on the contents of the stomach. However, there was always a simultaneous although slight retraction of the abdominal muscles; it was not certain whether this was due to an active contraction, or whether it was caused passively on account of the adhesions to the abdominal walls, left after the operation on the stomach. The experiment was therefore repeated on a patient with atony of the stomach. A thin manometer tube was inserted into the stomach *per os* alongside of the electrode. Here also there was a distinct increase of pressure, although there was no contraction of the abdominal muscles. There can therefore be no doubt that the muscular fibers of the stomach are directly stimulated by the intragastric faradization, and that the same beneficial effects are produced upon them which we know occurs elsewhere after faradization. At all events, I am well satisfied with the results obtained in quite a large number of patients whose condition was susceptible of improvement. Baraduc # is almost extravagant in his praises of "électrization interstomacale et la galvanisation du grand sympathique au cou."

---

* [Stockton. N. Y. Medical Journal, July 30, 1892, p. 138.—Ed.]

† [Turck. Medical News, February 29, 1896, p. 240.—Ed.]

‡ [Wegele. Therapeut. Monatshefte, April, 1895.—Ed.]

Baraduc. Journ. de la Société scient., 1891, No. 10. p. 97.

Before introducing the electrode the patient must drink one or two glasses of water, or, if the stomach is much dilated, it is filled with water through the tube. The current of electricity is thus conducted through the water to all parts of the stomach which are submerged.

The entire digestive tract may be electrized by having one electrode in the stomach and the other in the rectum, the an 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 with a moderate dilatation of the stomach, I have obtained surprising results, but in others none whatever.

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. According to Allan A. Jones,‖ an increase of the secretion of HCl can not always be demonstrated on human beings. Regnard and Loye ^ observed the same thing in an executed criminal whose vagi were stimulated by an electric cur-

---

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

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

‖ A. A. Jones. The Influence of Direct Electrization upon Gastric Secretion. N. Y. Medical Record, vol. xxxi, p. 677.

^ Quoted by Von Ziemssen, *loc. cit.*

rent 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 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, Stockton* [Einhorn, Brock†], and others. Even Von 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. 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. I have had excellent results in patients with nervous anorexia, and can also report good effects upon the movements of the bowels. Unfortunately the results of electric treatment are very variable and inconstant; thus 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.

[Although, as shown above, much clinical evidence has been accumulated as to the beneficial effects of electricity applied to the stomach, both by the direct and the percutaneous methods, yet the *modus operandi* is still a matter of great doubt. Thus, what is true

---

* Stockton. A New Gastric Electrode. N. Y. Medical Record, November 9, 1889. Clinical Results of Gastric Faradization. Amer. Jour. Medical Sciences, July, 1890.

† [Brock. Therapeut. Monatshefte, June, 1895.—Ed.]

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

of electrical therapeusis in other parts of the body is also true of the stomach. That much is taken for granted without sufficient proof has recently been shown by Meltzer in a most admirable paper.* In a series of unimpeachable experiments on dogs, cats, and rabbits, Meltzer has shown that the mucous membrane of the stomach and small intestines offer an almost insurmountable barrier to the passage of the faradic current.

Meltzer maintains that there is no positive proof of the generally accepted assumptions that percutaneous electrization of the stomach and intestines produces a contraction of these viscera, and that stimulation of the mucous membrane of the stomach is the most direct and safest way to effect its contraction. In his experiments, for the details of which I would refer the reader to his paper, Meltzer shows that not even all parts of the stomach of animals respond to direct faradization, and that the response is greater as we approach the pylorus. As for direct faradization of the stomach, even with the strongest currents, his experiments prove that although contractions may be obtained in some parts of the stomach when both electrodes are applied on the outside of the viscus, yet there is absolutely none when one electrode is inside and the other outside of the viscus or on the shaved skin above it. The same negative results were obtained when the stomach was filled with a saline solution and the electrode submerged, and even pressed against the mucous membrane, the other electrode being placed on the outer surface of the stomach or on the abdominal wall. Meltzer almost demonstrates that in the percutaneous methods the contractions are obtained with the abdominal muscles, but none whatever in the stomach itself. Similar experimental results were obtained by Moritz.†

As Riegel‡ properly urges, these results on small animals under anæsthesia can not be applied directly to human beings with gastric disorders; hence he would prefer clinical evidence rather than depend upon experimental data alone. Yet the experiments made by

* [Meltzer. An Experimental Study of Direct and Indirect Faradization of the Digestive Canal in Dogs, Cats, and Rabbits. New York Medical Journal, June 15, 1895.]

† [Moritz. Münch. med. Wochenschr., 1895, No. 49.—Ed.]

‡ [Riegel, *loc. cit.*, p. 306.—Ed.]

Goldschmidt* on normal subjects, and also on two patients with dilatation of the stomach with lessening of the motor functions, agree entirely with the negative results obtained by Meltzer.

Concerning the effects of electricity on absorption and secretion there is still much doubt.

The conclusions of Goldschmidt * give a very good idea of the present views as to the value of direct electrization of the stomach: 1. Direct (i. e., intragastric) galvanization is an excellent means for combating gastric neuroses; it is also serviceable in organic disorders. 2. There is no marked difference between direct galvanization and faradization; and yet galvanization (anode in stomach) is preferable in painful affections, faradization being better for functional disturbances. 3. The actual way in which electricity acts is still obscure.]

At this place I might also speak of the gymnastics of the abdominal organs, and of *massage and the hydriatic treatment 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.

---

* [Goldschmidt. Deutsch. Arch. für klin. Med., Bd. lvi, Heft 3, 4.—Ed.]

CHAPTER III.

STENOSES AND STRICTURES OF THE ŒSOPHAGUS AND OF THE CARDIA.

Disregarding the obstructions situated higher up in the mouth and throat, 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 œsophagus and the entrance to the stomach—the *mouth* or *cardia*—may be obstructed in various ways, and the swallowed food thus more or less impeded in entering the stomach.

Only the chronic conditions will be considered here, while the acute inflammatory affections, which may produce a temporary obstruction of the œsophagus, such as catarrhal, diphtheritic, phlegmonous, pustular, corrosive, and ulcerative œsophagitis, will only be discussed in so far as their consequences may result in a permanent narrowing of the lumen of the œsophagus. Therefore the conditions under discussion include strictures and stenoses due to *cicatrices*, *neoplasms*, *diverticula* and *spastic contractions of the œsophagus*.

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 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 undigested and only mingled with saliva and mucus, should the lower sections of the œsophagus be the seat of peristaltic contractions, or should they be compressed from without by coughing, etc. A patient of mine who had a carcinoma in the lower third of the œsophagus has written an excellent description of this condition.

The food which has been eaten—especially meat, potatoes, and bread—seems to stick above the stomach, the entrance to which appears to be narrowed. I frequently experience a sensation going up and down the œsophagus as if gases were ascending to the level of the sternum and then descending. Then I must swallow frequently, for I have the sensation as if the food had reached a mountain which it can not pass. This lasts two to four minutes. At times a peculiar noise can be heard. Then the food seems to pass on. At times belching affords relief. Usually there are cold sweats and dyspnœa, the appetite is lost, and exhaustion follows. Retching and vomiting of mucus occur about four times weekly. This affords no relief, as no real belching follows. Soft articles of food, such as grated potatoes and fat, white meats, pass through without trouble, although this is perceptible. After every meal, and at other times as well, I belch frequently, although this affords only temporary relief to the sense of fullness. The stools are normal. The tongue is rarely tolerably clean, but is usually coated. Although my general condition is fair, yet my strength is much lessened.

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 remarked 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 [$2\frac{1}{2}$ to $2\frac{3}{5}$ inches], while higher up the diameter was only 3 centimetres [$1\frac{1}{5}$ inch]. Neither of the cases impressed one in any way as marked ectases of the œsophagus from the mere inspection of the anatomical preparations.

Dilatation *below* the stricture is a very unusual occurrence, which I encountered some time ago † in a patient who had a carcinomatous stricture 14 centimetres [5·6 inches] below the introitus œsophagi. Below the stricture there was a marked dilatation of the œsophagus, which was 12 centimetres [4·8 inches] in its transverse diameter. The muscular fibres and the mucous membrane in this dilated area were almost entirely gone; the dilatation and the cardia were continuous, without any constriction between them. Probably the deficient contractility of the lower section of the œsophagus led to stagnation of the food above the cardia, and hence produced the dilatation.

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 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 meantime become fluidified passes by the stricture. Later on this takes place in a more

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

† Ewald. Dilatation der Speiseröhre. Berl. klin. Wochenschr., 1889, No. 22.

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 tissues 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 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 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.

At all events, the passage of food through such stenoses, especially when they are of a carcinomatous nature, is not infrequently very variable during the course of the disease, so that periods of

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

greater or less difficulty in swallowing may alternate. This is due to the varying degrees of inflammatory swelling of the tissues about the neoplasm, which thus produces a more or less marked stenosis of the lumen of the œsophagus. I wish also to call attention to the fact that even when the œsophagus is impassable to bougies, sufficient soft or fluid food may be swallowed, so that there is no loss of the patient's weight for a considerable period. However, after a time the inevitable results of the impaired nutrition appear and grow *pari passu* with the increasing constriction, and finally lead to a marked degree of emaciation and weakness. The abdomen sinks in, 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 modified by the causative factor of the disease and by the constitution of the patient.

Here we must make a distinction between the strictures which are due to neoplasms from those which have been caused by cicatrices after tubercular, syphilitic, corrosive, or peptic erosions or ulcers of the mucous membrane; for the course and the influence of treatment in the latter class usually, but unfortunately not always, give a much better prognosis. Life is least of all endangered in the spastic strictures.

Tuberculosis of the œsophagus needs scarcely be considered, since it is an exceedingly rare condition. Mazotti* has reported three

* Mazotti. Della alterazioni dell' esofago nella Tuberculosi. Rivista clin., 1885, I.

cases of œsophageal tuberculosis which gave no symptoms during life. Mackenzie,* in his large work on The Diseases of the Œsophagus, reports only a few cases.† But even in these rare cases the local process was usually accompanied by pulmonary or general tuberculosis; hence there is no primary stenosis of the œsophagus, and consequently no special treatment is indicated.

Syphilitic strictures are also exceedingly rare. Jullien,‡ in his exhaustive text-book, reports only 19 cases from 1850 to 1884, one of which is the case published by Virchow,# in which there was complete atresia of the posterior nares and a cicatricial stenosis of the upper part of the œsophagus. Lublinski ‖ has added two cases; one of these was a man 29 years of age, who, without presenting any other manifestation of syphilis, had a stricture at the level of the sixth dorsal vertebra; the other was a man 54 years old, who had a gumma of the tongue and a stenosis at the level of the fifth dorsal vertebra. Both cases were cured with potassic iodide. Such specific stenoses or strictures may be caused either by submucous gummata or by ulceration with consecutive cicatrization. [Neumann △ reports two additional cases of his own, and gives complete bibliography of all reported cases of syphilitic disease of the œsophagus.]

Cicatricial Strictures may be divided into two classes. The first include those which are the result of *direct corrosion* from swallowing caustic fluids or substances, inflammatory processes, trauma, burns, and diphtheria. In such cases the etiology may easily be established by the history, unless the facts are purposely concealed or the injuries have been inflicted by the patient during an attack of insanity or intoxication. Rokitanski and Virchow have long ago established the fact that, after swallowing corrosive fluids, the favorite sites of injury are the beginning of the upper and the lower

* Mackenzie. Krankheiten das Kehlkopfs. Berlin, 1884.

† [Additional cases have been reported by Meyerhof. Ueber Krebs und Tuberkulose des Speiseröhre. Inaug. Dissert. Giessen, 1894.—Hasselmann. Ueber Tuberkulose der Oesophagus. Inaug. Dissert. Munich, 1895.—Ed.]

‡ L. Jullien. Maladies veneriennes. Paris, 1886.

Virchow's Archiv, Bd. xv, p. 207.

‖ Lublinski. Die Syphilitischen Stenosen des Oesophagus. Berl. klin. Wochenschr., 1883, Nos. 33 and 34.

△ [Neumann. Syphilis, Nothnagel's Encyclopedia, Bd. xxiii, p. 346, 1896.—Ed.]

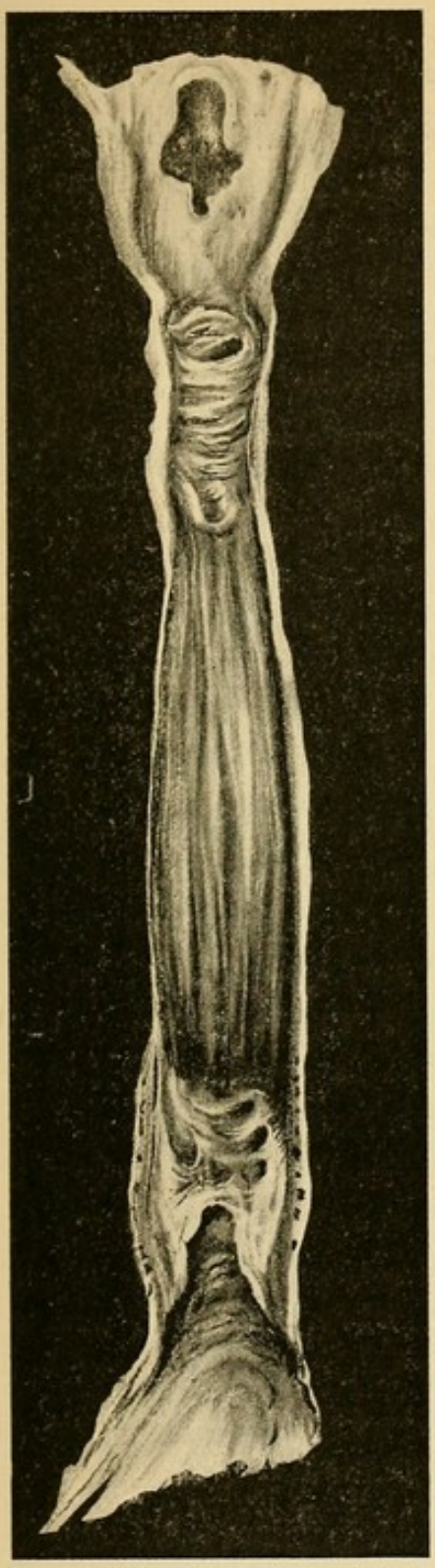


Fig. 22.—Two almost impassable cicatricial strictures in œsophagus of child.

thirds of the œsophagus; hence the resulting cicatrices are typically found at these situations, and not infrequently at the same time at both places. 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.

Such strictures may occur at any age. Von Hacker* has described cases in infants 18 and 21 months old. Not long ago, at the Augusta Hospital, I had a three-year-old child with two absolutely impassable strictures, which were caused by the nurse's careless administration of a strong soda lye (Fig. 22).

The second class includes those produced by *peptic ulcers, ulcus œsophagi ex digestione.* These cases are rare, but their occurrence has been firmly established by the observations of Eras, Quincke, Chiari, Berrez, Sabel, and others.† In these cases it is believed that the lower portion of the œsophagus is corroded by the regurgitation

* Von Hacker. Speiseröhreverengungen, Vienna, 1887.

† Eras. Die Anatomischen Canalizationsstörungen der Speiseröhre. Leipzig, 1866.—H. Quincke. Ulcus œsophagi ex digestione. Deutsch. Arch. für klin. Med. Bd. xxiv, p. 72.—Chiari. Prager med. Wochenschr., 1884, p. 273.—Berrez. De l'ulcere simple de l'œsophage. Thèse de Paris, 1888.—Sabel. Beiträge zur Lehre vom peptischen Geschwürs des Oesophagus. Dissert. Göttingen, 1891. [An additional case is that reported by Guiteras (International Medical Magazine, November, 1894). One peptic ulcer was situated 4½ inches below the cricoid carti-

of acid gastric juice, and that there is subsequent cicatrization of the ulcers which are thus produced. In 1892* I reported such a case, which occurred in a girl 19 years of age, in whom the obstruction of the œsophagus was so complete that gastrostomy had to be performed to save her life. A careful consideration of all the symptoms will enable one to differentiate these cases from a possible neoplasm, stenosis from other causes, or a diverticulum. A neoplasm may be excluded by the usual youthful age of the patient, the absence of glandular swellings, cancerous cachexia, as well as by the fact that painful deglutition occurred at the beginning of the trouble, but which later was less marked, or even disappeared; in neoplasms the reverse is usually true. The history of the case and the site of the stenosis will enable one to differentiate these cases from strictures after corrosion or diverticula; the latter occur only in the upper third of the œsophagus.

Spastic Strictures—i. e., the spasmodic contraction of the muscular fibers of the œsophagus during deglutition—are always the result of a necrosis or of a reflex, consequently of a purely functional nature, and 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. They occur in

---

lage; two large ulcers which had perforated were opposite the bifurcation of the trachea; the œsophagus was ulcerated to the cardia. The patient was a woman 44 years old, who ruminated; this will explain the lesion.—Ed.]

* Ewald. Zeitschr. für klin. Med., Bd. xx, Hefte 4–6.

† 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.

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. I purposely say a *large* sound, since the spasmodic contractions can be overcome more readily than with thin instruments.

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 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

---

* J. Barnes. A Singular Case of Spasmodic Disease simulating Hydrophobia. Amer. Medical 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.

‡ This case has since been reported in full by Meltzer, Berlin klin. Wochenschr., 1888, No. 3.

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 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.

I have since seen many cases of spastic stricture of the œsophagus, and even in men; these patients always have marked neuropathic tenderness, but the spasm of the œsophagus is the most prominent symptom, and is hence the chief cause of complaint.

The neoplasms which lead to constriction of the œsophagus 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 solid 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; or they may be osseous or periosteal tumors growing from the vertebral column; or, finally, aneurisms of the large arteries. We may also include the cases of dysphagia which are caused by the swelling, suppuration, or calcification of the glands at the bifurcation of the trachea and the small bunch of glands which lies above the foramen œsophageum of the diaphragm. Thus a case has been reported by Cahn,* in which a large glandular

* Quoted by Körner. Ueber Dysphagie bei Erkrankungen der Bronchialdrüsen. Deutsch. Arch. für klin. Med., Bd. xxxvii, p. 281.

mass surrounded the bifurcation of the trachea and was adherent to the outer wall of the œsophagus without causing any changes in the inner coats. These cases are usually tubercular or scrofulous; much less frequently primary carcinomata, or, at most, metastases. In some cases perforations into the œsophagus, and even communication between bronchus and œsophagus, have occurred.*

I shall here refer only casually to *diverticula of the œsophagus;* these must be carefully distinguished from the above-mentioned saccular dilatations, which are formed after stenoses have existed for a long time; for the former are as rare as the latter are common. This is especially true of the so-called *traction diverticula*—i. e., partial, funnellike bulgings of the wall of the œsophagus, which are produced thus: A circumscribed area of the outer wall of the œsophagus becomes adherent to some adjacent organ, usually a bronchial gland or the mediastinum, and is drawn outward by the retraction of the latter. [Their usual site is on the anterior wall near the bifurcation of the trachea.] They are pathological finds which have no practical significance. The *pressure diverticula* are much more important; they are sacculated pouches which also involve only a portion of the circumference of the œsophagus, usually its posterior wall, the origin of which is due to the pressure of food against some spot which is naturally weak, or which has lost its resistance as the result of some previous injury. It is evident that such diverticula when distended with food or saliva will displace the œsophagus, and may compress it to such a degree that all the food will enter the diverticulum; the obstruction will be rendered worse by the patient's efforts to overcome it by taking more food. Pressure diverticula are always found in the upper third of the œsophagus [usually at its junction with the pharynx]; when they are large they form a swelling in the neck, the size of which is variable. A sound can only be passed through the œsophagus when the sac is empty; otherwise, as shown above, the sound will enter the sac. As they are accessible for surgical interference, many successful operations have already been reported.†

---

* Heddaeus. Dysphagie durch Schwellung der Bronchialdrüsen. Berl. klin. Wochenschr., 1889, No. 36.

† [The most recent literature on this subject includes: Klemperer. Ein Fall

The *stenosing neoplasms of the œsophagus* are carcinomatous in the great majority of cases and are situated in its lower half or two thirds. Although benign growths, such as myomata, papillomata, fibromata, adenomata, and cysts in the walls of the œsophagus, have been described,* yet they are very rare and have never given rise to any stenotic symptoms. The favorite site of œsophageal cancer is at the level of the junction of the fourth and fifth dorsal vertebræ —i. e., 8 centimetres [3·2 inches] below the introitus œsophagi, or 23 centimetres [9·2 inches] from the incisor teeth; somewhat less frequently they are just above the cardia.† The reason for this is that both of these places are subject to pressure during deglutition, the former because it is at this point that the left bronchus crosses the œsophagus, and hence, in swallowing, the wall of the œsophagus is compressed between the bolus of food and the bronchus; the latter because, as already explained, the masses of food are arrested at the cardia.

It is far beyond my province to enter into a detailed description of all these various diseases of the œsophagus. My only object in presenting them was to recall in how many different ways the passage of food to the stomach may be interfered with. I wish now to discuss especially the processes which may involve the cardia, but which nevertheless really occur in the lower portion of the œsophagus.

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 involve the cardia from

---

von Pulsiondivertikel des Oesophagus. Deutsch. med. Wochenschr., 1894, No. 30. Vereinsbeilage, p. 65.—Körner. Tractionsdivertikel des Oesophagus. Inaug. Dissert., Berlin, 1894.—Rolleston. Traction Diverticulum of Œsophagus. Transact. London Patholog. Soc., 1895, vol. xlvi, p. 47.—Kelling. Zur Diagnose des tiefsitzenden Speiseröhredivertikels. Münch. med. Wochenschr., 1894, No. 47.—Also Rosenheim. Krankheiten der Speiseröhre und des Magens. 2te Auflage, 1896, chapter vi.—Ed.]

* Körner. Ueber die nicht carcinomatösen Geschwülste des Oesophagus. Berlin, 1884.

† [Voigt (Ueber Krebs der Speiseröhre, Inaug. Dissert., Tübingen, 1894) analyzed 72 cases of œsophageal cancer which were treated at the Tübingen Clinic from 1871 to 1893. It occurred most frequently in the lower third of the œsophagus—i. e., in 41 cases, 17 were in the middle third and 4 in the upper third. Metastases occurred in 9 cases. In 3 there was perforation into the left bronchus and trachea.—Ed.]

above—the lower section of the œsophagus; or less frequently from below—the cardiac portion of the stomach.

Rokitanski* states that a special characteristic of cancer of the 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 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. 23). 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

---

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

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

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

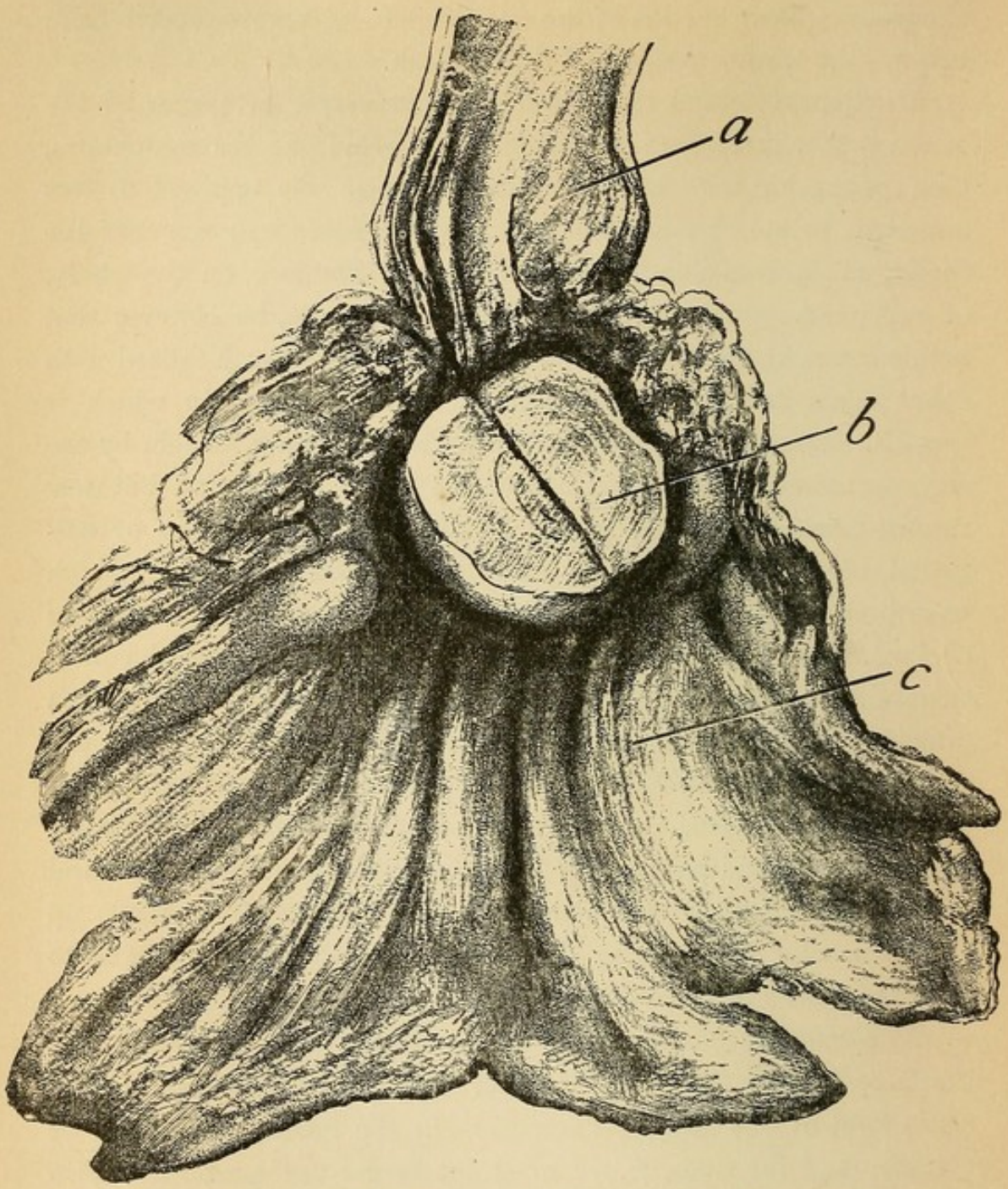


FIG. 23.—Localized cancer of cardiac orifice of stomach. (From Berlin Pathological Institute.) *a*, œsophagus; *b*, localized cancer of cardia; *c*, cavity of stomach.

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 *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.

The loss of the patient's strength is not entirely due to the difficulty of taking food; for F. Müller and Klemperer have shown in all patients with cancer, and Gaertig,* in cases of œsophageal carcinoma in particular, that the nitrogenous equilibrium—to say nothing of any gain in the bodily albumin—can not be maintained even when the greatest possible amount of albuminous food is taken; on the contrary, there is a continual loss in the bodily proteids. This affords a scientific explanation of the steadily increasing cachexia of these unfortunate persons.

However, the general bodily condition does not always stand in a direct relation to the patency of the cardia. I have frequently seen cases in which the stenosis was very great, yet the appearance and strength of the patient was quite good, even if they said that they were losing ground. On the other hand, the general cachexia due to the constitutional intoxication may be very great, in spite of the fact that the stenosis of the cardia is not at all great. It is a peculiarity of cardiac cancers that the general symptoms, such as metastases, enlarged glands, etc., are relatively slight.

I would direct especial attention to the fact that adenopathies, which are usually so constantly found in cancers elsewhere, are by no means so common in œsophageal cancers. They are absent in the majority of the cases. The situation in which they ought to be found are the left axilla and supra- and infra-clavicular regions. For a long time I have directed my attention to this point, and have collected 170 cases of gastric and about 60 of œsophageal cancers, which I have seen in my own practice and in consultation. Small glands, up to the size of a bean, have no diagnostic significance, since Dietrich's† careful researches have shown that in healthy persons the cervical glands are enlarged to the size of a pea or bean in 74·7 per cent, the axillary in 68·9 per cent, the cubital in 81·7 per cent, the inguinal in 92 per cent. Enlarged peripheral glands are therefore of no significance unless their size is that of a hazelnut, or greater.

---

* H. Gaertig. Untersuchungen über den Stoffwechsel in einem Fall von Carcinoma Oesophagi. Inaug. Dissert., Berlin, 1890.

† Dietrich. Die Palpation der Lymphdrüsen. Erlanger Sitzungsbericht, July 19, 1886.

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 cramplike 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.

Exploration with the œsophageal bougie is absolutely essential in the diagnosis of all cases of stenosis of the œsophagus or cardia. 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*. We need also not be surprised if the results of different examinations on the same patient differ 1 or 2 centimetres [⅖ to ⅘ inch]; for the sounds are very apt to yield and bend over when an obstruction is encountered, and thus the distance to which they have been introduced may not be always the same.

[Recently, Rosenheim * has again directed attention to the value of the **œsophagoscope** in the diagnosis of all affections of the œsophagus, and has devised new instruments for this purpose. He claims that with suitable instruments the procedure is both readily learned, and

* [Full details of the method and instruments are given in Rosenheim, *loc. cit.*, pp. 99–112.—Ed.].

that after cocainization the œsophagus may easily be inspected to the cardia. The method is of great value in differential diagnosis. Kirstein's autoscope has also been used for this purpose.*]

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 hazelnut, 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 given the necessary information concerning the technique of this manipulation on page 10.

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,

---

* [E. Meyer. Ueber Autoskopie und Oesophagoskopie. Allgemeine med. Centralzeitung, 1895, No. 100.—Ed.]

† 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, Februar 25, 1886.

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 foods 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 funnellike constriction. Such particles had not become adherent at previous attempts either to the sponge or to the rigid fenestrated sound.

Concerning the use of rigid bougies or tubes, I must not neglect to state explicitly *that even with careful manipulation the possible danger of causing a perforation is never absolutely excluded.* 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 reasons 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.

I have already narrated a similar case on p. 15. Just such cases warn us to be cautious under all circumstances in making an examination with the sound, and one cannot take too much trouble in

always assuring himself in the most careful manner of the condition of the heart and its adnexa before exploring the œsophagus or stomach with the sound.*

The following case of stenosis of the cardia may serve to illustrate what has been said above, and I annex the discussion of diagnosis and therapy thereto:

Mr. P., restaurateur, forty-eight years old, is a man of large and powerful 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 says that he has fallen off markedly only for the past ten weeks, because he has suffered from "stomach trouble" of 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. 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

* [See Discussion in Deutsch. med. Wochenschr. Vereins Beilage, August 1, 1895, p. 130.—Ed.]

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 ℥ 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 warming, it possesses no digestive action. The unchanged disk of albumen lies at the bottom of the test tube, and 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.

I lay especial stress upon the chemical examination 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:

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 divi-

sions of the stomach were formed, one horizontal and one vertical. The sound impinged upon the bottom of the former. That the condition may be more thoroughly comprehended, the two accompanying half schematic illustrations (Figs. 24 and 25), made by me at the autopsy, are here inserted.

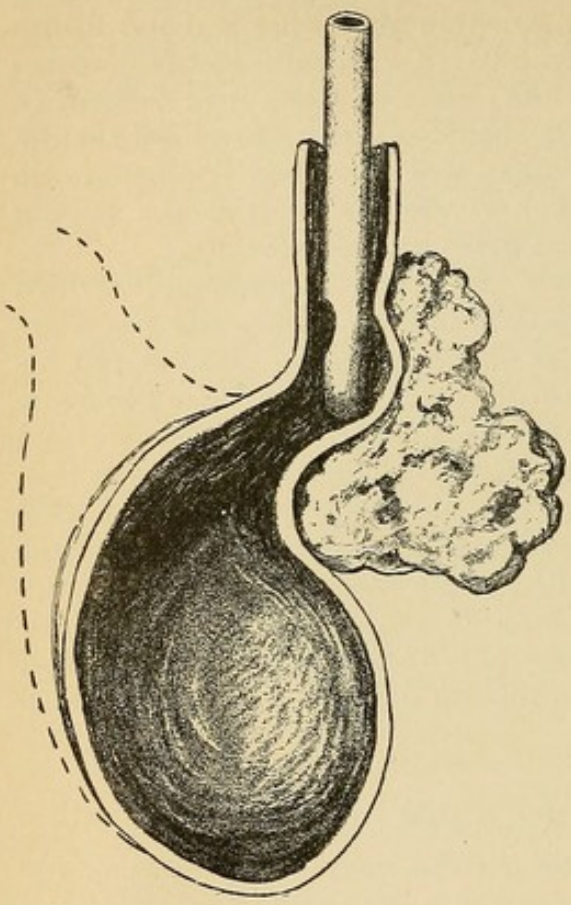


Fig. 24.—Stomach of Mrs. S., died June 30, 1887. Side view, to show the cardia and *cul-de-sac* surrounded by the new growth.

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. But while in that case the masses which came up through the tube always contained pepsin and several times also peptone and repeatedly showed a yellowish-green color due to admixture with bile, the present 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.

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

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

bones. He has had no fever. There can be no thought of a spastic contraction, judging from the history and the objective symptoms. We may exclude a diverticulum, because diverticula are always situated in the upper portion, chiefly the upper third, of the œsophagus, and never occur as low down as the cardia.

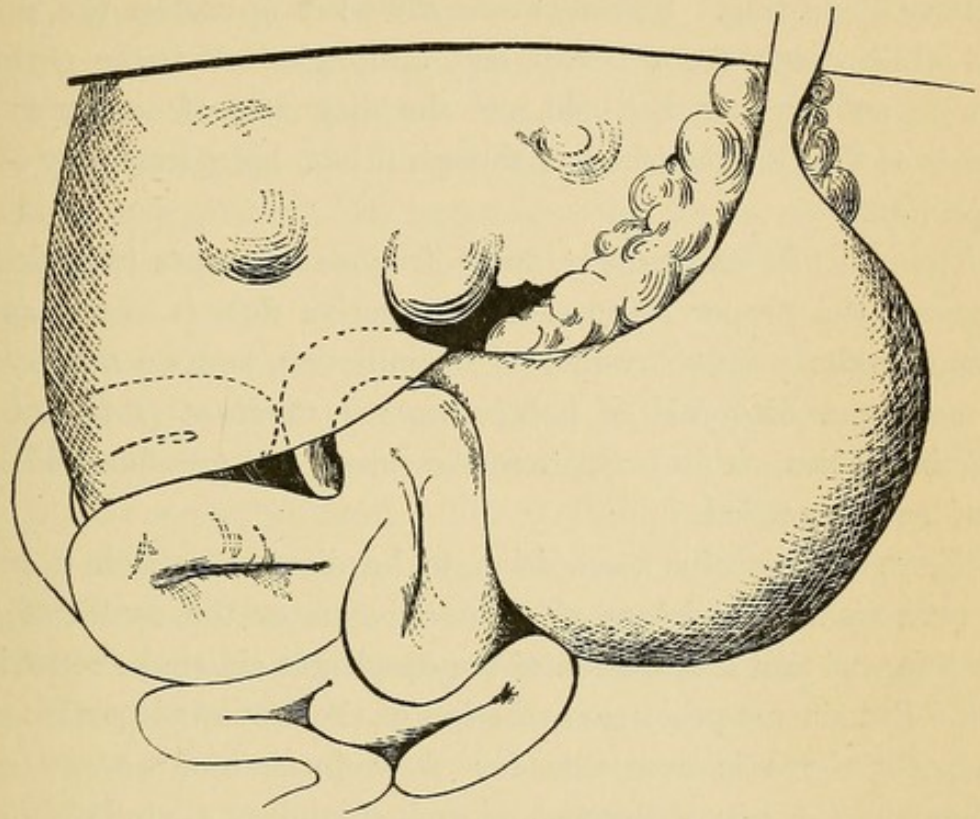


Fig. 25.—Stomach of Mrs. S., died June 30, 1887. Front view, showing cancerous nodules on the anterior surface of the liver, the head of the pancreas, and the cardia.

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—does 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 dilatation in cases of carcinomatous stricture, which, as a rule, cause death too rapidly. However, the dilatation existing in the above-described case must have reached a considerable size, otherwise it would not be conceivable how it could hold 100 c. c. [f ℥ iij ℥ ij] and over. Naturally this can only take place at the expense of the neighboring viscera by compressing or displacing them.

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, who had a stricture of the œsophagus due to corrosion. The stricture was 8 centimetres [3⅕ 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.

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 or cardia of long standing may also cause dilatation of the portion of the gullet lying above them. Leichtenstern ‡ has reported a well-marked example of this in a patient who had suffered for seven years from obstinate

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

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

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

hysterical vomiting. A similar case has been observed by Einhorn,* who could only overcome the spasm of the cardia by forced pressure with the glottis closed and the head thrown back. If he thus succeeded in getting some coffee or claret into the stomach, and immediately thereafter gave a glass of water, the latter could be removed unchanged from the lower portion of the œsophagus, although, with a tube introduced into the stomach, chyme containing HCl could be obtained.

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 upstairs. The patient, P., whose case I have just described, 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 the case described above 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 operation in our case, and, if possible, we shall attempt bloodless dilatation of the constricted portion, working from within the stomach.

The patient whose history I have given in detail above, on whom gastrostomy was to be performed because of our diagnosis of cancerous stricture of the cardia, was operated on by Prof. Sonnen-

* Einhorn. Fall von Dysphagie mit Oesophagusdilatation. Wiener med. Presse, 1890, No. 3.

burg five days later. Reserving the remarks concerning the operation kindly placed at my disposal by Prof. Sonnenburg for the end of this chapter, I wish now to state 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 gave a neutral reaction to 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 [4¾ 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 [7⅝ inches]. The opening of the fistula is 6 centimetres [2⅜ 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 [2⅜ to 2¾ inches]

into a hard, sausagelike 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 [2⅜ inches]; then it gradually becomes narrower, and, 13 centimetres [5⅛ inches] higher up, is only 3 centimetres [1⅛ 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. 26). 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 unaërated. 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.

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.

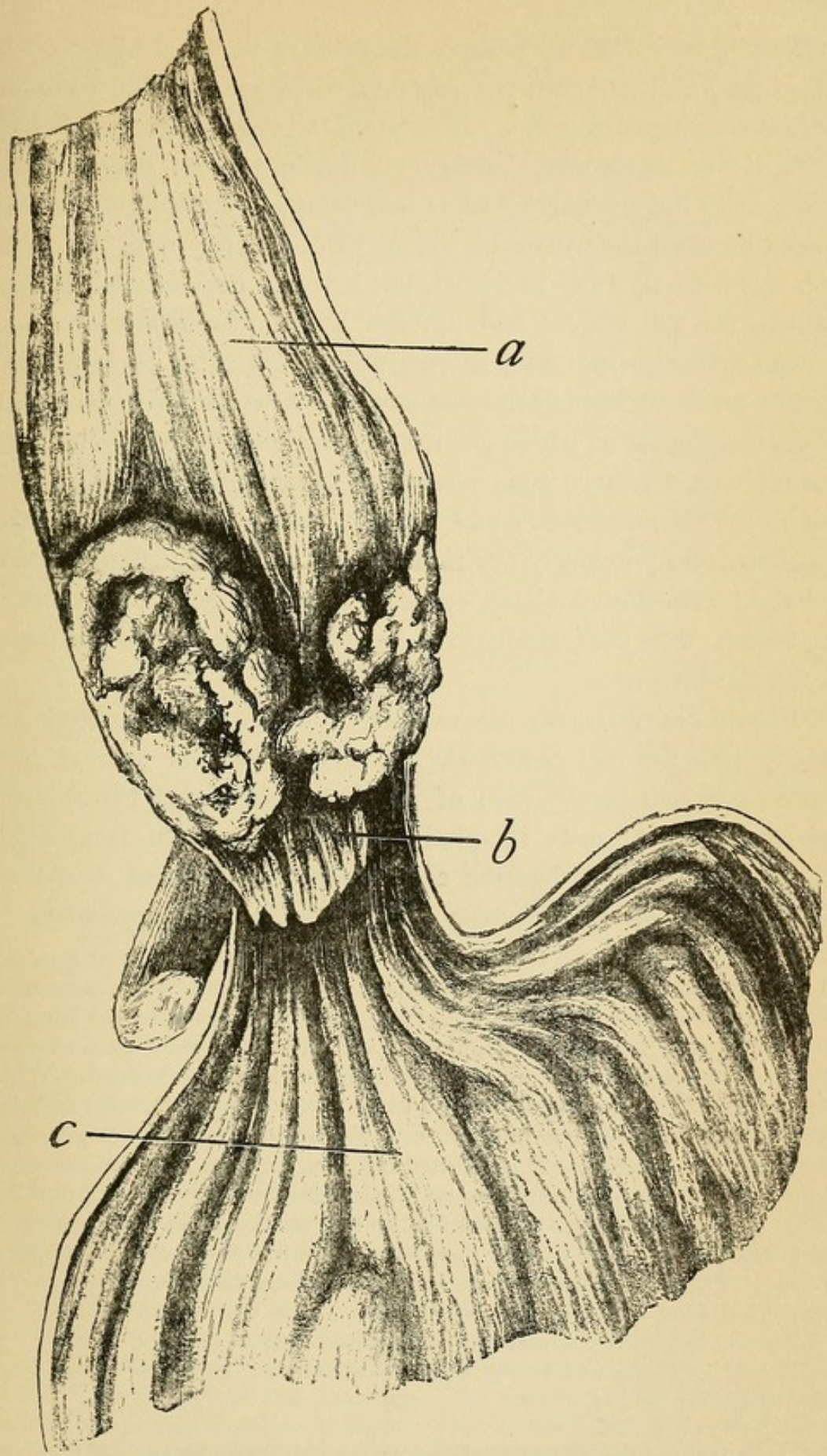


FIG. 26.—Carcinoma of œsophagus just above the cardia. Mr. P. died August 3, 1887. *a*, œsophagus; *b*, cardia; *c*, cavity of stomach.

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 woman 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.

I could narrate many cases which in their essential details are exactly like the one described, for in the last four years I have had twenty-five cases * (five of which were operated upon) in my service at the Augusta Hospital; but I shall refrain from doing so. Instead, I shall describe a somewhat rare case of *cicatricial stenoses of the cardia following a peptic ulcer of the œsophagus.*

Johanna J., nineteen years old, was admitted to sanitarium on June 20, 1891. She stated that her parents were alive and well; has seven brothers and sisters who are in good health. Her growth has been retarded, but she had always been well, with the exception that while at school she frequently had colic and stomach-ache after acid food. When fifteen years old, after eating tainted meat, she vomited a number of times daily; this lasted for six months, and she gradually improved so that until her eighteenth year she vomited only once a day. Then it ceased in January, 1891; her digestion was good; she had daily evacuations and felt well. In April, 1891, she noticed for the first time that the swallowing of food was painful, the pain being situated at the level of the ensiform process. Then deglutition gradually became more difficult, so that poorly masticated food could only be swallowed if she took some fluid with it. Two weeks before her admission, only fluids such as thin gruels could be swallowed. There was never any hæmatemesis. She had never menstruated.

* Numerous cases in dispensary and consultation practice are not included because I have no complete records of many of them.

On admission she was very much emaciated, and, although her clothing was not heavy, weighed only 25·2 kilogrammes [55½ pounds]. No sound of any kind could be passed through the stricture of the œsophagus; on swallowing water, only a delayed and very feeble deglutition murmur could be heard. The abdomen was sunken; no gastric succussion could be obtained. No tumor of any kind or glandular enlargements could be felt. Urine abundant and normal. No evidences of syphilis could be detected either from her history or from a thorough examination.

In considering the various etiological factors of the stenosis, both carcinoma and syphilis could be excluded by the history and examination. The possibility of a hysterical, spastic contraction of the œsophagus could not be excluded. But it is characteristic of the latter condition that the spasm can be overcome by the use of large bougies and a passage effected after allowing them to lie for some time. Furthermore, other signs of hysteria are never lacking in such cases. But in our patient such symptoms were absent, nor could anything be accomplished by the introduction of large bougies. Although a positive diagnosis was not possible immediately on her admission, yet prolonged observation made it more and more probable that there was a cicatricial stricture after an ulcer. At all events gastrostomy was absolutely indicated to prevent starvation.

The operation was performed on June 20, 1891. The stomach, which was found to be relatively large, was drawn out and was stitched to the peritonæum. At the end of the narcosis half a litre [one pint] of fluid was vomited, although on the previous day the patient had only taken 200 c. c. [about f ℥ vij]. On the following days nutritive enemata and small quantities of cold milk were given. General condition good. Five days later the stomach was opened with the Paquelin cautery, without narcosis. The fluid which escaped contained large quantities of free HCl, and had an acidity of 60 per cent. Milk with softened bread, bouillon, raw eggs, etc., were introduced into the stomach; the wound was kept open with a small wooden plug surrounded by iodoform gauze. Subsequent observation showed that the stomach emptied itself very slowly, and consequently some obstruction must exist at the pylorus, for even after 24 hours large quantities of stomach contents could be obtained on removing the plug. Every examination showed an abundance of free HCl, the acidity on different days being 81, 102, and 104 per cent. Up to the beginning of July the fistula gradually grew larger, so that not alone could the index finger be inserted, but also a small speculum by means of which the mucous membrane could be examined for some distance. Later on the fistula gradually became smaller; the patient was nourished at first through the fistula and then also by mouth. She gained considerably in weight, so that at the end of October she weighed 31 kgm. [68 lbs.], and a year later 35 kgm. [77 lbs.].

Inflation of the stomach with air through the fistula shows that the organ is displaced downward, the greater curvature being about a finger's breadth below the umbilicus; the lesser can be distinctly recognized below the ensiform process. The stomach has a slight hourglass shape, and, calculating from the amount of air which can be pumped in, holds about 700 c. c. [23 ounces]. The orifice of the fistula lies just below

the middle of the left costal border. If the finger is inserted it can be freely moved in all directions without encountering any obstacle. Even after repeated efforts, both with a silver catheter and a suitably curved tube, the pylorus could not be reached. A sound can be introduced through the fistula 15 ctm. [6 inches] upward, 16 ctm. [6·4 inches] downward and to the right, and 13 ctm. [5·6 inches] perpendicularly downward in the parasternal line. In both of the latter tests the point of the sound could be distinctly felt under the abdominal parietes. A thin bougie introduced through the mouth is arrested at 30 ctm. [12 inches] from the incisor teeth by an insuperable obstruction; the tip could not be seen with a speculum inserted into the fistula. The passage of the bougies caused spasmodic contractions and much nausea, during which the orifice of the fistula was almost closed.

At the end of October, 1892, the patient was feeling well and was able to do housework. Once only there was a slight transient disturbance of the stomach. The orifice of the fistula had contracted to the size of a lead pencil, and was still closed with a piece of wood, on the removal of which the stomach contents flowed out as from a faucet.

The present appearance of the patient is excellent; she has put on flesh so that it is hard to conceive that she is the same person who 18 months ago was in such a wretched, half-starved condition.

A word about the diagnosis of this case. Besides the œsophageal stricture, there is undoubtedly a stenosis of the pylorus which has caused a dilatation of the stomach. The history of the patient does not enable us to decide positively whether this is due to a cicatricial contraction after an ulcer or to an induration of the pyloric muscular fibers consecutive to a chronic catarrh; still, in view of the fact that she undoubtedly had an ulcer in the œsophagus, it is probable that she also had an ulcer near the pylorus. A careful consideration of all the facts as to the obstruction in the œsophagus leaves no other explanation except that there had been an ulcer which had occupied the typical site, i. e., just above the cardia, and which had gradually produced a cicatricial stenosis of the œsophagus. This stenosis was partially overcome by the passage of sounds, and also by the traction exerted on the scar by the stomach when full of food, after the latter had been rendered possible by the gastrostomy. The degree of patency is such that soft, mushy food can be swallowed, but coarse articles of diet, such as coarsely cut meat and vegetables, can not be introduced into the stomach.

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 larger sound would glide past them. In this, as always occurs under such circumstances, chance 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 1 milligramme [$\frac{1}{64}$ grain] of atropine with 5 milligrammes [$\frac{1}{12}$ grain] of morphine. The salivation then

* Morell Mackenzie. Die Krankheiten des Halses und der Nase. Berlin, 1884, pages 130 and 185.

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. 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.

Senator* has proposed the use of laminaria tents of various sizes which are screwed to an ordinary œsophageal bougie, just as olive-shaped bulbs are attached to a whalebone staff; they are to be inserted into the stricture which is to be dilated by their swelling up. Although the idea is a good one, yet it has proved to be impracticable because most patients can not tolerate the tents long enough to allow them to swell up sufficiently. Recent investigations have shown the requisite time to be more than two hours. Granting that the stricture is such that a sound can be pushed through it and that its depth has been carefully measured, there is also some danger that the inevitable retching and attempts at swallowing may cause the tent to be pushed below the stricture; it will then swell up and can not be withdrawn.

Rosenheim† has suggested the use of tin bougies. [These are inserted with the aid of the œsophagoscope.]

[Schreiber‡ has devised a "dilatation sound" which consists of an œsophageal tube to which a closed piece of rubber tubing is attached at the lower end; by forcibly distending the tube with water and

---

* Senator. Therapeut. Monatshefte, July, 1889.

† [Rosenheim. Krankheiten der Speiseröhre und des Magens. 2te Aufl., 1896, p. 159.—Ed.]

‡ [Schreiber. Die Dilatation Sonde. Volkmann's Klinische Vorträge, 1893, No. 85.—Ed.]

exerting pressure by the expansion of the rubber tubing, the dilatation is to be slowly accomplished. The method is ingenious, but requires much experience to suitably construct the instrument for each case.]

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 soft rubber 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 deepest

---

* 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.—Ed.]

† *Loc. cit.*

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

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 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. One can easily convince himself 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 food 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.

I could describe similar cases, but instead shall simply recall that of a boy, nine years of age, who, in spite of looking very well, had a stricture after swallowing lye. It becomes almost impassable every few months, and he must then be taken to the hospital. Here the stenosis is soon dilated, only to recur if the treatment is neglected.

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 maidservants 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**, 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 for cancer and 68·7 per cent for cicatricial stenosis. Unfortunately it is a matter of surmise as to what is meant by 19·5 per cent cured, and, according to my own experience, it is not difficult to understand why most surgeons are by no means anxious to undertake an operation which does not save life.

Gastrostomy to-day is in itself so free of danger that it is indicated in every case as soon as the diagnosis of a nondilatable 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 intercur-

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

rent 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 can readily be understood, 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.

For the technique of the operation I would refer to the text-books on surgery.* I shall only make one suggestion, to place the opening of the fistula in the stomach as close to the pylorus as possible, so that with a soft-rubber tube the food may be introduced directly into the duodenum, the pylorus serving, if possible, as a valve; for, as I shall show later on, the peptic and motor powers of the stomach are very much lessened in all these cases, the digestion being carried on entirely by the intestines. Hence it is inexpedient to load the stomach with food which will only be decomposed there, or will be rejected, unless it is promptly passed on through the pylorus.

However, it is to be regretted that 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

* [An excellent paper on the various methods and indications for gastrostomy and other methods of operation in stricture of the œsophagus, is that of Willy Meyer. Amer. Journal of Medical Sciences, October, 1894, p. 400.—Ed.]

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, the question of **feeding** must be considered.

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 allow 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, peptone chocolate, and Mosquera's beef meal. We can also make a palatable meat broth of an almost sirupy consistency by taking raw beef which has been chopped up very fine, stirring it with an egg, and adding some pepper and salt. Koumiss 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, 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.

* [Thompson's Dietetics, 1896, p. 145.—Ed.]

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 value 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 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

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

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 order the nutrient enemata to be prepared as follows: A teaspoonful of wheat 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 ¼ litre [½ pint]. In hospital practice or with the poor, three to five eggs, with about 150 c. c. [f ℥ v] of a 15- or 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. According 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 ℥ 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. It is well to bear in mind that during such a course the fæces may readily assume a ribbonlike form and a light yellow color.

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 soft-rubber tube, about the size of a finger 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

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

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 formation of a gastric fistula is to be considered. The kind and quantity of food which will be 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, and the case described above (p. 138), 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 exact investigations made by me# have shown that the digestive functions of the stomach suffer very little in such cases. In cases where gastrostomy is performed for carcinoma of

* [See Thompson's Dietetics, 1896, p. 375, for an excellent discussion on rectal feeding.—Ed.]

† 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.

Ewald. Zeitschr. für klin. Med., Bd. xx, Hefte 4-6.

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 consider these relations in their proper connection while discussing carcinoma of the stomach; but for our present purpose I shall anticipate and say that in all cases which were operated upon I have never found any secretion of hydrochloric acid or of pepsin. In several of those who died a short time after the operation this might be ascribed to the weakness of the patients; but the previously mentioned case of the woman with the numerous cancerous metastases and the carcinomatous stricture of the œsophagus is more important. Here the stomach contents flowing from the fistula were 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 fluid which flowed out was invariably only slightly changed, containing a little mucus, of neutral reaction, without peptone, 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 stomach contents 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. Reports like that of Riegel, † who found "the time of digestion and the amount of HCl normal" in two cases (the site of the carcinoma is not accurately given and the stricture was undoubtedly still patent), and a similar case of Boas, must be considered rare exceptions, and in which a cardiac carcinoma did not exist.

---

* Lancet, June 4, 1887.

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

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 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.

CHAPTER IV.

THE GENERAL RELATIONS OF THE STOMACH TO THE ORGANISM.—INFLAMMATION OF THE STOMACH.—GASTRITIS GLANDULARIS ACUTA, IDIOPATHICA ET SYMPATHICA.—GASTRITIS PHLEGMONOSA PURULENTA.—GASTRITIS TOXICA.

HAVING discussed the obstructions which the food may encounter in reaching the stomach, our next consideration is acute and chronic gastritis, by far the most frequent of the diseases to which the stomach is subject.

Before entering upon this topic I wish to preface a few remarks of a general nature upon the mutual relations of the stomach, intestines, and liver, and the influence of gastric disorders upon the general metabolism.

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 part 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 up to the present time designated catarrh were cured by the most varied modes of treatment.

I believe that such regulation frequently occurs without our aid and without therapeutic interference, and 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*. As the result of this regulation a certain amount of the reserve force is called into play, which, as in valvular disorders of the heart, brings about a compensation for a longer or shorter period, as the result of which one function of the stomach may be replaced by the increased activity 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? or that a marked dilatation and atony of the stomach may exist for a long time without causing any special disturbance? On the one hand, there is an 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; on the other hand, there is a greater activity in the chemical function of the stomach which counteracts any fermen-

tation in the food which may be unduly retained in the stomach; in these ways a compensation may be established. There is thus beyond any doubt a vicarious, regulating mechanism.

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

* T. Lauder Brunton. On Disorders of Digestion, their Consequences and Treatment. London, 1886, p. 25.

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 accounts 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. This applies to normal digestion. This process is even more marked with the products of

* *Vide* Ewald. Klinik, etc., I. Theil, 3te Auflage, p. 102.

imperfect gastric and intestinal digestion—i. e., ptomaines, those substances generated by 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 whatever, 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—autointoxication.* In the mild cases, which happily form the majority, there are only vague cerebral symptoms—fatigue, languor, mental dullness, and headache—especially in the occiput. In severer cases the cardiac action is sympathetically affected; palpitation, or an intermittent or irregular pulse, and, finally, even marked symptoms of poisoning may appear, possibly as the result of the simultaneous absorption of the gases of putrefaction, a good example of which is the well-known case recorded by Senator.† Kulneff ‡ was able to directly demonstrate the presence of a toxine in the stomach contents of two cases of dilatation of the stomach and one of gastric cancer.

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 disor-

* [The most recent discussions of this subject will be found in Bouchard's Lectures on Autointoxication in Disease, translated by Thos. Oliver, Philadelphia, 1894; and Albu's monograph, Ueber die Autointoxicationen des Intestinaltractus. Berlin, 1895.—Ed.]

† Senator. Berl. klin. Wochenschr., 1868, No. 24. Emminghaus, ibid., 1872, S. 477.

‡ Kulneff. Beiträge zur Kenntniss der Autointoxicationen, II.

der 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.

To correctly understand these phenomena another factor must be considered, namely, *the antifermentative action of hydrochloric acid.*

Even Spallanzani* had observed that small pieces of meat which had been soaked in gastric juice did not decompose even after standing for a number of days. Gastric juice containing HCl may be left exposed to the air for a week or longer without the development of any fungi or any putrefaction; but the growth of micro-organisms soon makes it turbid and foul if free HCl is absent. Investigations which I made have shown that loosely combined HCl can not retard this putrefaction. The same has been found by Kabrehl and Cohn.† The marked antifermentative power of HCl has long been known (Sieber, Miquel), and recently some writers, like Bunge,‡ have even considered the antibacterial or antifermentative action against the countless bacteria which are being continually introduced into the stomach as the chief function of the gastric juice. Falk, Wesener, Löffler, Miller, and recently Kabrehl and Hamburger,# have investigated the action of the gastric juice upon pathogenic bacteria and have demonstrated its destructive power upon them. On the other hand, Minkowski ‖ has correctly urged that the stomach can not be regarded as a certain sterilizer, but that it is only able to restrict the processes of decomposition within certain limits. One might also be inclined to agree with Minkowski, that in the living organism along with the action of the HCl there is

---

* See Ewald. Klinik, etc., I. Theil, 3te Auflage, p. 137 *et seq.*

† Kabrehl. Einwirkung des künstlichen Magensaftes auf pathogene Mikro-organismen. Zeitschr. für Hygiene, Bd. x, Heft 3.—F. O. Cohn. Zeitschr. für physiolog. Chemie, Bd. xv, Heft 1.

‡ Bunge. Lehrbuch der physiolog. Chemie, 2te Auflage, 1889, p. 143.

H. Hamburger. Ueber die Wirkung des Magensaftes auf pathogene Bakterien. Inaug. Dissert., Breslau, 1890.

‖ Minkowski. Ueber Gährungen im Magen. Mittheilungen aus der med. Klinik in Königsberg, 1888.

also some influence for the pepsin—i. e., the specific peptic digestion of organic substances; but Macfadyen,* and later Cohn, have shown that pepsin takes no part in the antiseptic action of the gastric juice. Hamburger details an experiment according to which the HCl combined with peptones may kill bacteria, "provided it is present in sufficient quantities."

But the cases of purely intestinal digestion which have already been mentioned a number of times, in which the gastric juice is permanently insufficient and free from HCl, and in which, nevertheless, digestion is satisfactory, prove that the absence of disinfection in the stomach does not produce any bad effects. Furthermore, in acute gastritis in which, as it appears, free HCl is absent as a rule, only slight decomposition occurs in the food. On the other hand, it must be borne in mind that, according to the experiments of Miller,† and a very interesting case of McNaught,‡ even gastric juice containing HCl may be unable to prevent certain processes of fermention. [Since then this has been corroborated by many observers, among whom Kaufmann, Strauss, and Riegel may be mentioned.]

McNaught's case was one of gastrectasis from pyloric stenosis in which inflammable gas was formed, as occurred in similar cases which have been described by Ewald, Schultze, Beatson, and others. McNaught not alone repeatedly found HCl in quantities as high as 12·2 per mille, but the stomach contents were so rich in yeast cells, sarcinæ, and bacteria, that he was able to infect sterilized milk and produce inflammable gas. Cultures showed the presence of a *clostrydium butyricum*, which was like that of Prazmowski, but which was not exactly identical with it.

I may add that it is by no means unusual to encounter patients with dilated stomachs who suffer from marked production of gas, although much free HCl may always be found in the stomach contents. In these, and in the cases quoted above, we must remember that it is well known that certain micro-organisms may thrive on acid media, and that fermentation is dependent in some cases upon

---

* Macfadyen. The Behavior of Bacteria in the Digestive Tract. Journal Anat. and Physiol., 1887. vol. xxi.

† Miller. Ueber Gährungsvorgänge im Verdauungstractus und die dabei betheiligten Spaltpilze. Deutsch. med. Wochenschr., 1885, No. xlix, and 1886, No. viii.

‡ McNaught. A Case of Dilatation of the Stomach accompanied by the Eructation of Inflammable Gas. Brit. Medical Journal, March 1, 1890.

the relation of the micro-organisms to the quantity of HCl present, and in other cases on the more or less rapid transfer of the contents of the stomach into the intestines. Nevertheless, the value of HCl as an antifermentative in the antisepsis of the stomach and intestines remains unquestioned; and we must assume, when there are no disturbances corresponding to the absence of HCl, that it has been replaced by increased motor activity of the stomach. This is shown by the occurrence of numerous dyspeptic symptoms which are due to the remarkably rapid decomposition where there is a deficiency or absence of HCl, and an insufficient vicarious increase of the peristalsis of the stomach.

That even when there is a complete absence of HCl—i. e., when gastric digestion is absolutely at a standstill—the food may for a time be absorbed and the bodily weight maintained, has been shown long ago by Wolff and myself, Grundzach and others.* The conclusion arrived at has been that the intestinal digestion acts vicariously and replaces the deficiency in the peptic digestion. This fact, which is self-evident when it is borne in mind that the bodily weight does not sink in these cases, has been confirmed by Von Noorden's† exact researches.

The relation between the amount of HCl secreted and the acidity of the urine I have already carefully considered elsewhere;‡ here I shall merely recapitulate that any diminution in the acidity of the urine is due to some loss in the acidity of the organism, such as vomiting or siphoning out acid stomach contents, hyperchlorhydria,# or the combination of an excessive amount of secreted HCl with bases, thus forming insoluble salts (calcium or magnesium salts). Even the physiological secretion of HCl during digestion represents

---

* [Langenbach (Deutsch. med. Woch., 1894, No. 52) has shown that the stomach may be practically entirely dispensed with, for in cases of extensive gastric cancer, in which almost the entire stomach was exsected, the patient survived in spite of the fact that the stomach, which was constructed by sewing the pyloric and cardiac ends together, was no larger than a hen's egg. The patient was in excellent health 6½ months after the operation.—Ed.]

† Von Noorden. Ueber die Ausnutzung der Nahrung bei Magenkranken. Zeitschr. für klin. Med., Bd. xvii.

‡ Ewald. Klinik, etc., I. Theil, 3te Auflage, p. 88 *et seq.*

Stroh. Ueber die Anomalien der Chlorausscheidung bei Magenkranken. Inaug. Dissert., Giessen, 1890.

such a loss; this is more or less compensated by reabsorption and the simultaneous or subsequent secretion of alkaline juices, especially the pancreatic; yet it is shown in the varying degrees of acidity of the urine at various times during the day. This will be much more marked in those cases where, as in the abnormal conditions cited above, acid or acid-forming salts are withdrawn from the blood.

[Attempts have been made by Herschell * and others to estimate the acidity of the stomach contents from that of the urine. Mathieu and Tréheux † have carefully studied this question on 12 persons after 84 meals; over 400 estimations of the degree of acidity of the stomach contents and urine were made. Their conclusions are that there is a relation between the two, yet so many factors influence these two curves of acidity that we are at present unable to draw any practical conclusions from them.

Attempts have also been made to use the amount of indican in the urine as a guide to the amount of hydrochloric acid secreted. Simon,‡ in an excellent essay, has carefully investigated this subject, and believes that by means of the indican reaction much information may be obtained as to the varying degrees of acidity of the stomach contents, and that we are also enabled to closely follow the results of treatment in cases of gastro-intestinal disease.

For the relation of hyperchlorhydria and the urinary chlorides, see Chapter VIII.]

I shall now consider the pathological conditions.

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—

---

* [Herschell. On Indigestion. London, 1893, p. 93.—Ed.]

† [Mathieu et Tréheux. Arch. gén. de méd., November, 1895.—Ed.]

‡ [Simon. The Modern Aspects of Indicanuria, with Special Reference to the Relations between Indican and the Acidity of the Gastric Juice. Amer. Jour. of Med. Sciences, 1895, vol. cx, pp. 48 and 157.—Ed.]

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. 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 va-

* F. A. Hoffmann. Vorlesungen über allgemeine Therapie. Leipzig, 1885, pp. 169 *et seq.*

rieties 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 everyday 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 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

* F. A. Hoffmann, *loc. cit.*

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 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

* G. Smirnow. Ueber Gastritis membranacea und diphtheritica. Virchow's Archiv, Bd. cxiii, S. 333.

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.

Among the products of fermentation the first to attract our attention is lactic acid. The fact that it is normally present in the digestion of bread speaks against its having any peculiar irritating qualities. 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 a sanitarium, 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. 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.

Pathology.—All clinicians and pathologists complain that our knowledge of the changes in the mucous membrane in acute gastric catarrh is 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. 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. [Much light has been shed on the minute anatomy of the

gastric mucosa by the study of exfoliated pieces of mucous membrane which are so frequently found in washing out the stomach. An elaborate paper, with bibliography on this subject, has recently been published by Cohnheim;* he has been able to demonstrate very extensive pathological changes in the various diseases of the stomach. Hayem† has also devoted much attention to the minute anatomy of acute gastritis, and has laid particular stress upon what he calls acute parenchymatous gastritis. The correctness of his views have been denied by subsequent writers, on the ground that what he has observed is the result of post-mortem changes.]

Consequently we must refer to the experiments made on animals, especially those of Ebstein,‡ Lösch,# and others. In studying the process in human beings, I must refer especially to the researches of Edinger,‖ Virchow, Klebs, Menassein, and others.△ Later on, Sachs,◊ Marfan,‡ G. Meyer,‡ and myself ‡ have published a number of remarkable and interesting facts upon this subject, the main features of which have been confirmed by the subsequent observations of W. Fenwick, Schwalbe, Stintzig, Westphalen, and Fischl.**

---

* [Cohnheim. Die Bedeutung kleiner Schleimhautstückchen für die Diagnostik der Magenkrankheiten. Boas's Arch. für Verdauungskrankheiten, 1895, Bd. i, p. 274.—Ed.]

† [Hayem. Semaine méd., October 27, 1894.—Ed.]

‡ Ebstein. Ueber die Veränderungen welche die Magenschleimhaut durch Einverleibung von Alkohol und Phosphor erleidet. Virchow's Archiv, Bd. lv, S. 469.

Lösch. Ueber die nach Einwirkung abnormer Reize auf die Magenschleimhaut auftretende pathologisch-anatomischen Veränderungen. Allgemeine Wiener med. Zeitung, 1881, No. 50.

‖ Edinger. Zur Kenntniss der Drüsenzellen des Magens, besonders beim Menschen. M. Schultze's Archiv, Bd. xvii, S. 209.

△ R. Virchow. Der Zustand des Magens bei Phosphorvergiftung. Virchow's Archiv, Bd. xxxi, S. 399.—Klebs. Handbuch d. patholog. Anatomie, 1868, S. 174. —Menassein, Chem. Beiträge zur Fieberlehre. Virch. Arch., Bd. lv, S. 452.—Uffelmann. Beobachtungen an einem Gastrotomirten. Deutsch. Arch. für klin. Med., Bd. xxvi, S. 441.

◊ A. Sachs. Zur Kenntniss der Magenschleimhaut in krankhaften Zuständen. Arch. für experiment. Pathologie, Bd. xxii, Heft 3, and Bd. xxiv, Hefte 1, 2.

‡ Marfan. Troubles et lésions gastriques dans la phthisie pulmonaire. Paris, 1887.—Stintzig, Münchener med. Wochenschr., 1890.

‡ G. Meyer. Zeitschr. für klin. Med., Bd. xvi, Hefte 3 und 4.

‡ Ewald. Diseases of the Stomach. Translated by Manges, 1892, pp. 318 *et seq.*

** W. Fenwick. Zusammenhang zwischen Magen und Organerkrankungen. Virchow's Arch., Bd. cxviii, p. 2.—Schwalbe. Die Gastritis der Phthisiker vom pathologisch-anatomischen Standpunkte. Virchow's Arch., Bd. cxvii, p. 310.—Stintzig.

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 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.

München. med. Wochenschr., 1889, No. 8.—Westphalen. St. Petersburg. Wochenschr., 1890, Nos. 37 and 38, and 1891, No. 21.—Fischl. Prager Zeitschr. für Heilkunde, 1891, Heft 3.

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. I wish to 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 proliferation 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 nature more functional; 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 substances 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

* *Loc. cit.*, p. 54.

† F. Schmidt. Zur Frage nach der Existenz des gastrischen Fiebers als einer eigenartigen Krankheit. Dissertation, Berlin, 1885.

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 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 chapter.

I have already 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,

* Gussmann. Eine Epidemie von acuter Gastritis. Württemb. Correspondenzblatt, 1888, No. 22.

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. 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;

* Berlin, 1863, S. 382.

† This does not include the coating frequently found in many persons, especially in the morning and in those who smoke excessively, at the base of the tongue, which consists of desquamated epithelium, detritus, remnants of food, and bacteria.

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 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 steplike 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, and where possibly some fruit seeds in the stool may be mistaken for gallstones—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

* [The *Brausepulver* (Ph. Germ.) consists of sodium bicarbonate 10 parts, tartaric acid 9 parts, white sugar 19 parts. Mix the well-dried powders.—Ed.]

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 mouth or the bowels. The simplest and best method is to let the patients drink considerable quantities, say $\frac{1}{2}$ to $\frac{3}{4}$ 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. $\frac{5}{6}$]

M. Ft. chart. no. j. Sig.: To be taken at once or in divided doses. In children we may give a teaspoonful of sirup 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 licorice 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. $\frac{1}{6}$] 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 bicarbonate of soda; possibly the generated carbonic-acid gas has the same 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—smallpox, measles, scarlatina, typhus and typhoid fevers—the croupous and diphtheritic processes, dysentery, pyæmia, and puerperal fever, may have disturbance 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 dys-

* [By using reliable tablet triturates, 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 valuable.—Ed.]

† Hoppe-Seyler. Allgemeine Biologie, 1877, S. 242. ‡ Manassein, *loc. cit.*

Ewald. Klinik, etc., I. Theil, 3te Auflage, S. 128.

‖ Sassezki. Ueber den Magensaft Fiebernder. Petersburger med. Wochenschr., 1879, No. 19.

pepsia 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 up to 39° to 40·5° C. [102·5° to 104·9° Fahr.]. 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

---

* L. Edinger. Zur Physiologie und Pathologie des Magens. Deutsch. Arch. für klin. Med., Bd. xxix, 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. xliv, S. 219.

[See also W. S. Fenwick. The Dyspepsia of Phthisis. London, 1894, p. 126. —Ed.]

changes of acute gastritis. [This has since been corroborated by Cohnheim and Hayem.]

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 Recklinghausen 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

* Cahn. Ein Fall von Gastritis diphtheritica bei Rachendiphtherie mit acuter gelber Leberatrophie. Deutsch. Arch. für klin. Med., Bd. xxxiv, S. 113.—G. Smirnow. Ueber Gastritis membranacea und diphtheritica. Virch. Arch., Bd. cxiii, S. 356.—G. Kalmus. Ein Beitrag zur Statistik und pathologischen Anatomie der secundäre Magendiphtheritis. Inaug. Dissertation. Kiel, 1888.

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 in Germany it is described as *status gastricus*. Its symptoms and treatment are so closely connected with chronic gastritis that their discussion may be deferred to the chapter 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, Rokitanski and Dittrich, Habershon, Brinton [and Heintz *] 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

---

* [Heintz. Deutsch. Arch. für klin. Med., 1892, Bd. xlix, p. 487.—Ed.]

† J. Glax. Die Magenentzündung. Deutsch. med. Zeitung, 1884, No. 3.

‡ Ziegler. Lehrbuch der allgemeine and spec. pathologische Anatomie, 1887 [Bd. ii], S. 516.

to have found numerous streptococci partly free in the tissues and partly inclosed in the cells.

A second form is the metastatic, which occurs in severe pyæmic, puerperal, and exanthematous diseases, or is due to an extension of a perigastric phlegmon. Here we may also include the phlegmonous abscesses which are due to some ulcerated condition of the gastric mucosa, which resemble phlegmonous inflammation of the stomach. Thus Thoman * has reported the case of a sixty-year-old woman who had had two violent attacks of severe febrile gastralgia with inflammatory, tumorlike induration of the epigastrium, and later died of hæmatemesis. Lindemann † treated a woman who had several teeth extracted. This was followed by ulcerative inflammation of the mouth, with intensely infectious secretion. Shortly after this she was attacked with a diffuse phlegmonous gastritis.

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 the muscularis; the muscle fibers 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.

---

* Thoman. Inflammatio phlegmonosa ventriculi; ulcus perforans; hæmatemesis; death. Allgemeine Wiener Zeitung, 1891, No. 10.

† Lindemann, quoted by Joh. Meyer, Petersburg. med. Wochensch., 1892, No. 40.

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 centimeters [⅝ 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.

A case published by Joh. Meyer‡ shows that the development of a hepatic tumor may cause displacement of the heart and compress the lungs by pushing the diaphragm upward, and may thus simulate a subphrenic abscess.

Grainger Stewart has observed inflammation and gangrene of the gall-bladder.# W. Lewin‖ has seen petechiæ over the entire

* Bukler. Idiopathisch-plegmonöse Gastritis. Bayer. ärztliches Intelligenzblatt, 1880, No. 37.

† Macleod. Suppurative Gastritis; Death; Necropsy. Lancet, 1887, vol. ii, p. 1166.

‡ Joh. Meyer. Ein Fall von idiopathischen Magenabscess and ein Fall von subphrenischen Abscess. Petersburg. med. Wochenschr., 1892, No. 40.

Edinburgh Med. Journal, February, 1868.

‖ W. Lewin. Berl. klin. Wochenschr., 1884, S. 73.

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. [Mintz has also reported it after cancer of the stomach.]

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.—It will be 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. The case quoted above has also led Joh. Meyer to accept this view.

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 diagnosis, already expressed in 1879 by Leube, have not been removed by the cases which have since been published. Even if large quan-

* Wiener Klinik, 1881, and Wiener med. Presse, 1877, Nos. 22–29.

† Berl. klin. Wochenschrift, 1883, S. 790.

‡ Deutsch. Archiv f. klin. Med., Bd. xxi, S. 628.

tities 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.

Parasitic Gastritis—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. [The fungus of thrush, *oidium albicans*, may also be found in the stomach; a case of this kind has been reported by Rosenheim.†]

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 #

---

* Kundrat. Ueber Gastroenteritis favosa. Wien. med. Blätter, 1884, No. 49.

† [Rosenheim. Krankheiten des Speiseröhre und des Magens. 2te Aufl., 1896, p. 236.—Ed.]

‡ Klebs. Ueber infectiöse Magenaffectionen. Allgemeine Wiener med. Zeitung, 1881, Nos. 29, 30.

J. Orth. Lehrbuch der spec. patholog. Anatomie, 1887, S. 704.

reports a case of gastric ulcer in which there were gray sloughs of the mucous membrane looking like bran and containing bacilli. [Martin* believes that bacterial necrosis plays an important part in the formation of many ulcers of the stomach. Nauwerck† also asserts that capillary mycotic emboli may cause gastric ulcers. (See Chapter VIII.) The occurrence of bacilli in gastric cancer will be discussed in Chapter VII.]

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.

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

---

* [Martin. Diseases of the Stomach. London, 1895. p. 418.—Ed.]

† [Nauwerck. Münch. med. Wochenschr., 1895, No. 39.—Ed.]

‡ E. Fränkel. Virchow's Archiv, Bd. cxviii, p. 526.

especially of the submucosa, with central sloughing and consecutive ulceration.

The bacteria found in diphtheria of the gastric mucosa have already been mentioned (page 180).

I must also mention the occurrence of sarcinæ, yeast cells, numerous fungi, etc.; they may at times grow very luxuriantly and irritate the mucous membrane by their products, yet they never seem to penetrate into it. Thus in the stomach contents, and especially in the tenacious mucus which adheres to the mucosa, we may find numerous micro-organisms, and especially sarcinæ, bacterium lactis, a bacillus butyricus, and numerous other organisms, and yet we can not find a single organism in or between the gastric tubules. Abelous,* who has made a very thorough study of the organisms of the stomach contents, and who, for example, isolated no less than eight different bacilli, also makes no mention of any invasion of the mucous membrane. [The researches of Kaufmann, Macfadyen, Strauss, and Bial have already been referred to.]

On the other hand, I may add 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. Senator and Hildebrandt‖ have reported similar cases. In Senator's cases the larvæ were not alone vomited, but came up spontaneously and were spat out by the patient or removed from the mouth with his finger. A long time ago Fermaud△ observed a somewhat similar case, in which gastritis

* Abelous. Recherches sur les microbes de l'estomac. Montpellier, 1889.

† C. Gerhardt. Magenkatarrh durch lebende Dipterenlarven. Jenaer med. Zeitschrift, Bd. iii, S. 522.

‡ Meschede, Ein Fall von Erkrankung, hervorgerufen durch verschluckte und lebend im Magen verweilende Maden. Virchow's Archiv, Bd. xxxvi, S. 300.

W. Lublinski. Ein Fall von lebenden Fliegenlarven im menschliche Magen, 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.—Ed.]

△ Fermaud. Observ. sur une cardialgie accompag. de symptomes de gastrite

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. Nevertheless, we may consider unique the case reported by Pomper * of a young girl, ten years old, in whom the oxyuris vermicularis worms crawled up the œsophagus and could be seen creeping up on the tongue.

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 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 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

---

intense reconnaissant pour cause la présence d'un ver terrestre dans l'estomac. Jour. de méd. pratique de Paris, 1836, tome vii. p. 57.

* Pomper. Beitrag zur Lehre vom Oxyuris vermicularis. Inaug. Dissert., Berlin, 1875.

† [So-called Paris green.] ‡ *Loc. cit.* # *Loc. cit.*

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.* A very characteristic case of cicatrization after corrosion by sulphuric acid has been pictured in Kast and Rumpel'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 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

* A. Lesser. Atlas der gerichtlichen Medicin. Berlin, Hirschwald, 1884.

† Kast und Rumpel. Pathologisch-anatomische Tafeln. Wandsbeck, 1892, Lieferung 1.

of the hand was vomited fifteen days after swallowing sulphuric acid.

In passing, I wish to state that an apparent improvement in the patient's condition soon after the ingestion of the poison should not tempt us to at once give a good prognosis. Not long ago I lost a strong young woman, nineteen years old, who had swallowed sulphuric acid; at the end of the first week there was a decided improvement; yet a few days later she became so weak that she soon died. In the chapter 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 got 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 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]

* Ewald. Zwei Fälle von Nitrobenzolvergiftung. Berl. klin. Wochenschr., 1875, S. 3.

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.

CHAPTER V.

CHRONIC GLANDULAR GASTRITIS.—CHRONIC CATARRH OF THE STOMACH.

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 Copland 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 *gastro-entérite*, which for a long time exerted a powerful influence on the conception of diseases of the stomach among the French, we find even to this day in all French books that dyspepsia embraces a large chapter. It may be interesting to note that the term dyspepsia was first used by Jean de Bovis in the sixteenth century. To be sure,

---

* An amusing recital of these various names may be found in Molière's Malade imaginaire:

Purgon: Et je veux qu'avant quatre jours vous deveniez dans un état incurable.

Argon: Ah! Miséricorde!

Purgon: Que vous tombiez dans la bradypepsie, dans la dyspepsie.

Argon: Mr. Purgon!

Purgon: De la dyspepsie, dans l'apepsie!

† 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.

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.; even a special "*dyspepsie des liquides*" is spoken of by Chomel! Coutaret has published a large octavo volume of 1176 pages under the title of Dyspepsie et Catarrhe Gastrique (Paris, 1890); and 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. It is only recently that Dujardin-Beaumetz ‡ took a decided stand against this view of the dyspepsias, and says: "*D'ailleurs cet mot de la dyspepsia essentielle est appelé de disparaître de la pathologie. Il cache en effet notre ignorance.*"

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 heartburn under what we now recognize as acid hypersecretion.

I shall revert to this topic while considering the conditions of

---

* F. Damaschino. Maladies des voies digestives. Paris, 1880.

† Germain Sée. Du régime alimentaire. Paris, 1887; Des dyspepsies gastro-intestinales. Paris, 1883.

‡ Dujardin-Beaumetz. L'Union Medic., July 22, 1892.

hyperchlorhydria, 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 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. In spite of the statements of certain authors (Jaworski, Korczynski,* Dujardin-Beaumetz, Hayem †), I can not force myself to accept the view that we shall designate as "catarrhs" conditions in which there is hypersecretion accompanying a more or less marked irritation of the mucous membrane. When we find hyperacidity, or, to speak more exactly, hyperchlorhydria, and also the evidences of inflammation of the mucosa (cellular proliferation, cloudiness of the epithelium, etc.), the latter must be regarded as secondary to the former. The hyperchlorhydria is usually due to some nervous influences which cause an overactivity of the secretory apparatus; and it exists in spite of the damage to part of the secretory parenchyma as an evidence of the overactivity of the intact portion, but not as the result of a "so-called acid catarrh," as Korczynski and Jaworski have proposed, since the adjective "so-called" shows that this designation is purely arbitrary.

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

---

* Von Korczynski and Jaworski. Deutsch. Arch. für klin. Med., Bd. xlvii.

† Dujardin-Beaumetz. Traitement des Maladies de l'estomac. Paris, 1891, p. 227.—Hayem. Gazette hebdom., 1892, Nos. 33 and 34.

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 hyperchlorhydria and hypersecretion. In accordance with these views, I shall describe these conditions among the nervous disturbances of the stomach. [This view is not shared by Boas, Rosenheim, and others, who maintain that there are cases of chronic gastritis with increased acidity of the stomach contents. This group of cases is called *gastritis acida.*)

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 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,

* *Vide* Ewald. Klinik, etc., I. Theil, 3te. Auflage, S. 47 and 50 *et seq.*

† Orth. *Loc. cit.*, p. 709.

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-

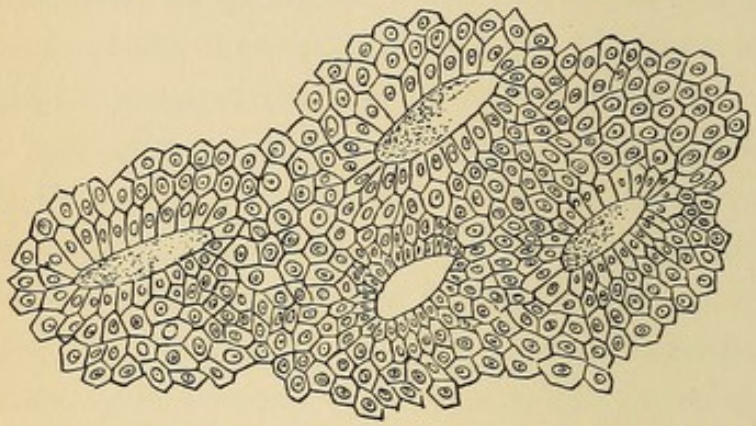


Fig. 27.—Mrs. St., September 27, 1887. From a pale, reddish shred, the size of a grain of sand, which was found between some pieces of mucus in the wash-water after lavage of the empty stomach.‡

* 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.

† [See also Hayem. Gastritis Parenchymatosa. Wiener Allgem. med. Zeit., 1894, Nos. 2–17. Hayem has published the best histological studies of the gastric mucous membrane.—Ed.]

‡ [Some light has been shed upon the changes in the gastric mucous membrane by the study of the fragments of tissue which are frequently found in the wash-water during lavage, as was originally proposed by Boas. A most elaborate study, with illustrations and complete bibliography, has been published by Cohnheim (Boas's Archiv, 1895, Bd. i, p. 274). Einhorn has also studied this subject in his publication on erosions of the stomach (N. Y. Medical Record, June 23, 1894), in which he has endeavored to construct a new clinical group for this symptom—a grouping which does not seem justified when one considers in how many different conditions these fragments may be found. This has been shown in Cohnheim's paper and also in Einhorn's original paper, and one which has just appeared (The State of the Gastric Mucosa in Secretory Disorders of the Stomach, N. Y. Medical Record, June 27, 1896). How far we are justified in drawing conclusions as to the condition of the other parts of the mucosa must remain an open question. This much seems to be established at present, that as yet we are unable to associate any definite pathological changes in the fragments of tissue with the various diseases of the stomach.—Ed.]

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. 27) one can readily see the mouths of the glandular ducts and the surrounding epithelium. The epithelial cells of the *Vorraum* [the short, tunnellike entrance to the cavity of a peptic gland] is for the greater part filled with a pale mucous mass which projects sharply against the lumen without any inclosing membrane, as described by Kupffer* in the normal stomach. I have been able to study this and the following 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

* Kupffer. Epithel und Drüsen des menschlichen Magens. München, 1883. Tafel I.

figures, which resemble a row of horseshoes with their openings toward the lumen of the gland. Fig. 28 has been taken from a piece of mucous membrane which was placed in hardening fluid im-

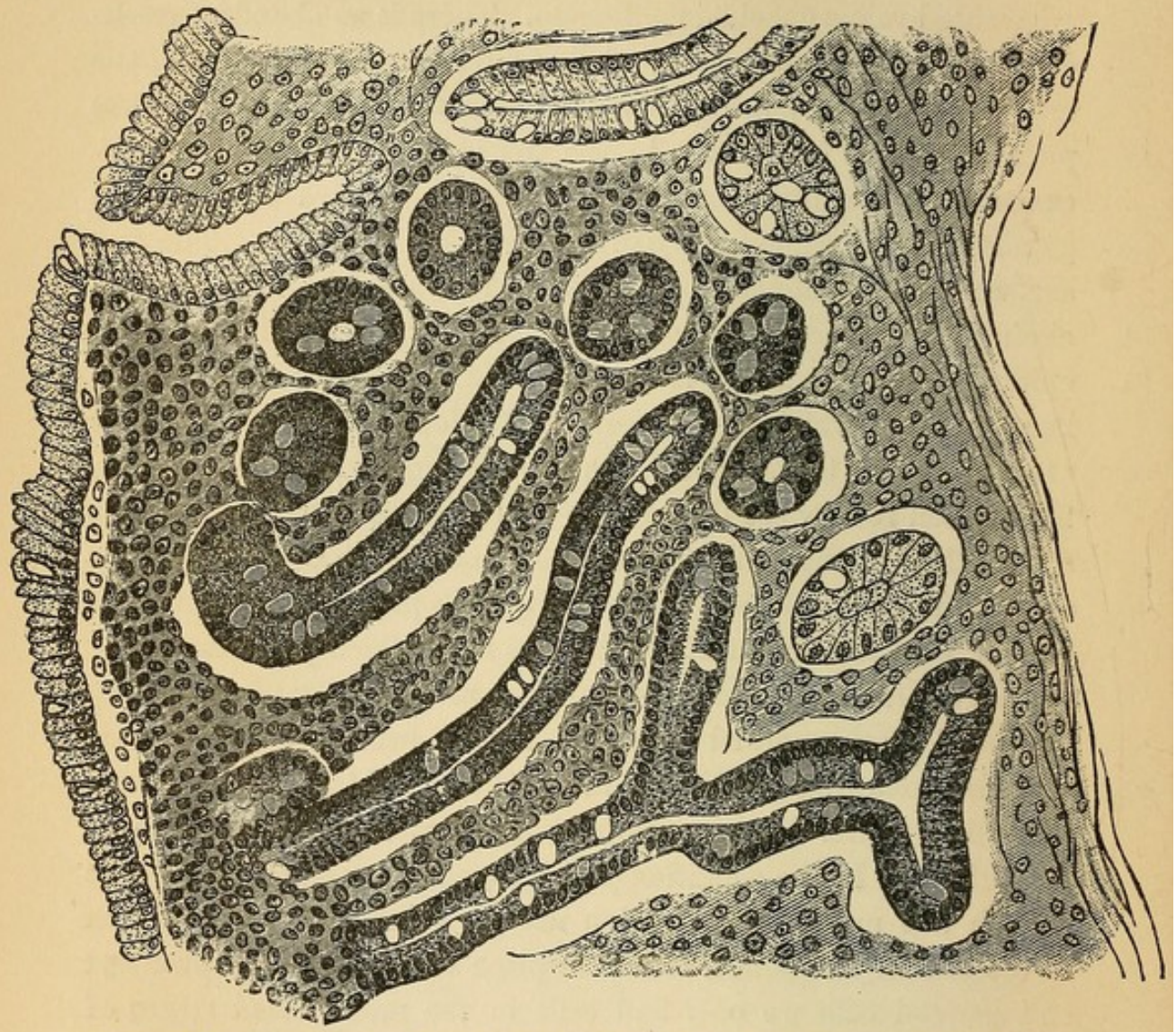


Fig. 28.—The specimen from which this figure has been drawn is from a piece of mucous membrane which was placed in alcohol immediately after its removal from the stomach, at an operation for resection of a pyloric carcinoma. It was stained by Heidenhain's method of hæmatoxylin and bichromate of potash. On the right side of the figure is the upper border of the mucous membrane, showing the epithelium, a few cells of which contain mucin. Directly under the epithelium is a small-celled infiltration which extends across the entire mucous membrane, dipping down to the submucosa between the glandular tubules, separating the latter and obliterating their excretory ducts. The section, being oblique, shows one portion of the glands in longitudinal, the other in transverse, section. In the glandular cells the mucoid degeneration may be seen to extend in even as far as their fundal portion. (Camera lucida.)

mediately after excision. Some of the glands are well preserved, while others are irregularly formed, but only in the pyloric region, the cells of which are in various stages of mucoid degeneration.

Some of the cells are still intact; others are filled with granular protoplasm and a large nucleus; in still others the greater portion of the cell consists of mucus which has crowded the protoplasm and nucleus to one side; finally, there are others in which the cell membrane has burst, the mucus has been poured out into the lumen of the gland, and has been precipitated in streaks by the alcohol. That this is really mucus, and not the isolated formation of vacuoles, as described by Stöhr and Sachs, is easily proved by the reaction with acetic acid and the bluish 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.

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 called especial attention. This 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 historical 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 involved, must finally lead to a total destruction of the secreting parenchyma with all its consequences.

[The correctness of these views on atrophy of the gastric mu-

---

* 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.

cosa have been questioned by Cohnheim,* who quotes Hammerschlag † and Schmidt ‡ in support of his views. Cohnheim maintains that in most cases it is only the true secreting portion of the mucosa which is destroyed, but that the excretory duct, i. e., the foveal layer—remains intact, or is even hypertrophied. The rapid post-mortem changes usually lead to the destruction of these superficial layers, and hence it is only by the examination of the bits of tissue in the wash-water during lavage that the real condition of the mucosa can be determined.]

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. 29, 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 muscu-

---

* [Cohnheim. *Loc. cit.*, pp. 290–294.—Ed.]

† [Hammerschlag. Wiener klin. Rundschau, 1895, No. 23.—Ed.]

‡ [Schmidt. Deutsch. med. Wochenschr., 1895, No. 19.—Ed.]

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 sogenannten "Magenatrophie." Zeitschr. für klin. Med., Bd. xvi, S. 366.—Ed.]

laris. 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.

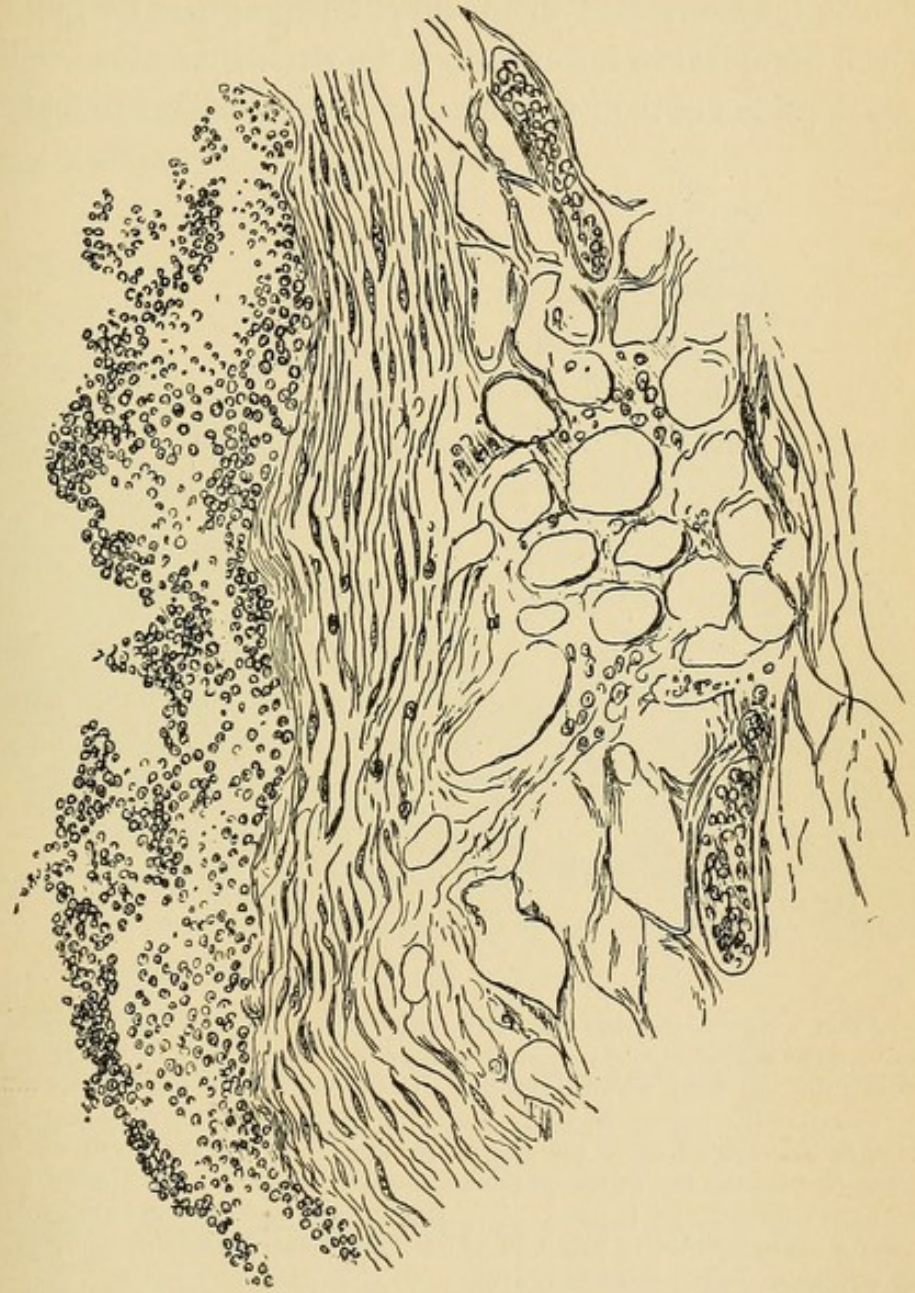


FIG. 29.—From a case of anadenia of the mucosa, with accompanying dilatation of the stomach. Instead of the mucosa we find only round cells, relatively few in number, which still barely indicate the normal villuslike arrangement. The muscularis mucosæ is much broader; the submucosa is stretched out, 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.)

2. The other form is characterized by a marked activity of the interstitial connective tissue, and leads to its hypertrophic prolifera-

tion, which proceeds from the base of the glands upward toward the lumen (Fig. 30).

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 first form, no cysts are formed, since the parenchymatous cells, having been deprived of their nutrition, undergo atrophy; so that finally,

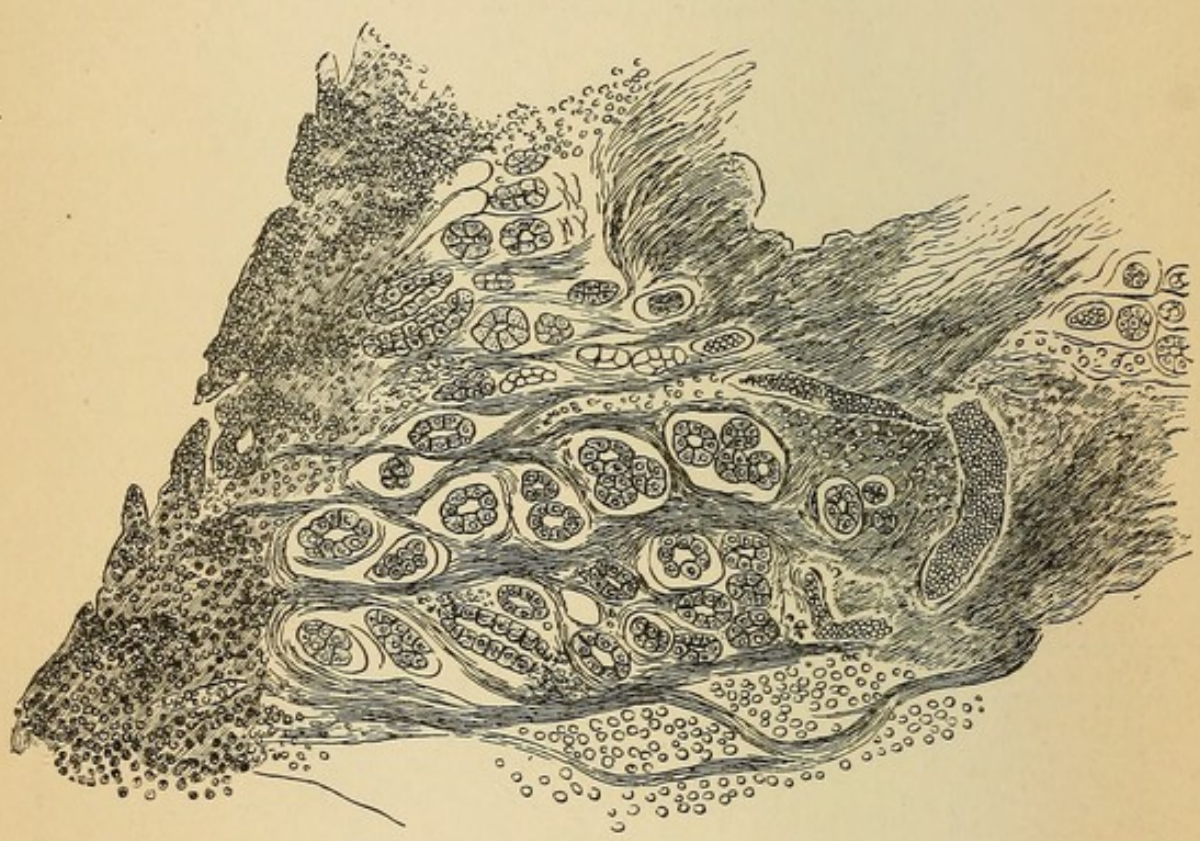


Fig. 30.—From a case of phthisis ventriculi, with cirrhotic atrophy. Broad bands of connective tissue ascend from the submucosa (situated to the right in the figure) upward between the glandular tubules, embrace them and cut them off, thereby causing the destruction of the parenchyma. In many places 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 dense 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 usually not enlarged *in toto*, but at times, as in a case reported by Nothnagel,* may be small and cirrhotic. I have 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.

To what extent the walls of the stomach may be altered by this process may readily be perceived from the following measurements of the various layers made by Westphalen :

	Normal stomach.	Atrophic fundus.
	Millimetre.†	Millimetre.
Mucosa	0·60	0·05
Muscularis mucosæ	0·05	0·01
Submucosa	0·30	0·20
Muscularis	0·70	0·13

On the other hand, there may be a compensating hypertrophy of the muscularis, so that the latter may be twice as broad as usual. This increase, as shown by a case which I have examined, is due to a typical hypertrophy of the muscular tissues.

In either form it is a severe, irreparable process which specially involves the glandular layer of the stomach, and which is characterized 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 propose 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.

* Nothnagel. Cirrhotische Verkleinerung des Magens und Schwund der Labdrüsen unter dem klinischen Bild der perniciösen Anämie. Deutsch. Archiv für klin. Med., Bd. xxiv, S. 53.

† [One millimetre equals $\frac{1}{25}$ inch.—Ed.]

Additional cases of anadenia have since been reported, of which I shall only mention those of Westphalen,* Klinkert,† and Hayem,‡ the latter of whom has described no less than 15 cases. In general, the statements which I have just made above are confirmed, and no new facts are presented, with the exception of a few variations in

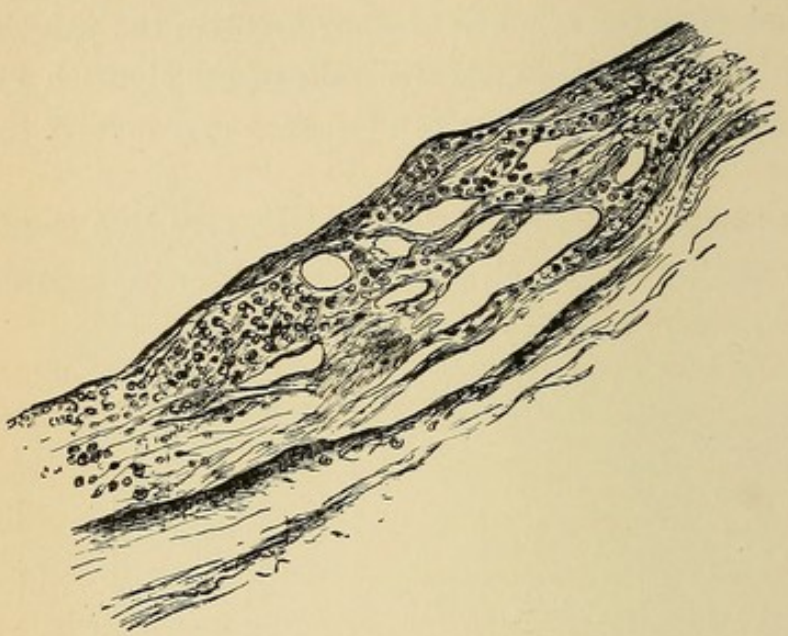


FIG. 31.—Total atrophic sclerosis of the mucous membrane, which has been converted into a long, stretched-out portion of connective tissue, with isolated round cells, and hyaline remnants of former glandular tissues. Toward the free border of what was formerly the mucous membrane (to the left of the 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. Cysts may be seen very close to the free border of the membrane.

the relation of the interstitial to the parenchymatous inflammation and the proliferation of the interstitial tissue. My own histological studies do not enable me to decide whether in the first form we are only dealing with secondary processes after prolonged catarrhal inflammation, or whether, as claimed by some writers, like Fenwick and Eisenlohr,# there is a genuine primary atrophy of the gastric mucosa. I believe this question can hardly be decided from the

* Westphalen. Ein Fall hochgradiger relativ motorischer Insufficienz des Magens und Atrophie der Magenschleimhaut. St. Petersburg. med. Wochenschr., 1890, No. 37.

† Klinkert. De klinische beteekniss van der atroph. Maag-Katarrh. Nederl. Weekbl. v. Geneesk., 1892, No. 5.

‡ Hayem. Résumé de l'anatomie pathologique de la gastrite chronique. Gaz. hebdom., 1892, Nos. 33 and 34.

Eisenlohr. Ueber primäre Atrophie der Magen und Darmschleimhaut. Deutsch. med. Wochenschr., 1892, No. 49.

histological appearances. It would be much easier to assume clinically that a primary atrophy might occur in young individuals without an antecedent protracted catarrh in the sense of the latter writers; yet of this also there exist no unequivocal proofs. [Under the name achylia gastrica, Einhorn * includes all cases in which the stomach contents contain no HCl or ferments; in one group there is atrophy of the gastric mucosa; in the other the mucous membrane may be intact, the cause of the absence of secretion being nervous.] At all events, there are many intermediate stages between the simple and mucous catarrhs and atrophy, so that at times it may be impossible to differentiate the two processes.

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.

---

* [Einhorn. Achylia Gastrica. N. Y. Medical Record, July 6, 1895.—Ed.]

† 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.

[An excellent picture of polyposis of the stomach may be found in Martin's Diseases of the Stomach, 1895, Fig. 23, p. 240.—Ed.]

Such a case of intussusception of the stomach, 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 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, anæmia after dysentery, typhoid fever, acute exanthemata, preg-

* A. Chiari. Ueber Intussusception am Magen. Prager med. Wochenschrift, 1888, No. 23.

nancy, 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 indirectly. To this category also belongs tobacco juice, which frequently produces 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.

[Turck * has conclusively shown the close relation that exists in many cases between diseases of the mouth and nasopharynx and chronic inflammation of the stomach and intestines. He maintains that "the invasion of the stomach from the infected mouth and pharynx is supported by the fact that many of the known pathogenic micro-organisms present identical biological and morphological forms in cases of gastritis as the micro-organisms found in diseases of the mouths and post-nasal cavities of the same patients." He also urges that the decomposition of the food and the growth of micro-organisms in the stomach lead to the formation of poisons which may be absorbed and produce both general toxic effects and local irritation.]

The continual regurgitation of bile into the stomach has been

* [Turck. N. Y. Medical Journal, November 23, 1895, p. 648; ibid., February 22, 1896; Medical News, April 4, 1896, p. 373.—Ed.]

regarded as a special etiological factor. Although the investigations of Dastre and Oddi* show that even large quantities of bile may have no effect on digestion, yet the results of these experiments of animals are directly opposed to the old views on this subject; and, according to the observations of Von den Velden, Malbrane, Riegel,† Weill,‡ and my own experience, it is beyond any doubt that a continual regurgitation of bile may cause chronic disturbances of digestion. But, as shown by Boas, in such cases the bile merely acts as an antacid, since the biliary albumen and mucus combine with the HCl, and it will depend entirely upon the energy of the HCl secretion and the amount of regurgitated bile as to how much the gastric digestion will be disturbed, and to what degree the mucosa will be irritated.

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 gastric 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*) [Hayem's *gastrité parenchymateuse muquese*]; 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. Boas,# by using the new methods of examination, deserves

* Dastre. Recherches sur la bile. Archives de physiologie, April, 1890, p. 315.

† Riegel. Beiträge zur Diagnostik und Therapie der Magenkrankheiten. Zeitschr. für klin. Med., Bd. xi, p. 87.

‡ E. Weill. Du refleux permanent de la bile dans l'estomac. Lyon médicale, December, 1890.

* J. Boas. Zur Symptomatologie des chronischen Magenkatarrhs und der Atrophie der Magenschleimhaut. Münch. med. Wochenschr., 1887, No. 42.

the credit of having differentiated the atrophic from the mucous form.

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.

I shall 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—*heartburn* or *pyrosis*, the *ardor ventriculi* of Hoffman. 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, espe-

cially 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 heartburn 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 even trismus usually precede it. The appetite is either slight or may be lacking entirely; yet the

* MacNaught. Med. Chronicle [Manchester], January, 1885.

† Talma. Ueber Behandlung von Magenkrankheiten. Zeitschrift für klin. Med., Bd. viii, p. 407.

good and bad phases alternate, so that in the former the patients often easily commit dietetic errors and cause fresh irritation. Many patients go 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 crave some sour drink or fluids, especially while eating. Soon after a meal they 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 albumenoids 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 shall show how these conditions may finally lead to dilatation or true gastrectasis (pp. 276 *et seq.*); here I wish to simply add that these decompositions usually occur toward evening; in the morning they may be absent or only very slight.

The conception and the term **atony of the stomach** 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, then it is not proper for certain writers to also include disturbances of the glandular secretion. Atony arises either primarily or secondarily. 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,† 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. I will not now enter into an irrelevant discussion to which some investigations have led as to whether there is a separate disturbance of the peristalsis of the fun-

* R. v. Pfungen. Ueber Atonie des Magens. Wien, 1887.

† Rosenbach. Der Mechanismus und die Diagnose der Mageninsufficienz. Volkmann's Klinische Vorträge, No. 153.

dal 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. [Boas and others group atony of the stomach among the gastric motor disturbances as insufficiency of the stomach. See Chapter VI, on Dilatation of the Stomach. Some authors, such as Boas,* assert that the motor functions are normal or even increased in chronic gastritis, and that rarely, and then only in long-standing cases, is it lessened. He claims that he has never seen a true dilatation follow chronic gastritis. Be this as it may, it is very important to consider the motility of the stomach in all cases of chronic gastritis, especially in reference to treatment.]

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.

---

* [Boas. Magenkrankheiten. Bd. ii, 2te Auflage, p. 21.—Ed.]

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.

Emaciation occurs soon, and is the more marked and earlier in its appearance the stouter the patients have previously been; losses of 15 to 25 kilogrammes [33 to 60 pounds] may often occur in a few weeks. In older patients this may occasion the gravest suspicions as to the nature of the illness, which may only be cleared up by the subsequent course of the disease.

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. In some patients the headaches are only relieved after vomiting slimy, bile-stained masses; in others they are accompanied by a burning sensation in the stomach, or "stomach cramps," which may occur periodically for years; such attacks may even date back to early youth. In one of my patients there was a distinct hereditary factor (grandfather, father, brothers, and sisters). 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 mu-

* 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 [Deutsch. Archiv für klin. Med., 1879, Bd. xxiii], Nothnagel, and Edleffsen [ibid., 1877, Bd. xx] directly deny it.

cous membrane may be irritated by the regurgitation 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 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 been especially studied and published by Rosenbach.‡ (See Chapter X, on the Gastric Neuroses.) But common to all patients is the very

---

A case of paroxysmal coughing proceeding reflexly from the gastric mucosa has been published by E. Bull, Deutsch. Archiv für klin. Med., Bd. xli, S. 472. [Brunton (Disorders of Digestion, p. 40) believes that stomach-coughs are due to the association of mild inflammatory conditions of the upper passages with the presence of some irritant in the stomach.—Ed.]

* [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.—Ed.]

† *Loc. cit.*, p. 391.

‡ O. Rosenbach. Neurose des Vagus bei Dyspepsie. Deutsch. med. Wochenschr., 1879, Nos. 42 and 43.

slight 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

---

* Brück. "Vom Schwindel." Hufeland's Journal, Bd. xvii, 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 halfway 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.

In the course of time I have seen a number of such cases in which it has usually been difficult to determine whether the gastric disturbances were the cause or a sequel of a general neurosis. "Theater-fear" (*Theaterangst*) seems to be a very frequent form of agoraphobia; it attacks the patients in theaters, concert halls, the circus, meeting places, etc.; they can only sit close to the door or keep on a level surface, and even then they may be overcome after a little while so that they must rush out into the open air. Such attacks, however, often depend upon the stomach, for not infrequently they may be checked by eating a piece of bread or chocolate or by taking a swallow of strong wine or cognac. [It is often difficult to distinguish these cases from gastric neurasthenia.]

A very interesting feature is the final stage of chronic catarrhal gastritis already spoken of as **atrophy of the mucous membrane,** or

* Westphal's Archiv, Bd. iii, S. 521; also Bd. v.

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 has been designated *phthisis mucosæ* by G. Meyer; it has also been improperly called gastric phthisis. [These cases have been included by Einhorn * under *achylia gastrica*.]

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 nutrition.

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. 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. As the observations of Jürgens, Blaschko, Sasaki, and Eisenlohr † have

* Einhorn, *loc. cit.*, and Boas' Arch., Bd. i. p. 158. A careful study of this condition, together with exhaustive bibliography, has been given by Stewart, Amer. Journ. Med. Sciences, 1895, vol. cx, p. 560.—Ed.]

† Eisenlohr. Ueber primäre Atrophie der Magen- und Darmschleimhaut. Deutsch. med. Wochenschr., 1892, No. 49.

shown, there is finally also an atrophy of the intestinal walls which manifests itself in a degeneration of the muscular layers, the nervous apparatus, and atrophy or fatty degeneration of the mucosa. Now are added the symptoms of insufficient regeneration of blood, a picture which may simulate progressive 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. When the compensatory action of the intestines suddenly ceases a fresh disease apparently breaks out. I have repeatedly seen such cases after an acute febrile disease, such as influenza, febrile bronchial catarrhs, etc.; they are suddenly followed by a group of symptoms which can only be regarded as the result of anadenia. A number of these cases progressively became worse and died of almost complete anorexia; in several of them there were gastralgic symptoms and perversions of taste (e. g., a continual fecal taste). The diagnosis was confirmed at the autopsies.

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.

The association of these atrophic conditions with severe anæmias indirectly brings them into relation with certain changes in the spinal cord which have been discovered by Lichtheim.* The latter consist of scattered miliary foci, or, when more marked, of extensive degeneration of the posterior columns and other parts of

* Lichtheim. Verhandl. des Congresses für innere Med., 1887. [See Fleiner. Boas' Archiv, Bd. i, p. 249.—Ed.]

the cord. The similarity of the symptoms to those of pernicious anæmia has already* been 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.

Under favorable conditions—i. e., sufficient compensation—the disease may last many years, as shown in a case described by Ein-

---

* [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.—Ed.]

† 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. xiv, S. 573.

horn.* [A number of cases of long duration and occurring in persons under forty years have since been reported.] But in this case, as in all the other cases which were first described, the observers have only calculated the amount of free HCl, and not the total HCl as well; thus we are uncertain whether there was a complete cessation of glandular function exerted or not. [In later reports on this and other cases Einhorn states that combined HCl was also always absent.]

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 functional 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 offhand 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

* Einhorn. Achylia gastrica. N. Y. Med. Record, June 11, 1892.

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 [in artificial digestion] after acidulating.

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. 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, bloody 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 ferment. [The stomach contents obtained after the test breakfast are very characteristic in appearance. The pieces of the roll are unchanged and are not at all digested; the amount of fluid is small, and hence it is often quite difficult to express the stomach contents. Rennet zymogen is sometimes found when all other kinds of ferment are absent.] 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 hydro-

chloric 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. to x] of diluted hydrochloric acid [decinormal HCl solution] are administered [through the stomach tube after having washed the viscus], 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. [Fragments of tissue have been found in the wash-water in lavage by Cohnheim and others.] The absence of hæmatemesis or of blood in the stomach contents is characteristic of anadenia. I have never encountered the latter.

These differences will generally enable us to distinguish the several 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 diagnostic difficulty is encountered in differentiating atrophy 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.

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. But, as I have already said, atrophy leads to a gradual extinction of the gastric functions without the severe

* Jaworski. Zur Diagnose des atrophischen Magenkatarrhs. Verhandlungen des vii. Congresses für innere Medicin. Wiesbaden, 1888. [A good description of this method will be found in Stewart, Amer. Jour. Med. Sciences, vol. cx, p. 563.—Ed.]

vomiting and gastralgia which occur so often in cancer. Another 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 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 rheumatism. 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.

The first class 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, breadcrumbs);* 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 abnormal fermentation, or lessens it if already present. Apparently in relation to such 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 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 was the first to show, what daily experience has since proven,△ that considerable quantities of hydrochloric acid

---

* Ewald. Klinik, etc., I. Theil, 3te 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.

‖ [Acid. hydrochlor. dil. (Ph. Germ.) has 25 per cent pure HCl.—Ed.]

△ Loewenthal (Berl. klin. Wochenschr., 1892, No. 47) went to the unnecessary trouble of proving this over again.

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. It is still better to pour 200 to 300 c. c. [℥ vij—x] of a ·4 to ·5-per-cent. solution of HCl directly into the stomach tube, provided the patient has become accustomed to the tube. I had repeatedly done this with very good success in obstinate catarrhs.* 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. But if one has obtained a clear conception of this subject, it will be seen that these small doses are like pouring drops of water into the sea. 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, 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 amounts of pepsin are said to liquefy large quantities of albumen, yet the artificial pepsin preparations contain a considerable amount of milk sugar; and further, only a portion of the pepsin is active, because a part of it is soon carried on into the in-

* Ewald. Zur Therapie der Krankheiten der Verdauungstractus. Berl. klin. Wochenschr., 1892.

† 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.

testines. 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.

[If pepsin is to be used, the best preparations are the various glycerin extracts which have been placed upon the market. It ought to be prescribed alone, for if combined with HCl and many other substances which have been recommended, such as alcohol (elixirs and wines of pepsin), the activity of the ferment is soon destroyed. Pineapple juice contains a proteolytic ferment (bromelin), and hence may be of service in chronic gastritis.†]

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 done more good 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.

It is best to prescribe the medicament which is to be employed in the lavage in the form of powders, one of which is to be added to a litre [quart] of warm, boiled water. Thus we may order:

---

* [Finkler. Comparative experiments between the action of papoid and pepsin. Therapeutic Gazette, August 15, 1887. Grote. Klinische Erfahrungen über die Wirkung des Papains bei Magenkrankheiten. Deutsch. med. Wochenschr., July 23, 1896.—Ed.]

† [Takadiastase is an amylaceous ferment which has been recently recommended to aid in the digestion of starches in cases of so-called "buccal dyspepsia." These cases seem to me to be forms of hyperchlorhydria.—Ed.]

Sodii bicarbonas.....	7·5 to 10·0	[ʒ j ¼ to ½]
Sodii carbonas.....	10·0	[ʒ j ⅜]
Acid. salicylici.....	1·0 to 3·0	[gr. xv to xlv]
Thymol.....	0·5	[gr. vijss.]
Acid. boric.....	10·0	[ʒ j ⅜]
Sodii biboras.....	15·0 to 20·0	[ʒ j ½ to ⅔]

Of the liquid preparations we may use: Liq. argenti nitras, 50 c. c. [ʒ j ⅔] of a 2-per-cent solution may be added to a litre [quart] of distilled water.* We may also employ Aq. chloroformi, 1000·0; if we wish to prepare it freshly, we may prescribe:

℞ Chloroformi.....	50·0	[ʒ ss ⅔]
Aq.....	1000·0	[Oij]

M. Sig.: Shake well several times during the day and use the supernatant liquid for lavage.

Kresin may be used in 0·5–1·0-per-cent solution, and is preferable to creolin and similar preparations because its odor and taste are less marked. [Hydrogen peroxide has also been recommended by some. I have obtained no special results with it.]

Even after a relatively small number (eight to ten) 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 much-abused "stomach pump," now that the public is better informed of 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 1-per-cent solution of common salt at 42° C. [107·5

---

* [Nitrate of silver may also be applied to the gastric mucous membrane with Einhorn's gastric spray. (N. Y. Med. Journal, September, 1892). The empty stomach is washed out with lukewarm water, and ʒ ss of a $\frac{1}{10}$ to $\frac{2}{10}$ per cent $AgNO_3$ is sprayed.—Ed.]

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 artificial digestion experiments. At all events, the results at Wiesbaden and Kissingen and of daily practice disprove it.

As a stimulant of the glandular secretion, we may also employ internal faradization of the stomach (see p. 103), although the tonic action on the muscular fibers undoubtedly also plays an important part. This much is at all events certain, that I have had perfect success with this method in a number of obstinate cases of chronic gastritis. It must be added, however, that the treatment was faithfully given several times weekly for a long time, together with appropriate drugs and diet; but since the latter had been previously used for a long time without any pronounced good effect, we must accord to the electricity the greater part of the success obtained.

The most contradictory views have recently been expressed concerning the use and action of the so-called *bitters and carminatives*. Although these substances formerly enjoyed a high reputation as gastric stimulants, yet the experiments of Tscheltzow, Jaworski, Reichmann, and Stekhoven† show that the bitters only have any specially

* *Vide* Ewald, Klinik, etc., I. Theil, 3te Aufl., p. 99.

† W. Jaworski. Experimenteller Beitrag zur Wirkung und therapeutischen Anwendung der Amara und der Galle. Zeitschr. für Therapie, 1886, No. 23.—Reichmann. Zeitschr. für klin. Med., 1888, Bd. xiv, p. 177.—Stekhoven. Weekbl. v. Geneesk., 1887.—Tscheltzow, quoted by Tawizki, Deutsch. Arch. für klin. Med., Bd. xlviii, p. 344.

good effect upon the secretive and digestive powers of the stomach when they are taken some time before the meal, and even then the effect on the gastric juice is only slight. On the other hand, Terray, Marcone, Tawizki, and Ramm,* partly from experiments on animals, partly from observations on human beings, uphold the old empirical notions that bitters have a decidedly good effect on the motility and secretions of the stomach. Marcone asserts that when introduced into the empty stomach they stimulate 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.

However all this may be, all writers agree that there is no marked difference between the various bitters, and that any good therapeutic results which may be obtained must be accepted according to the views above mentioned. My own belief is that these differences, which also correspond to what is observed in practice, are to be explained 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 of condurango bark, has been noted by too many and too good observers than that it should depend upon crude self-deception. I have always been satisfied with quassia and condurango, although I usually combine them with hydrochloric acid in such proportion that the solution contains 0·2 per cent of pure hydrochloric acid.

The following formulæ may be recommended:

℞ Cortic. condurango..... 30·0 [℥ j]
Macera per horas xij cum aq. 300·0 [f ℥ x]
Diger. lent. calore ad colatur. 150·0 [f ℥ v]
Adde
Acid. hydrochlor. dilut..... 5·0 [f ℥ j¼]
Syrup. zingiber..... ad 200·0 [f ℥ vj ʒ vj]
M. Sig.: One tablespoonful every two to three hours.

* Terray. Wien. med. Wochenschr., 1891, No. 12.—Marcone. Riforma medica, June 8, 1891.—Ramm, in Kobert's histor. Studien aus dem pharmakolog. Instit.

℞ Tinct. nuc. vomic..... 5·0 [f ʒ j¼]
Resorcin resublimat..... 10·0 [ʒ ijss.]
Tinct. gentian..... 25·0 [f ʒ vj¼]
Syrup. simpl..... ad 200·0 [f ℥ vj ʒ vj]

M. Sig.: One tablespoonful every two to three hours.

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. I usually prefer to combine the tinctura nucis vomicæ with a decoction of one of the above stomachics in such proportin that at least ten drops are in each tablespoonful:

℞ Tinct. nuc. vomicæ..... 5·0 [f ʒ j¼]
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 j¼]
Tinct. nuc. vomicæ..... 10·0 [f ʒ ijss.]
Tinct. castor. canadensis *..... 10·0 [f ʒ ijss.]

M. Sig.: Twenty drops (!) six times daily.

We may also follow the English custom and give ipecac in small doses of 2 to 3 centigrammes [gr. ⅓ to ½] with the extract. nuc. vomicæ in the same dose, ordering it in powders thrice daily, half an hour before meals.

Alcohol also, according to Klemperer,† stimulates the motility, so that the popular belief in the value of "stomach bitters" receives official approval, as it were, although the older investigations, as well as the more recent ones of Klemperer, Hugounang, Georges, Katz, and many others,‡ all agree that it has absolutely no

---

zu Dorpat., Bd. ii, 1890. Here an exhaustive review of the literature of the bitters may be found.

* [This preparation was officinal in the U. S. Pharm. of 1870.—Ed.]

† Klemperer. Alcohol und Kreosot als Stomachica. Zeitschr. für klin. Med., Bd. clxxi, Supplement, p. 324.

‡ Georges. Quelques expériences propres à éclairer la therapeutique de la dyspepsie gastrique. Arch. de méd., 1890, No. 1.

stimulating effect upon secretion and the peptic digestion is even retarded by it.

[The effect of alcohol on digestion has recently been most elaborately studied by Chittenden and Mendel.* Their results agree with those of Roberts,† that "in the presence of less than 10 per cent of proof spirit (5 per cent absolute alcohol) there was no appreciable retardation of gastric digestion. With 10 per cent of proof spirit retardation was only barely perceptible, while with 20 per cent retardation was quite distinct. Beyond this point the inhibitory effect of alcohol increased rapidly." In conclusion, they show that the actual effects of alcohol on digestion can not be determined from the results of the chemical changes alone, but only when these are combined with the effects on secretion, absorption, and penetration. "Not until these points have been thoroughly studied shall we be able to understand fully the action of alcoholic beverages on the whole process of digestion."]

Much has been written about *orexin*, a derivative of chinolin, which Penzoldt has introduced as a true stomachic.‡ Kronfeld # found 101 favorable reports in 176 cases which he could collect from the literature. This does not mean much, because bad results are not published, or, if published, are referred to less than the good ones. Henne ‖ reports that digestion is delayed and even checked by it. Although at the start I had a few unexpectedly good results in improving the appetites of phthisical patients, yet, although I have used it very frequently, I have, unfortunately, found it to be very uncertain; not infrequently it was a complete failure. Besides this, the patients often complained of severe burning pains in the stomach, "as if they had been poisoned." Why more or less

---

* [Chittenden and Mendel. The Influence of Alcohol and Alcoholic Drinks upon the Chemical Processes of Digestion. Amer. Jour. Med. Sciences, vol. cxl, 1896, pp. 35, 163, 314, and 431 *et seq.*—Ed.]

† [Roberts. Digestion and Diet. London, 1891, pp. 115 and 132.—Ed.]

‡ [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.—Ed.]

Kronfeld. Wirkungsweise des salzsäures Orexin. Wiener klin. Wochenschr., 1891, Nos. 3 and 4.

‖ Henne. Experimentelle Beiträge zur Therapie der Magenkrankheiten. Inaug. Dissert., Bern, 1891.

prompt effects should be obtained in some cases and absolutely none in others, I can not explain. My own experience shows that the most failures were in cases of nervous anorexia (hysteria, neurasthenia, etc.). It is administered as orexin hydrochlorate in pills of 0·1 gramme (gr. jss.), 3, 4, and 5 pills of which are taken on three successive days half an hour before the principal meal. [My experience with orexin, both the basic and the hydrochlorate, has been unsatisfactory. The most recent report on it is that of Battistini,* who found it useful in 19 out of 25 cases.]

Creosote and guaiacol have undoubtedly an exceedingly good effect on gastric digestion in many cases, which is probably due to the antifermentative effect of these preparations; but in some cases, either at the beginning or after they have been taken for some time, they are not borne well; the burning pain in the stomach and the constant repeating and offensive taste in the mouth absolutely destroy the appetite instead of improving it. But according to my own extensive experience with these drugs these cases are exceptional; they may be explained either by the fact that the dose has been increased too rapidly or the mode of administration has been bad, thus allowing the creosote to come into direct contact with the mucous membrane of the stomach. Creosote is best given in sugar-coated pills or capsules, each containing 5 centigrammes [$\frac{5}{6}$ grain] creosote with 1 centigramme [gr. $\frac{1}{6}$] balsam of tolu, 10 of which may be taken daily. Guaiacol may be taken in doses of 1 centigramme [gr. $\frac{1}{6}$] several times daily. Henne † claims that these drugs do not have any effect on the gastric juice, and attributes the good effects which he has had to their antiseptic qualities.

The same good effects may be obtained from *resorcin*, the value of which has so often been urged by Andeer. This is a true antiseptic, in spite of the statements of Brieger, Gilberti, P. Guttmann, and others to the contrary. I can fully agree with Menche ‡ in highly recommending it in diseases of the digestive tract accompanied by fermentation. It is essential that the purified, white resublimated

---

* [Battistini. Therap. Monatshefte, December, 1894.—Ed.]

† Henne. *Loc. cit.*

‡ Menche. Das Resorcin als innere Mittel. Centralbl. für klin. Med., 1891, No. 21.

resorcin which is free from all by-products be prescribed; it seems to have none of the bad effects which have been observed after ordinary resorcin. Nevertheless I have once had a case in which blackish-brown urine was passed after using it for a short time, but the urine cleared up immediately after the drug was discontinued. Resorcin is freely soluble in water and alcohol, and may be prescribed with the various infusions and tinctures or as a powder. Some recent favorite prescriptions have been:

℞ Tinct. nuc. vomic..... 25·0 [f ʒ vj¼]
Resorcin. resublimat..... 5·0 [ʒ j¼]
Tinct. cinchon. comp..... 10·0 [f ʒ ijss.]
M. Sig.: Ten to fifteen drops every two hours.

℞ Resorcin. resublimat.,
Bismuth. subnitrat.....āā 10·0 [ʒ ijss.]
Natrii bicarbonat.,
Ext. rhiz. calami,
Sacchar. alb.....āā 8·0 [ʒ ij]
M. Sig.: Teaspoonful every two hours.

These prescriptions may be varied by substituting, as may be needed, rhubarb, salicylates, sulphur, etc.

[My own experience agrees entirely with the above. Although I have used the drug very extensively, only once did I see the characteristic blackish urine which is so familiar after using carbolic acid. I believe such bad effects are due to a decomposition of the resorcin by the alkalies which are so often prescribed with it. It is possible that intermediate bodies, like pyrogallic acid, etc., may be set free. Solutions or powders with alkalies darken after a short time, and hence such combinations ought to be avoided. The great value of resorcin may readily be understood, if we recall that its chemical composition is almost identical with that of carbolic acid. It is valuable not alone as an antiseptic, but also as a sedative. Few drugs are more valuable in gastric disorders than resorcin. The doses given are usually too small; it may safely be given as high as 5 to 10 grains at a dose, and should be well diluted with water.*]

What is true of resorcin may also be said of *salicylic acid and*

* [Manges. Resorcin as a Gastro-intestinal Remedy. New York Polyclinic, June 15, 1895, p. 173.—Ed.]

the salicylates, especially sodium salicylate and bismuth salicylate. The fact that salicylic acid is not used more frequently in gastric catarrhs may be due to the fact that it is strongly irritant to the gastric mucosa and also to the kidneys; while it is claimed—whether rightly or wrongly, I do not know—that bismuth salicylate acts more upon the intestines than upon the stomach. [The decided cholagogue action of the salicylates renders them peculiarly valuable agents where disorders of the liver are associated with the gastric disorders. Phenol bismuth and betanaphthol bismuth (dose 15 to 30 grains) are said to be mostly decomposed in the stomach, and have been proposed to replace bismuth salicylate.]

I have been much less satisfied with the action of carbolic acid, thymol, benzoic acid, naphthalin, and naphthol; this is probably due to the fact that their disagreeable after-effects prevent the administration of sufficiently large doses.

On the other hand, in catarrhs associated with gastralgia, I have found *chloral hydrate* to be of very great value because it is an antifermentative as well as a sedative. The three cases of agoraphobia cited above were all cured with chloral. I order a tablespoonful of a 3- to 5-per-cent solution to be taken every two hours. The same is true of *chloroform*, the high antiputrefactive value of which has been shown by Salkowski. It is best administered in doses of 2 or 3 drops in a teaspoonful of water or claret every 2 or 3 hours.

I wish to call attention once more to the *antifermentative action of a systematic use of hydrochloric acid.*

It is also well known 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. [An excellent antacid for occasional use is the tablet proposed by Roberts.* Each tablet consists of

℞ Calcii carbonat. præcipit..... gr. iijss.
Magnes. carbonat..... gr. ijss.
Sodii chloridi..... gr. j

The tablets are to be allowed to dissolve slowly in the mouth, the

* [See Sir William Roberts. British Med. Journal, 1889, vol. ii, p. 373.—Ed.]

copious flow of alkaline saliva being thus induced. Concerning the action of bicarbonate of soda in gastric disorders many papers have recently been written; of these the most important is that of Reichmann.* After very careful experiments he concludes that it acts as an antacid upon the acid already secreted, but that it in no way influences the secretory power of the stomach, even if used for a long time.]

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.

[The popular use of charcoal has been ably defended in a recent prize essay by Wild,† who has made a careful laboratory study of it. Although not possessing any antiseptic properties, yet his experiments showed that it may be useful either by oxidizing the chemical substances formed during abnormal decomposition or the toxins produced by pathogenic organisms. "This action may be direct or indirect through the aërobic processes of putrefaction, and it is possible that a supply of oxygen contained in the charcoal may modify the pathogenic organisms themselves, and render them or their products less virulent. The power of charcoal to remove alkaloids from solutions is worth considering, as certain toxins and ptomaines are possibly of this nature. It may thus prevent auto-intoxication from the alimentary canal." It may be given in from 2 to 6 teaspoonfuls or more daily. Wood charcoal absorbs much more gas than animal charcoal.]

However, the best treatment of fermentation, if at all pronounced, is lavage of the stomach, the details of which will be discussed in the chapter on Dilatation of the Stomach.

[Turck ‡ has recently suggested the use of his gyromele (revolv-

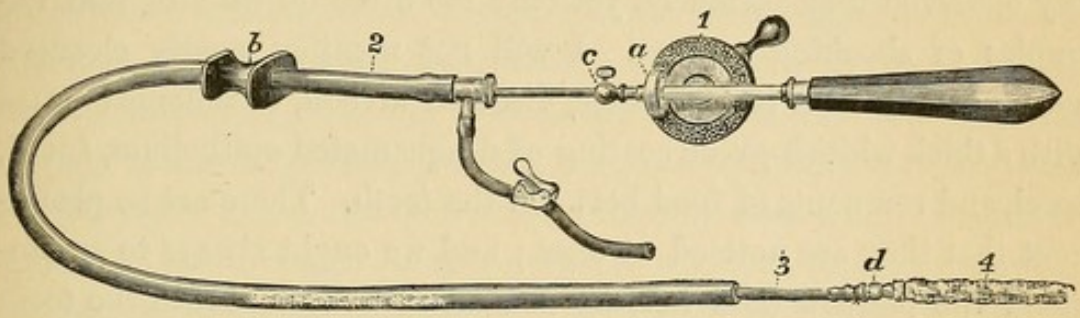
---

* [Reichmann. Boas' Archiv., Bd. i, p. 44.—Ed.]

† [Wild. Medical Chronicle, 1896, No. 4, p. 401. Abstracted in N. Y. Medical Journal, 1896, vol. lxiii, p. 463.—Ed.]

‡ [Turck. Wiener med. Wochenschr., 1895, Nos. 1 and 2.—N. Y. Medical Journal, November 23, 1895, p. 648. Medical News, April 4, 1896, p. 373.—Ed.]

ing sound) (Fig. 32) in the treatment of chronic gastritis. The instrument consists of a stomach tube inside of which is a flexible cable (3); to the lower end of the latter is attached a sponge (4) covering a spiral spring (*d*) which can be removed and changed; the sponge may be protruded from or withdrawn into the stomach tube. The



[Fig. 32.—Turck's gyromele.]

stomach tube and cable are attached to a hand piece by which the latter can be made to rotate very rapidly. The instrument is introduced (with the sponge withdrawn up to the tube) just like an ordinary stomach tube; the sponge is pushed out by depressing the long handle and is made to revolve rapidly by turning the crank. Water may be introduced through the small lateral tube which is armed with a pinchcock. The movable gag (*b*) is placed between the patient's teeth. The revolving sponge catches up any adherent mucus and food fragments and cleanses the mucous membrane just as the ancients sought to cleanse the stomach with their gastric brushes. By changing the position of the tube the various parts of the stomach may be cleansed. The instrument may also be used to obtain bacteriological cultures of the stomach contents. Turck claims excellent results for his instrument in the treatment of chronic gastritis.]

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. However, all these procedures are useless unless they are combined with a careful regulation of the diet.

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 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.

[Attention has already been directed to Turck's work on the importance of the naso-pharynx in the treatment of chronic gastritis (page 207). Hemmeter * has devised a tongue brush for removing the *débris* which accumulates at the root of the tongue.]

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

* [Hemmeter. N. Y. Medical Journal, December 28, 1895, p. 836.—Ed.]

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.* Still, it is of great importance to give the patient a daily bill of fare in which the time of meals and the kind and exact amount of food are explicitly stated.† But in doing this we should follow the patient's tastes as far as possible, and should arrange regular meals at two to three hours' intervals.

That what is allowed should be given in the most digestible condition, is self-evident. 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

---

* [This subject is very well discussed in Sir William Roberts's work on Digestion and Diet, London, 1891, pp. 160 *et seq.* A good review of the chapter on this topic will be found in the American Journal of the Medical Sciences, 1891, vol. ci, p. 397.—Ed.]

† [Boas has recently protested vigorously against the custom of giving the patient a printed diet list, as too much freedom is thus allowed. Nevertheless, with a little care such lists, if properly prepared, will be found useful. The best set of detachable diet lists which has yet been published is that of J. B. Thomas, Diet Lists and Sick-Room Dietary. Published by W. B. Saunders, Philadelphia, 1895. —Ed.]

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,† with the aid of the stomach tube, has experimented on himself with various articles of food prepared in as many ways as possible. 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. It is scarcely necessary to mention that white meats like veal, poultry, and young game, venison, etc., are easy to digest. Eggs, even when raw, are badly borne, much more frequently than would be suspected; scrambled eggs and omelettes are to be excluded at once. 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 from red meats is not indicated, not on account of its albuminoids, but because the high percentage of salts may irritate the gastric mucosa; this is not the case with bouillons made from white meats. Gelatinous soups and jellies made from calves' feet, calves' heads, ox tails, etc., are bland and nutritious on account of their gelatin, which is easily oxidized and saves the bodily fats from combustion. 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

* R. H. Chittenden. On the Relative Digestibility of Fish Flesh in the Gastric Juice. Amer. Chemic. Jour., vol. vi, No. 5. Chittenden places oysters almost at the foot of his table. This is not absolutely correct. Not long ago I artificially digested some oysters and found that they were digested more rapidly and completely than soft-boiled egg albumin. Raw and not fried oysters should be allowed; they should be chewed, and not swallowed whole. The greater part of an oyster consists, as is well known, of glycogen and a digestive ferment, hepatic diastase. In chewing, both substances are brought together, so that the glycogen is immediately converted. By frying, the ferment is destroyed and the usefulness of the glycogen is also lessened, just the same as happens when the oysters enter a stomach which contains too much HCl. Hence oysters are especially well digested when there is a deficiency in the secretion of HCl. Roberts, *loc. cit.*

† X. Gigglberger. Ueber die Dauer der Magenverdauung von Fleischspeisen. Inaug. Dissertation. Erlangen, 1886.

‡ *Vide* Ewald. Klinik. etc. I. Theil. 3te Auflage, pp. 114 *et seq.* [Elaborate tables are given as to the digestibility of the various articles of diet.—Ed.]

sauces should not be found on the dyspeptic's table. A substitute for meat may be found in the peptone preparations and peptone chocolate;* the latter is expensive, but 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. Therefore 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; consequently 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. Koumyss and matzoon are well borne by most persons; some, however, can only take them for a short time. It must also not be forgotten that an exclusive milk diet is a kind of slow starvation, and that to live on milk alone

* [Mosquera's beef cacao is a similar preparation; 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. Somatose may also be highly recommended.—Ed.]

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.

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.* According to experiments performed on himself, Eichenberg † claims that small quantities of alcoholic beverages (cognac, alcohol) lessen the time of digestion a little ($\frac{1}{6}$ to $\frac{1}{10}$ of the total time), just as 50 to 60 drops of the officinal diluted HCl do. As bland beverages we may use the time-honored orgeat, rice water, and decoctions of hops, salep, and barley.

It is self-evident that in diet lists we can only give general directions and the maximum quantities beyond which the patients must not go. For the exact selection and preparation of the various articles of diet I would refer to what has already been said, and to Weil's Tisch für Magenkranke or Heyl's Kochbuch für Krankenküche.‡

Although it is important to regulate the patient's diet, yet it is equally essential to see that the ordinary diet is resumed at the proper time. Most patients are only too glad to resume this as soon

---

* [These remarks apply with even greater force to the use at meals of alkaline carbonated waters like Vichy, Seltzers, etc.—Ed.]

† Eichenberg. Ueber die Aufenthaltsdauer der Speisen im Magen bei Zufuhr von Salzsäuer, Alkohol, und andere Reizmitteln. Dissert. Erlangen, 1891. (The writer experimented on himself.)

‡ [For additional data upon the dietetics of chronic gastritis, see Thompson's Practical Dietetics, 1896, pp. 496 *et seq.*; Burney Yeo, Hare's System of Therapeutics, 1891, vol. i, pp. 646 *et seq.*—Ed.]

as possible; yet there are many anxious patients, of whom we shall speak later when discussing neurasthenia, who allow themselves to run down by remaining unnecessarily long on a restricted diet, so that the original catarrh of the stomach is followed by nervous dyspepsia or a general weakness which can only be combated by an energetic change of diet.

That the regulation of the diet must be combined with attention to *general hygiene* need hardly be mentioned in our times. The care of the skin and lungs—in short, the care to obtain pure air—constitutes the most important part not alone of the prophylaxis, but also of the treatment, of nearly all chronic diseases. But it is in cases of chronic gastric catarrh that much harm is done, because most patients think 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 home gymnastics, massage, daily walks and rides can accomplish much good. "*Maximeque qua superiores partes moveat, quod genus in omnibus stomachi vitiis aptissimum est*," says Celsus; yet it would be even better to bring the body into moderate action but not overexertion. [The bicycle has afforded a happy solution of the above problem. Its rational use is followed by the most excellent results in this class of cases.] †

---

* Mitan. Das Rudern, eine heilgymnastische Uebung. Inaug. Dissertation. Berlin, 1882.

† [Those who are interested in the medical aspects of the bicycle may consult an exhaustive study by Mendelsohn in Deutsch. med. Wochenschr., 1896, Nos. 18 to 25. An extended discussion of this paper will be found, ibid., Vereinsbeilage, April 2, 1896 *et seq.*—Ed.]

[In some cases it is equally important to prescribe rest; persons with enfeebled digestion are often benefited by lying down for a short time after eating.]

Finally, some special points in the treatment still require discussion.

Where *gastralgia* 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 ʒ j¼]
	Aq. amygdalæ amaræ.....	20·0 [f ʒ v]

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 spoken very highly of the use of calcium and bromide salts and 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, for I have used it in the form of an infusion for more than twenty years; occasionally excellent results were obtained with the officinal extract, using as much as one decigramme [gr. jss.] at a dose; others were attacked with severe cerebral symptoms, like intoxication and headache; in still others it had no effect whatever.

[I can fully agree with Mackenzie's recommendation of canna-

* Siebert. Ueber Magenschmerz und Magengeschwür. Deutsche Klinik, No. 10, 1852.

bis indica in the treatment of gastralgia and enteralgia.* The varying reports are due not to the drug but to the preparation employed. The unpleasant effects due to idiosyncrasies may be avoided by beginning with small doses and gradually increasing until the point of tolerance is reached. Mackenzie prefers the tincture for rapid effects, the extract being more suitable for slow and continuous use.]

Codeine, especially codeine phosphate,† acts 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, extract of belladonna, etc. :

℞ 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.

It is superior to morphine because it retards the intestinal peristalsis much less, and its use is very rarely followed by nausea.

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 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 stom-

* [Stephen Mackenzie. On some Classes of Cases in which Indian Hemp is of special Service. Medical Week, 1894, p. 457.—Ed.]

† [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].—Ed.]

‡ [This portion of this work has not yet been published.—Ed.]

ach 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 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 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, benzonaphthol, and extract. nuc. vomic. (in atony of the stomach with tendency to flatulence from intestinal fermentation):

℞ Extr. nuc. vomicæ..... 0·5 [gr. vijss.]
Bismuthi salicylatis,
Benzonaphthol.....āā 10·0 [ʒ ijss.]
Pulv. rad. rhei..... 15·0 [ℨ ss.]
Natrii sulphatis.,
Potassii bitartratis.....āā 8·0 [ʒ ij]
Natrii bicarbonatis..... 5·0 [ʒ j¼]

M. Sig.: One teaspoonful every two hours.

Here I may also mention cream of tartar, Rochelle salt, or tartrate of soda (Ph. Germ.); they may be given in effervescing lemonades,

* Ewald und Boas. Zur Physiologie und Pathologie der Verdauung. II. Virchow's Archiv, Bd. civ.

in powder with washed 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 in all its various proportions it is a very valuable aid to dyspeptics; yet it has one great disadvantage, that its action is temporary and is followed by obstinate constipation. 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. Ph.] 0·05 [gr. $\frac{5}{6}$] with 10·0 [ʒ ijss.] of glycerin has been highly praised by some, but according to my experience is very uncertain.

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

---

* [This drug may also be used as a stomachic as well as a laxative.

℞ Tinct. nucis vomicis..... 10·0 [ʒ ijss.]
Ext. cascaræ sagradæ fluidi,
Elix. aurantii.....āā 40·0 [ʒ x]
Aquam.....ad 120·0 [℥ iv]

M. Sig.: Teaspoonful fifteen minutes before eating.—Ed.]

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 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 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. Small enemata of about 300–500 c. c. [℥ x–xvj] of pure, slightly warmed olive oil often have an excellent, mild laxative action where other forms of injections have no effect at all, or, if they do act, only cause unsatisfactory watery stools with much tenesmus and abdominal pain. I have used them frequently, and can indorse the very favorable reports of Kussmaul and Fleiner.* 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. Dilatation of the rectum after the use of too large enemata is much more to be feared, and patients ought to be warned against this possibility. 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

* Fleiner. Ueber die Behandlung der Constipation mit grossen Oelklystieren. Berl. klin. Wochenschr., 1893, No. 3. [These oil enemata are especially valuable in cases of so-called spastic constipation. Such cases may readily be recognized by the passage of small, very hard scybalæ and by the failure of the ordinary cathartics. The latter make matters worse, because, instead of relaxing the spasm of the intestines, they only increase it.—Ed.]

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.*

---

* 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.

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 aggravating 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.

For the influence of common-salt mineral waters on digestion

---

(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., 1883.—Hayem and Hare. Physical and Natural Therapeutics, 1895.—Ed.]

* 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.

I refer to what was said on page 228, 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 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 seashore; 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

* J. Boas. Verhandlungen des Vereins für innere Med. zu Berlin, November 5, 1888.

† 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."

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 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. The stereotyped directions to walk after drinking this or that water in the morning on an empty stomach will do for the majority of patients, but by no means for all. The waters do not agree with some when taken in this way, but will be well borne if taken while still in bed or later in the morning,

provided we do not suddenly upset the patient's routine mode of living. There are still others who can only proceed gradually to take the actual "cure." Therefore I frequently prescribe a preliminary course of some other water at home before the patient goes to the springs; for example, if Carlsbad has been recommended, I advise taking small quantities—say ¼ to ⅓ litre [quart]—of Wiesbaden *Kochbrunnen* water.

In the above I have simply given the general indications for choosing springs; for further details one may consult the text-books on balneology, and to the admirable treatise of Leichtenstern in Ziemssen's Handbuch der allgemeinen Therapie.* I need hardly indicate 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 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.

---

* [Vol. IV of American translation, New York, 1885.—Tr.]

† Ewald. Der chronische Magenkatarrh und seine Behandlung an den Heilquellen. Deutsch. med. Zeitung, March 3, 1889.

CHAPTER VI.

[MECHANICAL] INSUFFICIENCY AND DILATATION OF THE STOMACH.

As I have already stated [page 90], there is no absolute standard for the normal size of the stomach, and its capacity stands in no relation whatever to the size of the individual. 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. Furthermore, as Kussmaul and Rosenbach * have already shown, there are very large stomachs which exert no disturbing influence on digestion, so that they are discovered accidentally while making some other examination. I therefore distinguish between *the large stomach, megalogastria*, and the *enlargement of the stomach, gastric dilatation or gastrectasis*, which in turn is to be divided into an acute or subacute and a chronic form. Megalogastria 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*.

Accordingly, I would define dilatation of the stomach, or gastrectasis, as that condition of the stomach in which the clinical symptoms of disturbance of the gastric functions proceed from an enlargement of that organ; megalogastria, however, is the congenital or acquired large stomach, the functions of which are compensated. Persons with large stomachs may have catarrhal gastritis, etc., but this does not mean that they have dilatation as it is understood clinically, although they are more disposed to this condition than are others.

---

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

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. Megalogastria and gastrectasis have frequently been confounded with each other. An entirely different condition, if I may anticipate, is *gastric insufficiency*—Westphalen's relative dilatation, Rosenbach's relative gastric insufficiency—which indeed may and frequently does lead to the symptoms of gastrectasis, 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:** ‡

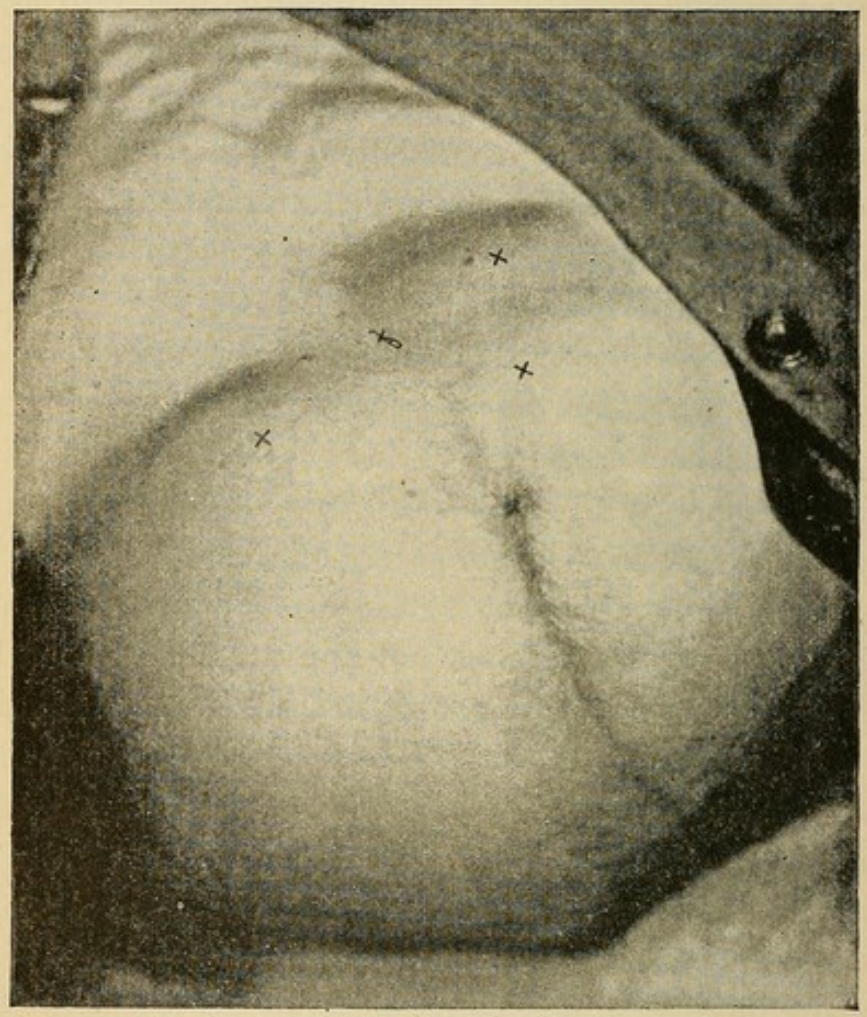
1. *Inspection.*—With relaxed and thin abdominal walls we frequently see the left hypochondriac region and a larger or smaller portion of the right, according to the extent to which the stomach is filled with air or ingesta, bulge out like a hemisphere or balloon, beginning just below the free margin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

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

† [An excellent discussion of this subject will be found in Riegel. Ueber Megalogastrie und Gastrectasie, Deutsch. med. Wochenschr., April 12, 1894, p. 333.—Ed.]

‡ [See also p. 80 *et seq.*—Ed.]

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‡). [See Fig. 33]. If we inject air into the stomach,



[Fig. 33.—Photograph showing tumor caused by dilated stomach, and also undulatory waves of peristalsis. The crosses are placed on the three prominent waves. The letter *f* indicates the depression on the lesser curvature. (Osler.)]

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. The epigastrium, which before had been sunken in, now projects forward, so that we may usually,

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

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

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

although not always, distinguish dilatation from gastroptosis (see page 89). In electric transillumination of the stomach we see a broad illuminated zone extending from the left of the navel down to the suprapubic or left inguinal regions. [See Fig. 15.] In advanced dilatation the body is usually emaciated, the abdominal walls are relaxed and slightly sunken, and the false ribs on the left side are raised like wings. The skin is dry, pale, and somewhat tawny.

[Inspection is a means of diagnosis which is very much neglected. Its great value may be appreciated by bearing in mind that Osler,* in 10 out of 13 cases of gastric dilatation, was able to make the diagnosis from mere inspection. An excellent idea of what is seen on inspection of the abdomen when the stomach is



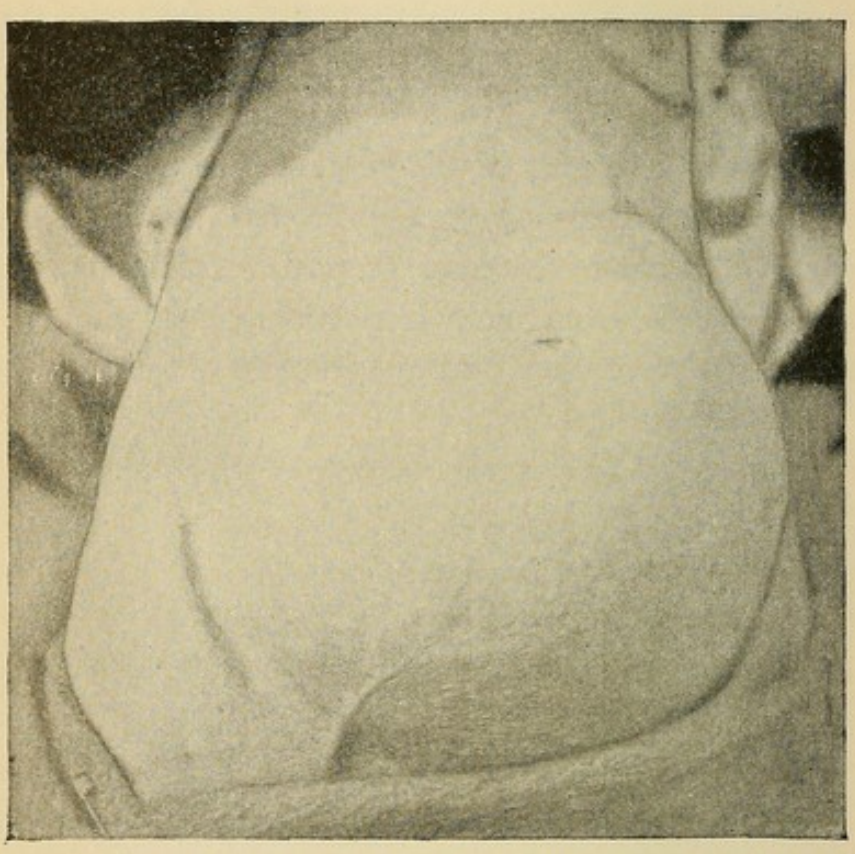
[Fig. 34.—Profile view of abdomen of woman, sixty-five years old, showing the tumor caused by dilated stomach. From photograph taken during life. (Osler.)]

dilated may be obtained from Figs. 33, 34, and 35. The peristaltic waves are well shown in Fig. 33; when present—which occurs much more frequently than is generally supposed—they are a great aid in diagnosis. The force of the waves may be increased by flapping the abdomen with a wet towel or rubbing the skin with a lump of ice. They are not visible in Figs. 34 and 35, as the dilata-

*[Osler. Lectures on the Diagnosis of Abdominal Tumors, 1895, p. 23. This excellent work should be studied by all who would attain any proficiency in abdominal diagnosis.—Ed.]

tion in this was so great that there was paralytic distention of the stomach.]

2. *Percussion.*—Should any suspicion of dilatation exist, it is best before percussing to first distend the stomach with air. The double bulb ought to be alone used for this purpose, for I have



[Fig. 35.—Anterior view of same case as Fig. 34, showing tumor caused by dilatation of stomach. From photograph taken during life. (Osler.)]

seen so many errors arise from the use of carbonic-acid gas that I consider the latter only a poor compromise. I shall cite but one of many examples of this: 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 actually insufficient for the capacity of the stomach.* The percussion note over the inflated stomach is always tympanitic and more

* [Nevertheless, Osler, Riegel, and many other good observers express themselves as being satisfied with the carbonic-acid gas method. It possesses the very great advantage over the inflation with air that the introduction of the stomach tube is unnecessary. A teaspoonful of sodium bicarbonate and not quite a teaspoonful of tartaric acid, or the two powders of a Seidlitz powder, are each dissolved in half

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 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. Kernig lays stress upon the fact that on examination in the recumbent posture of patients with dilated stomachs the dullness in the left lateral region disappears on turning over on the right side, a tympanitic note appearing instead. This does not occur in normal subjects; on the contrary, the dullness either persists, or is displaced a little laterally forward, or gives a little less dull note than when recumbent. The same is true if the percussion is done while standing. Yet it is evident, *a priori*, that this must depend essentially upon the quantity of gas and ingesta in the stomach and intestines; for Kernig also found differences even in healthy persons according to the length of time which had elapsed since taking food, so that there was no distinct dullness in the third to the fifth hour after a meal.

On the other hand, I have repeatedly found that when the dilatation is well marked the differences in dullness on postural

---

a goblet of water and drunk in rapid succession. The patient must refrain from belching. If in doubt, we can always resort to inflation with air.—Ed.]

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

changes, as above described, persisted in all stages of digestion and even when fasting.

*Dehio's method** has been recommended for determining the boundaries of the stomach in normal and pathological conditions. 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 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. I have found, however, that the latter is not true in all cases, for if the transverse colon is markedly dilated and contains watery stools, the same difference in resonance will be observed. Yet this will cause confusion in only a few exceptional cases.

At the same time, this procedure allows us to recognize the conditions 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. [In other words, Dehio's method is an excellent means of determining the tone or contractility of the gastric muscular wall.] 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 ab-

---

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

dominal walls are not so thick as to entirely prevent the transmission of the more delicate differences in sound.

3. *Palpation.*—Leube has recommended "palpation of the tip of the tube" 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. It seems that Leube himself does not value this method very highly; furthermore, it has not become popular on account of the inconveniences connected with it and because the results are doubtful. Albutt* is right in saying: "In my opinion palpation of the tip of the sound is unnecessary when the abdominal walls are thin, while in stout persons the instrument can not be distinctly felt."

[Boas† has recently called attention to this method and claims excellent results from it. A very long, soft-rubber tube is introduced into the stomach, and if the abdominal walls are sufficiently relaxed the tube may readily be palpated along the greater curvature. Experiments made by Schmilinsky‡ show that the tube invariably passes on until it reaches the greater curvature and then glides along it until it reaches the pylorus. According to him, Fig. 3 (page 16) is incorrect. It is to be noted that not the tip, but the tube itself, is palpated. If any doubt exists as to what is palpated, the tube may be withdrawn; while this is being done we may readily feel the tube slip from under the fingers. To avoid errors, the epigastrium ought to be palpated before the introduction of the tube. The examination is made either on an empty stomach or after introducing one to two pints of water. It is best done in the recumbent posture. The instrument moves with respiration, and the position of the pylorus may also be ascertained. The method will not be successful in fat people or patients with rigid abdomens.

With a little practice the method is easily learned. Boas was

---

* *Loc. cit.*

† [Boas, Centralblatt für innere Med., February 8, 1896.—Ed.]

‡ [Schmilinsky, Ueber Sondenpalption und die Lage des Magens. Boas's Archiv, Bd. ii, p. 215.—Ed.]

successful in 25 out of 30 cases; Schmilinsky failed to feel the sound in only 3 out of 100 cases. My experience with the method is at present rather limited; but, so far as I can now express an opinion, I would say that it promises to be a very useful procedure.

Osler * calls attention to the fact that palpation will often enable us to recognize the position of the pylorus by noting that in following the peristaltic waves the muscular contractions at the pylorus are unusually firm; in some instances the contractions and relaxations remind one of the uterus. Furthermore, in palpating the pylorus region gas may be felt as it gurgles through the pylorus. This is usually marked when the stomach is inflated; but it may also occur spontaneously and at regular intervals. "In doubtful tumors of this region this is a sign to which scarcely sufficient attention has been paid."

Another point to which Osler directs attention is that in dilatation of the stomach the palpation of a pyloric tumor may be very variable from time to time, according to the degree of distention of the stomach. See Figs. 6 and 13 (*loc. cit.*).]

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.† [Succussion sound can usually be brought out best by striking the abdomen with the ulnar side of the hand, care being taken that the abdominal parietes are relaxed as much as possible. By successively striking the abdomen from above downward, and noting where the sounds cease or change in character, we are often enabled to at once determine the solution of the lower curvature. The patient must be in the recumbent posture.] In themselves they have no pathognomonic significance. They may arise in the transverse colon as well as in the

* [Osler, *loc. cit.*, p. 26.—Ed.]

† 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. [Rose, N. Y. Medical Journal, June 15, 1895, p. 739.—Ed.]

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 pathognomonic (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.

[Bianchi's phonendoscope * promises to be a very useful instrument in auscultating the size of the stomach. The method of using it is simple, and my experience with it has been very satisfactory.]

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 Selters 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, 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. Unlike 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.

---

* [For details of the instrument and mode of employment, see Schwalbe, Deutsch. med. Wochenschr., July 30, 1896.—Ed.]

† Penzoldt. Die Magenerweiterung. Erlangen, 1877.

‡ Kussmaul, in Volkmann's Samml. klin. Vorträge, No. 181.

Strümpell and Laker* speak of sounds which could be heard at quite a distance and which were isochronous with respiration in a patient with dilatation of the stomach. I have made similar observations, but they are simply to be regarded as curiosities. 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. Furthermore, the method is rendered entirely superfluous, because Dehio's method is much simpler.

5. *Mensuration of the Stomach.*—As already stated on page 92 this may be determined either by ascertaining the volume of air

---

* Berl. klin. Wochenschr., 1879, No. 30. Aus den Sitzungsberichten der med. Gesellschaft zu Leipzig.—Laker. Ueber ein rhythmisches Klangphänomen des Magens. Wiener med. Presse, 1889, Nos. 43 and 44.

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

‡ *Loc. cit.*

which can be inflated into the stomach, or by measuring the amount of water which is required to fill it. 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 tone of the gastric muscular fibers, and the capacity of the stomach is so different individually. Therefore the first method is preferable if it is carefully carried out. That the results are variable and not absolute has already been shown (page 92).

Ost* has called attention to the fact that, even normally a portion of the inflated air seems to escape into the intestines; for, after inflation and then emptying the stomach of its air as far as possible, Ost regularly found that the circumference of the abdomen had increased a few centimetres. Kuttner verified this statement by experiments at the Augusta Hospital; in almost every instance the circumference of the abdomen increased 1 to 2 centimetres [$\frac{2}{5}$ to $\frac{4}{5}$ inch]. That gas may readily escape from the stomach into the intestines had been shown in 1888 by Senn,† in his experiments on dogs into whose stomachs he had inflated hydrogen.

But where such gross errors can not be avoided, it is futile to calculate the expansion of the air in the stomach, as proposed by Jaworski, Ost, and Kelling.‡

But, as things stand, we must abstain from laying undue stress upon small differences in measuring the capacity of the stomach, and should only speak positively of an absolutely large stomach when its capacity exceeds 1,500 to 1,600 c. c. [℥l to liij], although even these figures are not to be taken absolutely, but only as approximate.#

---

* Ost. Beiträge zur Bestimmung der Capacität des Magens. Inaug. Dissert. Dorpat, 1891.

† Senn. Inflation of the Stomach with Hydrogen Gas. Medical News, Aug. 25, 1888.

‡ Kelling. Ein einfaches Verfahren zur Bestimmung der Magengrösse mittels Luft. Deutsch. med. Wochenschr., 1892, Nos. 51–52.

[A very careful study of the mensuration and situation of the stomach, intra-

[The use of the gastrodiaphane in determining the size of the stomach has already been discussed on page 96.]

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, under such circumstances if 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

---

gastric pressure, etc., will be found in Kelling, Volkmann's Sammlung klinische Vorträge, No. 144, Feb., 1896.—Ed.]

* 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.—Ed.]

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. 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 beginning of this chapter, 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. [Boas and others * have reported cases of acute dilatation of the stomach. This condition may arise either from overloading the viscus, traumatisms, or from central or peripheral nervous causes (see page 290). Rosenheim † also states that he has observed cases in which mechanical insufficiency of the stomach occurred periodically in attacks. The patients in whom he observed this were neurasthenics.]

But it is important not to confound the clinical symptoms of gastrectasis with the anatomical condition of the organ; for the

* [Boas, Deutsch. med. Wochenschr., 1894, pp. 155 and 172; Rosenheim, Magenkrankheiten, 2te Aufl., p. 452.—Ed.]

† [Rosenheim, *loc. cit.*, p. 453.—Ed.]

clinical picture is primarily a series of symptoms caused by fermentation and stagnation of the chyme which are usually, but not always, due to a dilated stomach, yet which may arise whenever stagnation and decomposition of the stomach contents occur from any cause. It is well, therefore, to distinguish dilatation proper from the symptoms of gastric fermentation, which may at times be present without any dilatation whatsoever. A case of the latter I shall describe later on.

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. Cicatrization is usually due to ulcers situated near the pylorus, the healing of which causes not alone a stenosis but also frequently a thickening of the pylorus, which may even be palpated through the abdominal walls, and which may be mistaken for a malignant neoplasm. As will be shown later, this error may be avoided by the examination of the stomach contents. At all events, cicatrization of ulcers is a quite frequent cause of dilatation. Neoplasms at the pylorus usually involve the greater part of its circumference, or may surround it entirely like a ring; or they 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 [$1\frac{1}{5}$ inch] 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. 36). Bernabel * reports a similar case, which is remarkable, however, by the formation of true pedunculated polypi. The largest was 6·8 centimetres [$2\frac{3}{4}$ inches] in

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

length, and was situated on the anterior wall of the stomach, 5 centimetres [2 inches] above the pylorus.

On the other hand, it is self-evident that all stenoses of the duodenum, especially of its superior horizontal portion, must also cause dilatation of the stomach. 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. Pertik endeavors to explain the origin of this diverticulum as being due to an unusually well developed fold of mucous membrane which was gradually made larger by the pressure of the chyme, in the same way as similar semilunar, diaphragm-like reduplications of mucous membrane have been observed by Deiters ‡ (Grawitz) at the pylorus and also in other parts of the small intestines.

Congenital stenosis of the pylorus may also be included among the mechanical constrictions; such cases have been described by Landerer,# Maier,‖ and Hirschspring.^ 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

---

* Cruveilhier. Anatomie pathologique du corps humain. Livr. 4, p. 1.

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

‡ Deiters. Beiträge zur Aetiologie der Magenerweiterung. Inaug. Dissert. Greifswald, 1889.

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

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

^ Hirschspring. Fälle von angeborener Pylorusstenose. Jahrbüch. für Kinderheilkunde, 1888, Heft 1.

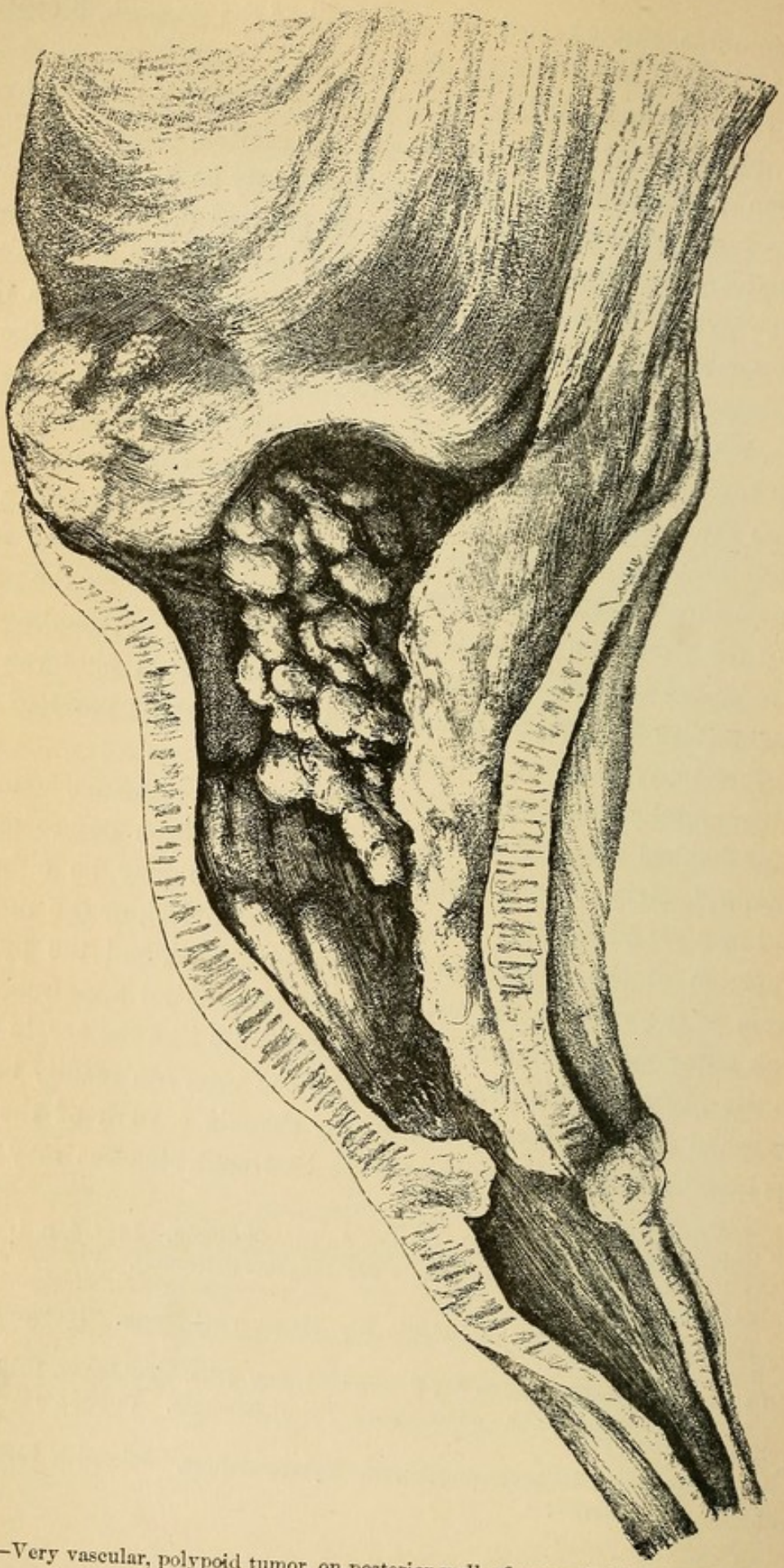


FIG. 36.—Very vascular, polypoid tumor, on posterior wall of stomach, 1¼ inch above the pylorus.

the development of a dilatation as soon as the expulsive power of the pyloric portion of the stomach is 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 are 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, 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. 37).

An additional factor may perhaps be found in the following: While under the usual circumstances the demarcation 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 pres-

* *Loc. cit.*

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

sure 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.

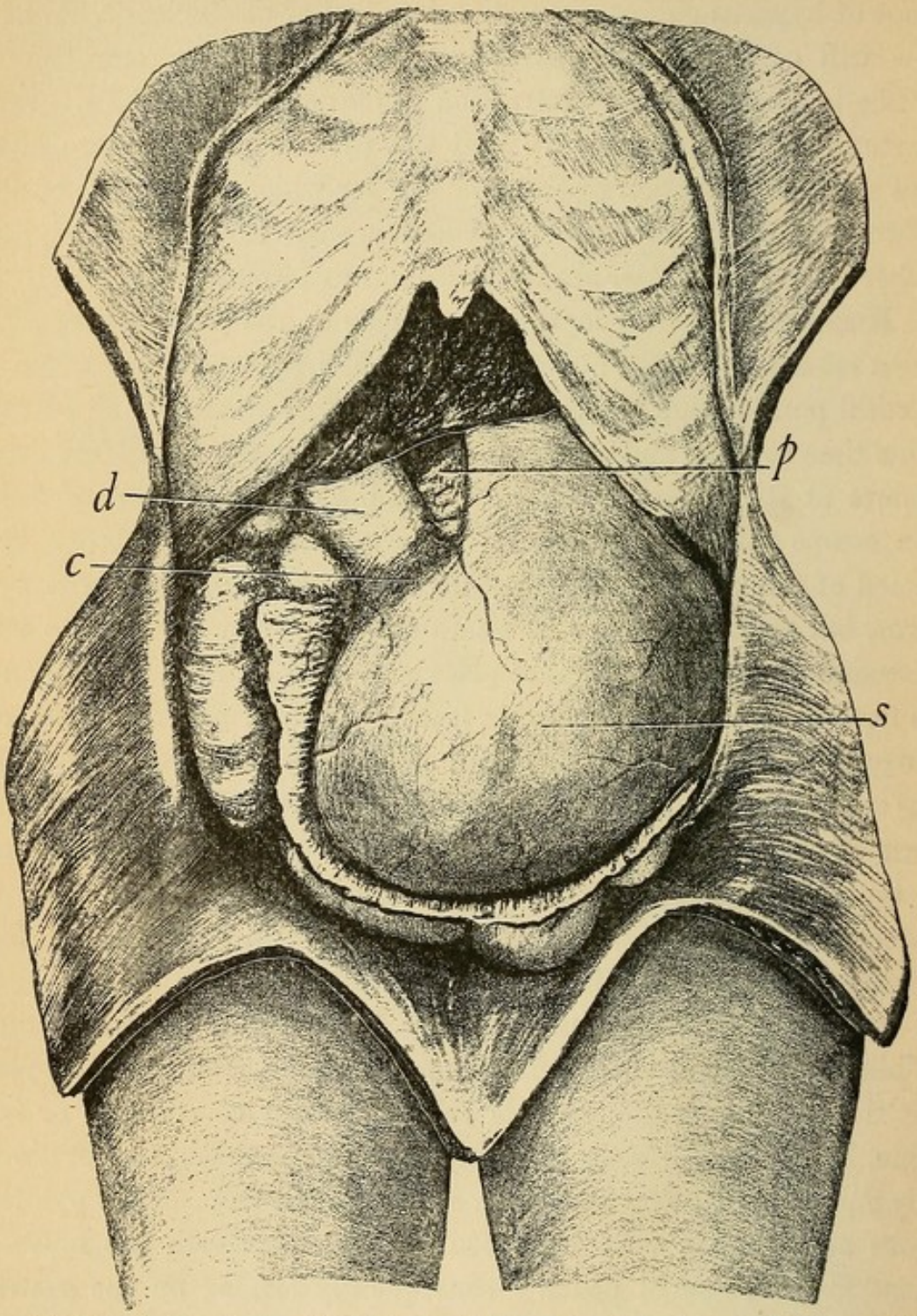


Fig. 37.—Cancer of pylorus, with dilatation of stomach and duodenum. Distance of the greater curvature from the symphysis = 4 ctm. [1⅝ inch]. Portion of the œsophagus in the abdominal cavity = 4 ctm. [1⅝ inch]. Length of lesser curvature = 10 ctm. [4 inches]. *c* = carcinoma. *p* = pancreas; it has sunk 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.

Finally, *spastic contraction of the pylorus* [*pylorospasm*] may cause dilatation. 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.† It is at all events true that many cases of gastrectasis without mechanical obstruction are accompanied by excessive and untimely secretion of HCl, yet it remains doubtful whether a spasm of the pylorus or an overloading of the stomach as the result of incomplete digestion of carbohydrates is the exciting cause. A well-observed case of this, 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 [¼ inch] thick, the mucosa 4 to 5 millimetres [⅛ inch], the serosa 2 millimetres [$\frac{1}{12}$ inch], the pyloric orifice being quite patent. No

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

† [Fleiner (Boas's Arch., Bd. i, Heft 4) believes that spasm of the pylorus occurs frequently in the hyperacidity which accompanies ulcer of the stomach, and may even explain the frequency with which ulcers occur near the pylorus.—Ed.]

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

neoplasm could be found either on macroscopic or microscopic examination. There were ten cherry pits still present in the enormously dilated stomach.

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 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. A number of cases have recently been published † in which gallstones were either wedged in the orifice of the common duct or stenosed the intestines or produced fistulous tracts with annular cicatricial strictures; or the stones had perforated the intestines directly after adhesions between the gall bladder and the intestines had been formed.

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. Rokitanski ‡ has seen cases of gastrectasis which were caused by

---

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

† Grundzach. Ueber Gallensteine im Magen. Wiener med. Presse, 1891, No. 28. —A. Smith. Some Clinical Points on Gastrectasia. N. Y. Medical Record, February 4, 1888. [Bouveret (Revue de Médecine, January, 1896) reports additional cases of pyloric stenosis due to gallstones. He calls attention to one symptom which is characteristic of stenosis due to fixation of the pylorus by adhesions—i. e., the vomiting and other symptoms of dilatation persist as long as the patient is active and on his feet, but cease as soon as he rests in the recumbent posture. Abstracted in Amer. Journ. Med. Sciences, June, 1896, p. 728.—Ed.]

‡ Rokitanski. Handbuch der pathol. Anatomie, Bd. ii, S. 178.

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. This proportion may seem rather high, yet according to Kuttner's researches # it can not be much above the correct figure. But a floating kidney is by no means an indispensable feature in every dilatation of the stomach, since Lenhartz ‖ was unable to find a floating kidney in any of the 16 cases of dilatation which he examined for this purpose. Therefore 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, and that, as has been conclusively shown by Kuttner, in many cases of so-called dilatation with floating kidney there is no gastrectasis, but either a megalogastria or a gastroptosis which has deceived inexperienced observers. At all events, Bartel's views are untenable, because any pressure which the right kidney might exert on the duodenum necessarily requires that this kidney 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

* 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.

Kuttner. Ueber palpable Nieren. Berl. klin. Wochenschr., 1890.

‖ Lenhartz. Beiträge zur moderne Diagnostik der Magenkrankheiten. Deutsch. med. Wochenschr., 1890, No. 7.

△ *Loc. cit.*, S. 225.

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 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 Clozier‡ when he includes deficient hygiene in combination with continual erect position of the body among the causes of dilatation of the stomach. But some writers believe that dilatation is not caused alone by the chemical insufficiency which is associated with gastric catarrh, but also, on the contrary, by the excess of function,

---

* 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.

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

hyperchlorhydria, and hypersecretion, which delays the digestion of the starches, the stomach being emptied either not at all or only very late.

The weakening 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 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 contractility is intact, probably leads also to the simultaneous closure of the sphincters, and in this way causes an abnormally 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

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

† Minkowski, *loc. cit.*

of the vocal cords are produced by laryngeal catarrh. To this is also due the occurrence of dilatation in general neuroses and gastroptosis and enteroptosis, conditions which will be described later on. 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 demarcation 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. On the contrary, persistent sluggishness or paresis of the intestines may give rise to diminished peristalsis in the stomach. G. Sée and Mathieu † have also called attention to this point. I saw a very striking 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 defined 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. [Infiltration of the muscular layers occurs very early in cancer of the stomach, long before there is any stenosis of the pylorus. This early weakening of the gastric motility in cancer, combined with the absence of HCl, explains the early occurrence of lactic acid in this disease.] A similar condition is produced when broad bands of the muscular

---

* Ewald, Klinik, etc. I. Theil, 3te Aufl., S. 192.

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

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.*

Pathology.—I have already discussed 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. 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 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. In the chronic inflammatory forms 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 quite considerable. This he regards as the result of a chronic hypertrophic inflammation of the muscularis. 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 degenera-

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

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

tion), as described by Kussmaul and R. Meyer, and also found by Cahn; 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 with 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 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. 38). I have never found conditions which pointed to new 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 mammeloné* 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 dilatationlike 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 more 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

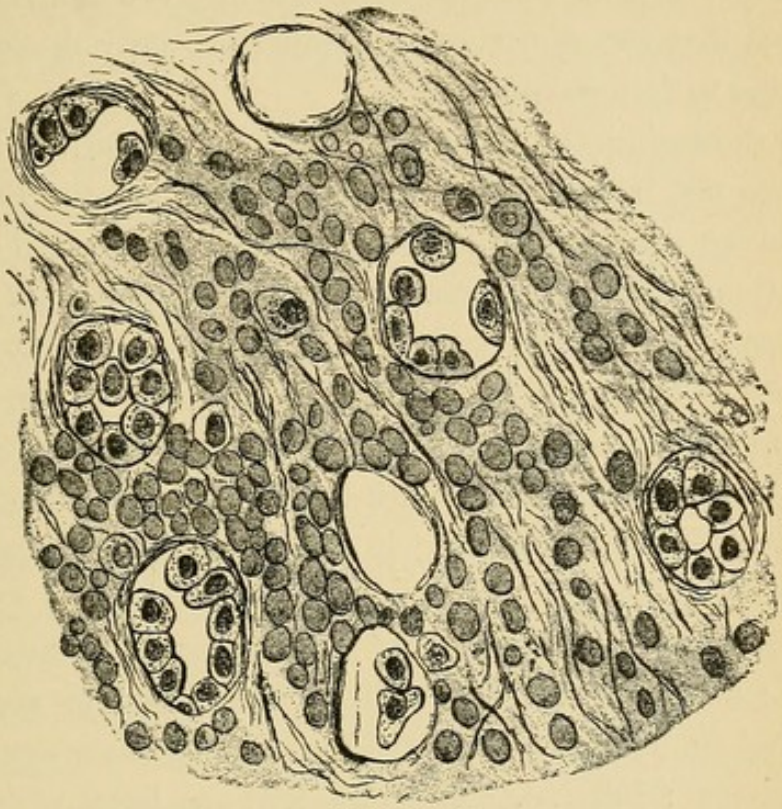


Fig. 38.—Cross-section through the mucous membrane of a dilated stomach. The ducts of the glands are forced apart, the interstices entirely filled by an infiltration of small cells. The glandular epithelium is unchanged in part, partly fatty, and in some places entirely gone. Single epithelial cells may be seen in the interstitial tissue.—Camera lucida.

a short time ago at the Augusta Hospital I found a marked dilatation of the stomach in a girl 13 years of age who claimed to have heard succussion sounds (which were very evident at the examination) since her earliest childhood. During the past few years I have frequently seen cases of more or less marked dilatation in young patients between 12 and 17 years old, in none of which could a manifest cause for its origin be discovered. Wiederhofer,‡

---

* 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,* Malibran,† and others, have demonstrated and carefully studied dilatation of the stomach in children which they have ascribed to atonic and anæmic conditions. My own experience in the polyclinic of the Augusta Hospital shows that marked dilatation is by no means rare in children, although they are as a rule so well compensated that the symptoms presented are only dyspeptic, and not those due to fermentation.

Before discussing the symptomatology of dilatation, I wish to state that we not infrequently see cases which present the typical clinical picture of gastric dilatation and yet in which there is no true dilatation of the stomach. 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 later on. [Recently most writers have grouped all cases of gastrectasis under the general heading of mechanical insufficiency of the stomach, and have subdivided them according to the severity of the motor disturbance.]

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 a well-developed dilatation. Thus it is that the latter is discovered only on a very careful examination of the patient. This occurred to me not long ago 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

---

* 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.

‡ O. Rosenbach, *loc cit.*

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 [17⅝ 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. [Liebermeister * gives the details of the case of a hackman who was noted for the enormous quantities of beer which he could swallow at a single draught. The autopsy which was made after his death from an accident showed that the capacity was 6 litres [13 pints], but otherwise the organ was normal.

Characteristics of Stomach Contents.—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 are added. If the vomit, or the masses removed from the stomach through the tube, 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 morsels of 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 in-

---

* [Liebermeister. Die Krankheiten des Unterleibsorgane, 1894, p. 70. Quoted from Boas.—Ed.]

stigation 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.† [See Fig. 41.] It is a matter of regret that the pathognostic significance of the 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 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. [The relations of sarcinæ ventriculi have recently been studied by Oppler,# who found that they occurred in large numbers only in gastrectases due to benign stenoses of the pylorus; where the cause of the latter is malignant they are rarely found. Oppler would explain this by the fact that sarcinæ only thrive in the presence of HCl.] However, if large numbers of micro-organisms are present in the stomach contents in spite of the free hydrochloric acid, or if the reaction

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

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

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

[Oppler. Münch. med. Wochenschr., 1894, No. 29.—Ed.]

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 inspection. 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 bacilli; 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.

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 in the stomach contents obtained from a neurasthenic I found a small piece of fish skin, which, according to the positive statements of the patient, must have been in the stomach for three and a half days.

The chemical relations of the gastric juice in gastrectasis depend upon the cause of the dilatation. Should a cancer be present, we will find all the anomalies of secretion, which will be explicitly discussed in the chapter on Carcinoma of the Stomach. If, on the other hand, we have to deal with cicatricial contractions of the pylorus, atonic conditions of the muscular fibers, 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. But even in the same patient and with the same diet the quantity of HCl may vary on different days, so that variations from 0·07 per cent to 0·28 per cent may be found. It is by no means rare to find

* Werner. Zur Casuistik des Magenkrebses, etc. Würtemberg. med. Correspondenzbl., 1869, 22–24.

hypersecretion (hypersecretio acida continua), so that after emptying the stomach in the evening, on the following morning we may obtain fluid containing HCl sometimes in considerable amounts. In 33 cases Riegel* found 0·10 to 0·46 per cent HCl; in 68 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.

Fermentations.—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, 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—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

---

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

† Ewald. Klinik, etc. I. Theil. 3te Auflage, S. 125. [See also Boas, Therap. Monatshefte, January and February, 1896, for a good *résumé* of the fermentation and changes in the stomach contents in gastrectases.—Ed.]

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

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 sulphureted hydrogen. Similar observations have been made by Schultze, Heynsius, and Popoff; a gas-forming bacillus has been isolated from the stomach contents by Miller, the activity of which only ceases in 1·6 per mille HCl. The gas produced contained only Co_2 and H. A similar case of McNaught's has already been referred to (page 161). The formation of gases in the contents of dilated and catarrhal stomachs has been systematically studied by both G. Hoppe-Seyler and Kuhn.* According to the former, the occurrence of inflammable gas is by no means a rarity, for in 13 out of 22 cases he could obtain a gas from the stomach which consisted of a mixture of Co_2 and H; the amount of the latter was as high as 60 per cent, and was the result of butyric acid fermentation which may take place even when there is as much as 0·2 per cent HCl. The same conclusions were reached by Kuhn (who studied the gases which developed in the stomach contents after their removal, the organisms of fermentation, etc.). The methods used by both of these investigators are too complicated for general practice. [Strauss has recently shown that the bacillus coli communis produces gas when grown on culture media containing sugar (see page 45)].

But we may easily ascertain whether there are gases in any stomach contents, the intensity of their formation, and whether they consist only of Co_2, or of other gases (the most important of which is hydrogen). This is done by filling two ordinary fermentation tubes (the best is Einhorn's fermentation saccharimeter) with stomach contents, in the one unfiltered, in the other filtered, putting them aside at ordinary temperature and observing the rapidity of the formation of gas. After this has ceased add some caustic potash, which on account of its weight will sink, and may thus be easily

---

* G. Hoppe-Seyler. Deutsch. Arch. für klin. Med., Bd. l, p. 82.—Kuhn. Zeitschr. für klin. Med., Bd. xxi, p. 572; Deutsche med. Wochenschr., 1892, Nos. 49, 50.—[Strauss. Zeitschr. für klin. Med., Bd. xxvi and xxvii. See also literature quoted on page 55.—Ed.]

introduced into the graduated portion of the apparatus. If the gas disappears after a time and the graduated part of the tube refills entirely, then the only gas present is CO_2.

In view of what has already been said, it seems to me to be a strange coincidence that in my former and present investigations I have never seen any hydrogen fermentation. It is also remarkable that the total acidity is not excessive even in cases of very marked fermentation in spite of the intense odor and acridity of the regurgitated or vomited stomach contents. This is undoubtedly due to the fact that the acids which are formed are immediately converted into neutral or basic salts. Another form of abnormal chemical change leads to the products 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. Betz, Senator, Ewald, Emminghaus, Boas * [Strauss, and others] have demonstrated the occurrence of sulphureted hydrogen in the stomach contents; Boas claims that its presence is quite common where albumens are decomposed. It may be detected with acetate of lead paper moistened with caustic potash. 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. Still, as already mentioned, the decomposition of proteids may occur even if HCl is present, or may be absent even when no HCl is found. 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. Usually in such cases we have to deal with large degenerating neoplasms. [Boas † and others claim that as a rule the total acidity is considerably increased in most cases of stagnation and decomposition of the stomach contents, the high

* Boas. Ueber das Vorkommen von Schwefelwasserstoff im Magen. Deutsch. med. Wochenschr., 1892, No. 49.

† [Boas. *Op. cit.*, Bd. ii, p. 99.—Ed.]

total acidity being due either to free or combined HCl and organic acids.

Concerning the presence of acetone, toxines, etc., see pages 45, 46].

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 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.

[In this connection it is well to recall the researches of Von Mering,* who showed that when there is stagnation of the chyme, absorption of liquids is not alone delayed, but that there is also a transudation of fluid from the gastric mucosa as the result of the irritation of the latter by the various ingredients of the stagnating food.]

It is very apparent that these different disturbances of function react one upon the other. The development of the products of decomposition paralyzes the muscularis, and this paralysis favors the stagnation and with it the further decomposition of the ingesta.

---

* [See p. 76.]

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.† 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 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

* 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.

† [Additional cases of mechanical insufficiency in spite of the normal size and situation may be found in Boas, *op. cit.*, Bd. ii, p. 96.—Ed.]

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.* [See page 267.]

As the disease progresses the nutrition is affected more and more; a highly marked marasmus appears. The hands and feet become bluish-red, cold, and moist; while the face not infrequently becomes reddened by the development of acne pustules and marked ingestion of the capillaries. 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. 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 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

* For example, Hilton Fagge, On Acute Dilatation of the Stomach, Guy's Hosp. Reports, xviii, pp. 1–22; and Albutt, On Gastrectasis, Lancet, 1887. Hood. A Case of Acute Dilatation of the Stomach. Lancet, December 19, 1891.

† [According to Osler (*loc. cit.*, p. 25), increased peristalsis is not infrequently seen in dilatation of the stomach.—Ed.]

skin; the latter is roughened almost as it is 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. The face may also become involved; it then assumes a masklike, rigid appearance. Temperature and pulse are often very high; and in a short time all the symptoms may become so very much aggravated that death speedily results. [The symptoms usually occur in attacks of varying duration which come on at irregular intervals. As a rule they appear after severe vomiting.]

According to this, it seems that the disturbed absorption of water and the resultant dryness of the tissues may in individual cases be the cause of an abnormal irritability of the nervous system which may become intensified sufficiently to present the picture of tetany, so that in addition to the symptoms already described we may also find a decided increase in the mechanical and electrical irritability of the nerves and muscles. Trousseau's symptom and the facial phenomenon may also be present. 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

---

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

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

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.† During the last few years quite a number of cases of tetany after gastric dilatation have been reported, so that Bouveret and Devic ‡ have been able to present an exhaustive analysis of 23 cases. In their opinion there has usually been a continuous hypersecretion, although at times, and especially toward the end of the disease, this may be absent. Although Müller was unable to isolate any toxine from the stomach contents, Bouveret and Devic succeeded in producing symptoms of tetany in animals by intravenous injections of the alcoholic extract of the stomach contents of such cases, and especially when the chyme contained a marked excess of free HCl. It remains to be seen how far these somewhat surprising statements will be verified. In a case of my own, in which the attack occurred immediately after the introduction of a stomach tube, the amount of HCl, instead of being increased, was much diminished. 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. [Fleiner # has recently published an exhaustive essay on tetany in which he reports four cases of his own. He objects to the name tetany because the group of symptoms is unlike that disease in many respects, and the symptoms present in different attacks even in the same persons are not always the same. Thus once they may resemble tetany, at another time tetanus, and

* 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.

‡ Bouveret et Devic. Recherches cliniques et experimentelles sur la tetanie d'origine gastrique. Rev. de méd., 1892, Nos. 1 and 2. An exhaustive bibliography is given here.

[Fleiner. Boas' Archiv, 1895, Bd. i, pp. 243–262. Contains full bibliography. —Ed.]

finally the attacks may be epileptiform. He also denies the assertion of Bouveret and Devic that hypersecretion and hyperchlorhydria are present in all cases of tetany; in one of his cases there was no free HCl. Neither was he able to extract any preformed toxine from the stomach contents, and he believes that the substances extracted by Bouveret and Devic were due to faulty chemical manipulations. He also shows that Kussmaul himself has discarded his original belief that tetany was due to a rapid thickening of the blood and drying of the nerves and muscles. His own views are that the cause is a reflex action and not originally an autointoxication; that the etiological factor is not always the same, but that "in most cases of convulsions and tonic muscular spasms of gastric origin which may resemble epilepsy, tetanus, or tetany, there are severe anatomical changes in the pyloric region of the stomach or duodenum which more or less completely prevent the passage of the chyme into the intestines and at times render it impassible, and then produce the condition of so-called hypersecretion."] Tetany is always a severe complication of gastric dilatation, for of the 23 cases collected, 16 were fatal—a mortality of 69·5 per cent.

The Urine.—I have 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. The bodies found were probably albumoses, and not peptone. 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 favor-

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

able 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. Besides triple phosphates, crystals of magnesium phosphates, i. e., large highly refracting rhombic plates have been found. [In cases of tetany, increased toxicity of the urine has been reported by Bouveret and Devic and others.† Albumen, and sometimes sugar, have also been found in this condition.]

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 been fully discussed. It is just in dilatation of the stomach that the differential diagnosis is relegated more than elsewhere to the background. According to Loreta, catarrhal dilatation may be distinguished from that after cicatricial stricture of the pylorus by the occurrence of large quantities of undigested food in the wash water in lavage in the former, whereas in the latter the stomach contents are an acid chyme. In the former the appetite may be present; in the latter it is changed.‡ In some stages of dilatation, as my own experience shows, this is perfectly true. But the amount of HCl diminishes # as the mucosa becomes more and more involved by chronic inflammatory changes.

It is self-evident 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

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

† [*Loc. cit.*]

‡ Quoted by Marten, Lancet, August 2, 1890.

In one case I found the acidity as high as 98, although lactic and butyric acids were absent.

earnest attention. The differentiation of gastroptosis from dilatation will be considered while discussing the former condition. On the whole, the tendency 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 gastrectasis. 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 megalogastria 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, however, 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 dilatations of the stomach when they are recognized early offer us a very grateful field for treatment, unless, which is not unusually the case, they have been treated in the meantime with every kind 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 10 and as long as 12 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 ob-

struction to the emptying of the stomach is immediately removed by operative procedures, as in the case of Klemperer.* Korcynzski and Jaworski † report a case of dilatation consecutive to gastric ulcer, in which the former disappeared almost entirely and the latter was cured; they believed that the ulcer caused a marked infiltration of the mucosa at the pylorus which produced a stenosis of this orifice; on the lessening of the catarrhal condition this stenosis disappeared. In these cases 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 megalogastria.

[According to Boas,‡ the prognosis may be based upon the condition of the stomach after having given his test supper. This consists of two cups of tea, two rolls, and a slice of cold meat. This meal is taken at 8 P. M. On the following morning the tube is passed. If no remnants of food are found macroscopically the prognosis is good; if, on the contrary, food is obtained, the case is much severer. He therefore subdivides the cases of muscular insufficiency into two classes, which he calls first and second degree respectively, the former including the cases of simple atony, the latter the gastrectases.]

The prognosis of the complications, tetany, coma dyspepticum,

---

* Klemperer. Deutsch. med. Wochenschr., 1889, p. 170. The case was one of cicatricial pyloric stenosis produced by corrosion with hydrochloric acid; consecutive dilatation of the stomach (capacity, 2½ litres [Ovss.]). After dilating the stenosis by operation, the dilatation became less, so that at the death of the 35-year-old patient two months later from phthisis, the stomach, although large, was not found to be actually dilated.

† Korcynzski und Jaworski. Rundes Magengeschwür und saurer Magenkatarrh. Deutch. Arch. für klin. Med., Bd. xlvii, S. 586.

‡ Boas, *op. cit.*, Bd. ii, p. 70.

etc., which may occasionally occur, has already been considered. I merely wish to add that several cases of sudden death have been reported in which excessive formation of gas has caused rupture of the stomach.*

The treatment † of dilatation of the stomach must fulfill two indications: 1. By means of a carefully regulated 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.

1. *The diet* 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. When it is possible, it is advisable to substitute peptonized milk, which may be made quite palatable by adding cream. 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. 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, [somatose], etc., which contain much nourishment in a small volume.# I have lately found condensed peptonized milk to be

---

* Matthieu. Rupture of the Stomach due probably to Overdistention by Gases. Chicago Med. Rep., 1887, p. 274.

† [See also valuable paper by Oser, Wiener Med. Presse, September 25, 1889. —Ed.]

‡ [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.—Ed.]

[Analogous preparations are Rudisch's sarcopeptones, Carnrick's beef pepto-

very serviceable; it has an agreeable taste, and can be purchased in small packages as the so-called "*Muttermilchpatronen*," or of a gelatinous consistence in larger boxes. [Ordinary fresh unsweetened condensed milk will be found equally useful.] 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 food stuffs, especially amylaceous foods and 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 stale rolls or toast. 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 advantage of preventing the lack of water in the tissues by means of the fluids introduced (Liebermeister).

2. *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. Concerning the other disinfectants, I would refer

---

noids, Bush's bovinine, etc. Peptone chocolate is now sold in this country under the name of vigor chocolate.—Ed.]

* [Mosquera's beef meal may be used for this purpose.—Ed.]

to what has already been said on page 233. Kuhn (*loc. cit.*) has tabulated the various useful antifermentatives according to their value in checking fermentation, the percentages denoting the concentration necessary for this purpose :

Acid. salicylic..	0·0025 per cent.	Resorcin..	0·25 per cent.
Natrii salicylas.	0·0025 "	Creosote ..	0·5 "
Natrii benzoas.	0·03 "	Acid. boric.	over 1 "
Saccharin.....	0·05 "	Aq. chlori.	5 "
Acid. carbolic..	0·1 "	Alcohol...	5 p. c. or more.

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 ⅔]
Aq..... 100·0 [f ℥ iij ⅓]
M. Sig. : Tablespoonful every two hours.

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.

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

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

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.,
Extr. scammon.....āā 2·0 [gr. xxx]
M. Div. in pil. no. xxx.
Sig.: One pill before dinner.

I have frequently used aloin subcutaneously with good results.

3. 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 antisep-

tic 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. Still the time must be adapted to the individual case. Thus in continuous hypersecretion it is better to wash the stomach in the evening, or even both morning and 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. Consequently lavage is being employed more and more, so

---

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

that the severe and neglected cases of dilatation which were formerly encountered are now no longer seen.

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. 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 Fenwick * has collected a number of cases which have been reported, and from his own practice (seven cases in all), in which perforation, hæmorrhage, convulsions, and death after various intervals occurred after lavage. However, a number of these cases should never have been washed out, or the same thing may have happened here as occurred in 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. [An interesting fact concerning the great value of lavage, etc., in gastrectasis is the statement of Kussmaul, that in the last ten years he has not seen a single case of tetany, although he was the first to describe it as a complication of this condition. ‡]

Here we must also mention the few cases in which rupture of the gastric mucosa or wall has occurred (usually longitudinally along the lesser curvature) as the result of overloading the stomach with fluids. A. Key-Aberg # has carefully reported a case of this kind

---

* *Loc. cit.*, on p. 15.

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

‡ [Quoted by Fleiner. *Loc. cit.*, p. 254.—Ed.]

A. Key-Aberg. Vierteljahrschr. für gerichtlich. Med. und öffentl. Gesundheitspflege, 3te Folge, Bd. i, 1891.

in which rupture of gastric mucosa and hæmorrhage were caused by the water left in the stomach after lavage in a case of opium poisoning; the man, although semiconscious, nevertheless retched a great deal. He also cites the few cases of this kind which have been reported, some of which are not entirely free from objections.* Other details on the complications of lavage have already been discussed on page 15.

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. On the other hand, we must not forget that the decided pressure exerted on the stomach will distend and dilate the gastric walls if the chyme is not forced through the pylorus.

Faradization of the stomach has already been discussed on page 102. It certainly accelerates the emptying of the stomach. For example, Brunner ‡ demonstrated that a test breakfast disappeared much more rapidly from the stomach when the abdominal walls were faradized. I have so often convinced myself of the beneficial effects of intragastric faradization, and the patients themselves have so decidedly felt that it alone benefited them (for they lost ground as soon as it was discontinued), that I am sure that the results are due to something more than suggestion.

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.#

---

* Revilliod. Rupture de l'estomac. Rev. méd. de la Suisse Romande, 1855, No. 1.

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

‡ 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

In a few cases of marked dilatation I have obtained good results from wearing an abdominal bandage (as will be described more fully under Gastroptosis), since the relaxed abdominal walls are supported and thus facilitate the movements of the stomach and intestines.

Surgical Treatment.—Finally, we must think of *dilatation or excision of the stenosis.* I can not do much more than mention these procedures here, and therefore simply call attention to the fact that quite a series of successful operations—i. e., excision of the constricting tumor, forcible dilatation of the cicatricial stenosis, and gastroenterostomy—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 is worthy of special consideration is that proposed by Heinecke and Mikulicz, of splitting the stricture longitudinally and then passing the sutures transversely; a number of excellent results have been obtained by this operation.

The question of whether resection of the pylorus or gastroenterostomy is preferable has been carefully discussed during the past few years by many eminent surgeons, of whom I shall mention only the German operators, Billroth, Lücke, Mikulicz, Hahn, Lauenstein, Von Hacker, etc. The indications and technique have been much improved.† Thus, for example, Lauenstein ‡ reports 17 cases of gastroenterostomy, in 13 of which there was cancer of the pylorus. Five cases were fatal and 12 were successful so far as the operation was concerned. Three of the cases which were operated on account of benign stenosis remained permanently well. Of the 13 operated because of pyloric cancer, three died; the others survived on an aver-

---

size of a finger, which is 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.—Ed.]

* Hubert. Jour. de méd. de Bruxelles, avril, 1883, p. 309. [Also Loreta, Lancet, April 26, 1884; Bull and Kinnicutt, A Case of Cicatricial Stenosis of Pylorus relieved by Loreta's Operation. New York Medical Record, June 8, 1889. This paper gives the results of twenty cases.—Ed.]

† An exhaustive discussion may be found in the dissertation of W. Hellwig. Behandlung der Magenerweiterung mit Gastroenterostomie. Halle, 1892.

‡ C. Lauenstein. Zur Indication, Anlegung und Function der Magendümdarmfistel. Centralbl. für Chirurgie, 1891, No. 40.

age five months, and were free from symptoms for about three months. Hahn's * results are still better: 11 operations, of which 6 were fatal; one case survived 5 years (!), another one year, the others survived several months. Hellwig † reports two successful cases which had been operated on by von Bramann, and summarizes the operative indications as follows: "Gastroenterostomy is generally indicated in those cases of dilatation of the stomach in which a demonstrable obstruction exists at the pylorus which can not be removed by a radical operation; otherwise resection of the pylorus ought to be performed. However, the general condition of the patient ought to be at least such that there should be no metastases, and the possible duration of life should not be one of a few months."

Von Bramann urges that gastroenterostomy ought also to be performed on severe, primary gastrectases to spare the patients the years of lavage. Birchner,‡ on the other hand, suggests making a fold in the walls of the stomach so as to elevate the greater curvature, thereby raising the lowest part of the stomach to such a level that the contractions of the stomach may expel the chyme through the pylorus. This is a less serious operation than gastroenterostomy, and Birchner has already reported three successful cases. Although in the second edition of this book I have already suggested a similar procedure—i. e., to excise a lancet-shaped piece of the wall of the stomach—yet Birchner's operation will probably only be successful in those cases in which the pyloric obstruction is not such that a fresh dilatation will be formed later on. Furthermore, it is very much to be feared in this and similar operations that the patients may subsequently be troubled by the resulting cicatrices.

It is not my province to enter into further details of this topic. Enough has been said to show that surgeons are ready to afford

---

* E. Hahn. Ueber Gastroenterostomie. Deutsch. med. Wochenschr., 1891, No. 30.

† Hellwig, *loc. cit.*

‡ Birchner. Eine operative Behandlung der Magenerweiterung. Correspondenzbl. für schweizer Aerzte, 1891, No. 23. [Weir. New York Medical Journal, July, 1892. Up to 1894 this operation had been performed seven times; all recovered promptly. In five there was complete restoration of the stomach, one died after a second operation; cancer was suspected in this case; another case died from heart failure six weeks after the operation. Quoted from American Yearbook of Medicine and Surgery, 1896, p. 124.—Ed.]

relief where our former methods left us in the lurch, and that it is our duty in every case of this kind to consider *as early as possible* the possibilities of operative relief. Jaworski, Obalinski, and Rydygier * have, however, shown what was to have been expected *a priori*, that in cancer of the stomach, even when these operations of resection and gastroenterostomy are successful, neither the mechanical nor the chemical functions of the stomach return to the normal, but that in general only symptomatic relief is afforded by the removal of the mechanical obstruction. Nevertheless, in these cases decided subjective and objective relief is obtained, in spite of the fact that the presence of a malignant cicatrization in the stomach must also exert a deleterious effect on the functions of the intestines, liver, and pancreas. Thus in Jaworski's case the stools were frequent, soft, and decolorized, and also contained much undigested meat and fat; biliary coloring matter was also absent.

So far as I may judge from my own cases—four of resection of the pylorus and three gastroenterostomies—I would only advise resection in nonmalignant stenoses; in all other cases, gastroenterostomy. For, no matter how sharply a cancer may seem to be limited macroscopically, there are always numerous offshoots which often extend a considerable distance; hence, "operating in the healthy tissues" is usually only a delusion (see chapter on Cancer of the Stomach). Senn, one of the most distinguished surgeons in this branch, closes an exhaustive study,† in which he reports 13 gastroenterostomies, with 8 so-called cures—i. e., death weeks or months after the operation—as follows:

"1. Pyloroplasty, as devised by Heinecke-Mikulicz, is the safest and most efficient operation for cicatricial stenosis of the pylorus.

"2. Pylorectomy in the treatment of carcinoma of the pylorus is a justifiable procedure when the disease is limited to the organ primarily affected and the patient's general condition furnishes no contraindication.

"3. Gastroenterostomy by the aid of large, moist, perforated

---

* Jaworski und Obalinski. Wiener klin. Wochenschr., 1889, No. 5.—Jaworski und Rydygier. Deutsch. med. Wochenschr., 1889, No. 14.

† 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.

plates of decalcified bone should be resorted to in the treatment of malignant stenosis of the pylorus as soon as a positive diagnosis can be made, and a radical operation is contraindicated by local or general conditions of the patient."

[The present view as to the surgical treatment of dilatation due to pyloric stenoses, either benign or malignant, is decidedly in favor of gastroenterostomy. Thus Rosenheim * reports 8 cases which were operated in this way with no deaths, the improvement in the gastric functions being satisfactory in all of them. Loreta's operation has fallen into disfavor; pyloroplasty and resection of the pylorus have still a high mortality, that of the former being 22·6 per cent., according to Mintz (see also Surgical Treatment of Cancer of Stomach). The use of the Murphy button has not materially changed these indications.

According to Fleiner,† operative interference is indicated when the amounts of food and fluid which pass from the stomach into the intestines no longer suffice for the needs of the system, and when these factors and the disturbances of the economy which result from the lesion can not be remedied by medical treatment. Well-marked tetany is a contraindication to operative interference; still, if the tetany can be improved by appropriate treatment, an operation may be attempted. One of the four cases which he reports was successful.]

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 give 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

* [Rosenheim, *op. cit.*, p. 485. An excellent *résumé* of this subject may be found here and in Boas, *op. cit.*, Bd. ii, p. 122.—Ed.]

† [Fleiner, *loc. cit.*, p. 262.—Ed.]

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 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 a 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 troughlike 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$\frac{1}{2}$ inch] below the umbilicus. Examination of the stomach contents, which have been filtered, reveals the total absence of hydrochloric acid, faint peptone reaction, large amounts of propeptone, erythrodextrin, fatty acids, but no lactic acid. At a former examination I ascertained that the filtrate of the stomach contents did not digest albumen, and 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 the urine voided three quarters of an hour, an hour and a quarter, and an hour and three quarters afterward. In the last portion we get an indistinct violet coloration on adding ferric chloride, but 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 a 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 swallowing. 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 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 persuaded the patient, who had come from a distance, to enter the sanitarium, where she could be treated with an appropriate dry diet, systematic lavage, strychnine, and faradization of the stomach.

Three weeks after the treatment had been begun, HCl disappeared permanently, and a small tumor, hardly the size of a walnut, was discovered in the pyloric region. Operation was proposed but was rejected by the patient, who left the sanitarium and died a few months later of cancer of the stomach.

(I wish to direct particular attention to this case, because it is typical of its kind. To-day I would be still more guarded in the diagnosis and prognosis in view of the fact that cancer may develop from an ulcer, the course of which has been absolutely latent.)

The third case 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 debauches, 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. From this it will be seen 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.

CHAPTER VII.

CANCER OF THE STOMACH.

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 ..	‡	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. Scheffer, Jahrbücher für Kinderheilkunde, Bd. xv. Bibliographies may be found in C. Stern, Deutsch. med. Wochenschr., 1892, No. 22; and Duzan, Du cancer chez les enfants. Thèse de Paris, 1875.—Ed.

† 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. Similar results were obtained by Häberlin*, whose statistics are based upon 6,863 men and 4,559 women (1877–1886); he found 72 per cent for the period of the fortieth to the seventieth year, and 90 per cent if the seventieth to eightieth years be included. 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. This opinion, which I had expressed some time ago,† has been corroborated by Häberlin. He estimates the yearly number of deaths from gastric cancer per 1,000 persons to be 0·1, 0·46, 1·35, 2·67, 3·31 for each decade from the fortieth to the eightieth year. Thus the conditions are the same as in phthisis, the relative frequency of which, as estimated for the total number of people living at that period, steadily increases with advancing age. The disease also seems to be distributed differently in different regions. Griesinger never saw any case of it in Egypt, while Cloquet and Autenrieth found it unusually common in Normandy and the Black Forest [Baden] respectively. Häberlin concludes that twice as many cases of cancer of the stomach occur in Switzerland as in Berlin and Vienna.

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. Wilson Fox found the proportion to be 52 per cent in men and 48 per cent in women.

---

* Häberlin. Ueber Verbreitung und Aetiologie des Magenkrebses. Deutsch. Archiv für klin. Med., Bd. xliv und xlv.

† Ewald. First American edition of this work, p. 263.

‡ Ledoux-Lebard. Arch. génér. de méd., avril, 1885.

Bräutigam found the relation to be 3:2 in Bavaria, and Häberlin 7:5 in Switzerland.

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 predisposition 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, with the exception of a few statistics, 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. 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.

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:

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

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. Lebert found heredity in 7 per cent of his cases; Häberlin has analyzed 138 cases, and has found positive evidence of gastric cancer in the parents in 8 per cent, in brothers and sisters 2·2 per cent; probable gastric cancer in parents in 4·3 per cent, uncertain in 5 per cent; cancer in other organs, 2·9 per cent. In 178 cases of my own, the histories of which were taken as carefully as possible, heredity existed in only 6·7 per cent. 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 Cancer 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. The statements of Roth † are entirely different; an analysis of the mortality records of Laenggries in Bavaria, from 1682 to 1885, shows an inheritance of cancer in more than half the cases. But here the reliability of the data may be questioned, and, moreover, the range of observation is too limited.

[Graf ‡ has carefully studied the question of heredity in 4,233 cases of cancer of all kinds which he had collected. He found

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

† Roth. Ueber Erblichkeit des Krebses. Friedreich's Blätter, 1889, pp. 26 to 45.

‡ [Graf. Ueber das Carcinom mit besonderer Berücksichtigung seiner Aetiologie, Heredität und seines endemischen Auftretens. Archiv für klin. Chirurgie, Bd. I, Heft i. Contains complete bibliography.—Ed.]

that cancers were decidedly hereditary in certain families, and that it occurred more frequently in some districts than in others. The latter was especially true of cancers of the digestive tract. This was especially noticeable where the population was more exposed than elsewhere to irritative conditions of this tract. Thus we may explain the frequency with which husband and wife or members of certain families are attacked, because they are exposed to the same irritant action of certain strongly seasoned or indigestible articles of food.]

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*.

I shall 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

* An elaborate discussion may be found in Hauser, Das Cylinderepithelcarcinom des Magens, June, 1890.

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 not very long ago 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 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

---

* Walshe, *loc. cit.*, p. 167.

† Alberts, *loc. cit.*, p. 195.

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

Brinton, *loc. cit.*, p. 248.

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

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." Hauser's work has since been corroborated by a number of writers.# The statistics of Häberlin's cases show that 7 per cent of carcinomata occurred after ulcers.

[Kelynack ‖ reports an interesting case of ulcer of the stomach in a man, 27 years old, who had been ill for four years with symptoms which were characteristic of ulcer, until an actual tumor and cachexia became noticeable during two months before his death.

---

* Heitler. Entwickelung von Krebs auf narbigem Grunde in Magen und in der Gallenblase. Wiener med. Wochenschr., 1883, No. 31. Kollmar (Zur Differential diagnose zwischen Magengeschwür und Magenkrebs. Berl. klin. Wochenschr., 1891, Nos. 5 and 6) has collected only 14 cases from the literature. This, however, gives an erroneous idea of the frequency of this occurrence, because all the cases of this well-known fact are not published.

† Hauser. Das chronische Magengeschwür und dessen Beziehung zur Entwickelung des Magencarcinoms. Leipzig, 1883, S. 70 und 73. Also *loc. cit.*

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

Stienon. Contribution à l'anatomie pathologique de l'ulcère de l'estomac. Bruxelles, 1889.—Kulcke. Zur Diagnose und Therapie des Magencarcinoms. Inaug. Dissert., Berlin, 1889.—Rosenheim. Berl. klin. Wochenschr., 1889, No. 47.

‖ [Kelynack. On the Occurrence of a Cancerous Development in Simple Ulcer of the Stomach. Brit. Medical Journal, January 18, 1896, p. 142. Contains a complete bibliography and references to all published cases.—Ed.]

At the autopsy the carcinoma was found to be limited to the ulcer and its vicinity. There were no metastases. Hydrochloric acid persisted almost to the end.]

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. The same is true of bacterial origin and transmission of cancer, as shown in the experimental and bacteriological researches of Alberts, Schill, Scheurlen, Adamkiewicz, Sanarelli, and Barbei. Hauser has presented strong arguments against this doctrine; he directs especial attention to the histological differences in the tissue changes produced by carcinoma and by bacteria, and also to the primary difference in the histogenetic origin and formation of metastases in each. Furthermore, he has shown that all so-called inoculations of cancers are nothing more than successful transplantations of living tissues which have proliferated at the point of inoculation.

Pathological Anatomy.—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. In the cells of these proliferating glands, as has been shown by Hauser and Hansemann,* numerous karyokinetic figures may be demonstrated. In the deeper layers of the tissues there is formed a richly reticulated network with many anastomoses, the outlying branches of which, as I† have demonstrated years ago, penetrate deeply into the apparently healthy tissues in the form of long tubules filled with cuboidal epithelium. Thus 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

---

* Hauser, *loc. cit.*—Hansemann. Virch. Arch., 1890, Bd. cxix, p. 299.

† Ewald. Berl. klin. Wochenschr., 1888, p. 995.

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.

After Korcynski and Jaworski * had laid much stress upon the relation between carcinoma and catarrhal gastritis, Rosenheim, Matthieu, and myself † have, a number of years ago, carefully studied the mucous membrane which was not involved by the carcinomatous process. Their statements have been corroborated and augmented by Fischl,‡ who examined 15 cases, and myself, in two cases in which I was able to make sections from fresh tissue which was cut from the periphery of the cancerous tumor at operations. According to these authors, the mucosa is inflamed far beyond the seat of the neoplasm, being manifested by a more or less pronounced interstitial gastritis with its characteristic granular degeneration of the glandular cells, cystic enlargement of the tubules, and atrophy of the mucosa, as already described on page 200.

Varieties.—Any of the 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

---

* Korcynski und Jaworski. Deutsch. med. Wochenschr., 1886. Nos. 47–49.

† Ewald. Klinik, etc., 1888.—Rosenheim. Berl. klin. Woch., 1881, Nos. 51, 52. —Matthieu. Archiv. gén. de méd., avril, 1889.

‡ Fischl. Die Gastritis bei Carcinom des Magens. Prager Zeitschr. für Heilkunde, 1891, Heft 3.

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

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 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 *gelatinosum*. 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. I shall

* [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, footnote.—Ed.]

merely add that several varieties of cancer may be found in isolated areas in the same stomach. Thus, for example, we may find a medullary carcinoma at the lower curvature and a scirrhus at the pylorus.

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.

Finally, it is to be observed that other neoplasms, such as sarcoma and lymphadenoma, may also occur in the stomach; their clinical course can not be distinguished from that of carcinoma. Lymphadenomata are exceedingly rare; Pitt * has collected 17 cases, which may be divided into two groups, one in which the new growth begins in the mucosa and submucosa, and forms a soft tumor which projects into the cavity of the stomach; in the other there is a diffuse proliferation under the serosa, which only exceptionally extends into the submucosa and mucosa.

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 an occurrence is a great rarity. Otherwise the

---

* Newton Pitt. Lymphadenoma of the Stomach and Intestines. Transact. Pathol. Soc., London, 1890, vol. xi.

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, sausagelike 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 ʒ vjss.] of water. The scirrhus variety involves the whole organ much less frequently. I have two specimens of this in which the entire viscus is so infiltrated with a dense scirrhus that it looks like a piece of intestines. In passing, I will say that in these cases the stomach could not be palpated, so that in one of them the diagnosis of the neurasthenia was made by another physician, since there were no marked dyspeptic symptoms; and even up to a short time before his death the patient had to undergo the Weir-Mitchell treatment. Such a case of scirrhus is pictured in Fig. 39, 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. Of 195 cases of gastric cancer, Israel # found the pylorus involved in 128; the cardia, 26; the lesser curvature, 23; the greater curvature, 11; and flat carcinoma of the entire

---

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

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

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

Israel. Berl. klin. Wochenschr., 1890, No. 29.

stomach, 6. 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:

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. 39. 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 intestines, as occurred in the case which I have already described on page 94 (Fig. 12). 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 ad-

---

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

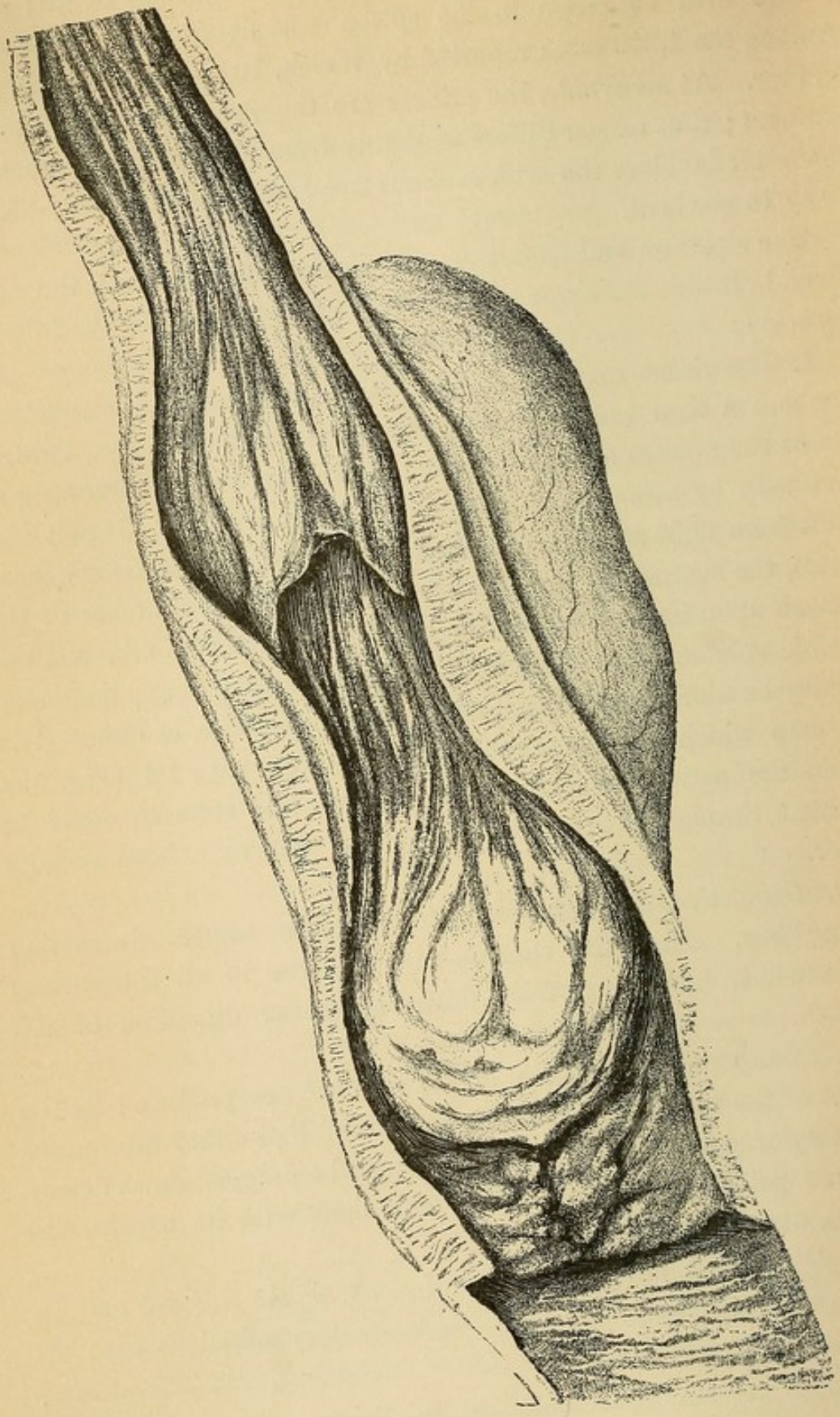


Fig. 39.—Scirrhus ventriculi totalis (reduced to one fifth).

jacent 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 great rarity. Ely * has, however, collected 13 cases, in which the primary cancer was in the œsophagus in 6 cases, in the mamma in 3, in the testicle in 2, and once each in the leg, suprarenal capsule, and colon. 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 growth in the uterus or ovaries, and no evidence can be found to indicate a metastasis from either organ. Dittrich has never seen the simultaneous occurrence of the disease in the stomach and uterus. In 38 cases of gastric cancer Häberlin found "metastasis of the uterus mentioned only once." Recently I performed an autopsy in a case in which there was found an immense cystosarcoma 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 occur-

---

* [J. S. Ely. A Study of Metastatic Carcinoma of the Stomach. American Journal of the Medical Sciences, June, 1890, p. 584.—Ed.]

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

rence 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 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

* Virchow. Die krankhafte Geschwülste, Bd. i, S. 54.

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

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. In this connection I would refer to the statements I have already made on page 123. 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. [Lépine † observed it in only three out of 40 cases of gastric cancer on which autopsies had been performed. He reports one case in which the left supraclavicular gland was larger than a hen's egg, although the gastric tumor could only be palpated with great difficulty.]

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 scirrhous, and least of all in the 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

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

† [Lépine. Deutsch. med. Wochenschr., 1894, p. 298.—Ed.]

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 per 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 epigastrium, also regurgitation of food and a tendency to nausea, together with more or less obstinate constipation, open the scene.

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 patients assert that they have always had good stomachs, and that they have always been moderate in eating and drinking.

---

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

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

While the gluttons have themselves to blame to some extent for their dilated stomachs, the unfortunate victims of gastric cancer have not even the melancholy satisfaction that in the days of health their stomachs had afforded especial joy and pleasure.

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. A patient of mine 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. Various kinds of epithelium and micro-organisms (Fig. 40) are usually present (see page 304). The vomited matter may often contain blood, either in small amounts as bright-red streaks in the mucus, or in large quan-

tities as bright-red or brownish-red clots or brown, chocolate-colored to black coagula and 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. Although hæmatemesis when it does occur in cancer of the stomach is usually a late symptom, yet in rare cases it may take place at the beginning of the disease. Thus, Mey * reports three cases in which profuse hæmorrhage from the stomach was the first symptom given by the patients. The autopsy in each case revealed scirrhous cancer of the stomach, the consistency and character of which eliminated the possibility of having arisen from an ulcer.

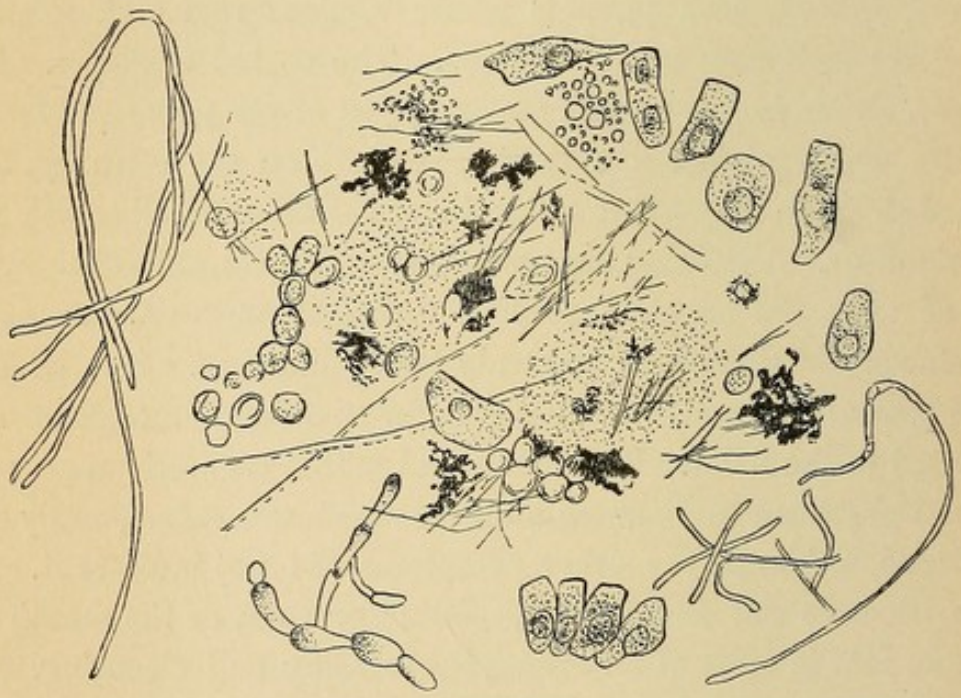


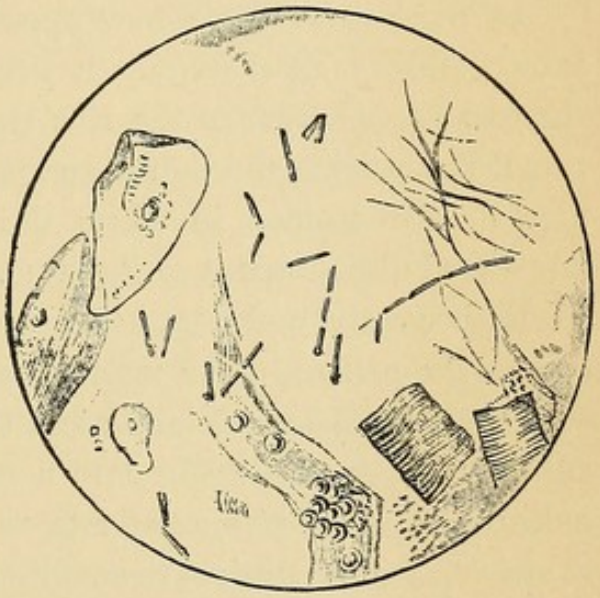
Fig. 40.

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-

* Edg. Mey. Ueber profuse Magenblutungen und Hydrops Anasarca als initiale Symptome des Magencarcinoms. Dissert., Dorpat, 1891.

cells, and also cells of another variety of fungi, probably an aspergillus. A dense network of delicate and coarse fungous 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 fibres, 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.

[Boas * and Oppler † have described certain long bacilli (Fig. 41) which they found in large number in the stomach contents in cases of gastric cancer; they are very long, threadlike bacilli, which have sharp bends, and usually lie at an angle to one another and are immobile. They believe that their presence is diagnostic of cancer of the stomach. Kaufmann and Schlesinger, ‡ Riegel, # Strauss, ‖ Manges, ^ Rosenheim, and Richter ◊ have also found them in most cases of cancer. They produce lactic acid, and Kaufmann and Schlesinger are inclined to believe that they are the specific cause of the formation of lactic acid which is so frequently found in this disease. This is denied by Rosenheim and Richter, who found there bacilli in the stomach contents of a case of benign pyloric stenosis in which HCl was absent, and also assert that they may occasionally occur in stomach contents with free HCl.



[Fig. 41.—Boas and Oppler's long bacilli; from the contents of a cancerous stomach. Magnification, Leitz I, 7. From Riegel.]

* [Boas, *op. cit.*, Bd. ii, p. 182.—Ed.]
† [Oppler. Deutsch. med. Wochenschr., 1895, No. 5.—Ed.]
‡ [Kaufmann und Schlesinger. Wiener klin. Rundschau, 1895, No. 15.—Ed.]
# [Riegel. Krankheiten des Magens, 1896, p. 173.—Ed.]
‖ [Strauss. Zeitschr. für klin. Med., Bd. xxviii.—Ed.]
^ [Manges. New York Med. Record, April 27, 1895.—Ed.]
◊ [Rosenheim und Richter. Zeitschr. für klin. Med., Bd. xxviii.—Ed.]

Sarcinæ are usually absent in gastric cancer, for they require HCl for their growth. After a careful study Oppler * asserts that sarcinæ occur only in large numbers when the stagnation of the chyme is due to benign pyloric stenoses, severe gastric atonies, and occasionally in other noncancerous diseases of the stomach. He found that pure cultures of sarcinæ when added to cancerous stomach contents disappeared in a short time.]

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.

In very rare cases neither anorexia nor emaciation may occur. On April 8, 1891, I performed an autopsy on a patient who was brought into the hospital on April 4th, unconscious and hemiplegic. According to

* [Oppler. Münchener med. Wochenschr., 1894, No. 29.—Ed.]

the statement of his friends he had never suffered from any gastric symptoms; his general bodily condition was excellent, as was shown by a heavy panniculus adiposus. A tumor was found in the right anterior central convolution, and a large, broken-down cancer of the greater curvature of the stomach, with metastases in the liver.

For almost four months I had in my service at the hospital a sixty-two-year-old man who suffered from chronic bronchitis, chronic pleurisy, and pericarditis, with slight symptoms of congestion and moderate gastric complaints. During all that time I watched him until he died of progressive inanition, after having become slightly delirious. At the autopsy, in addition to what was expected, a cancer of the pylorus with slight dilatation of the stomach was found.

Similar cases of pyloric cancers without anorexia and emaciation have been reported by Siredey, and also by Muselier.* Muselier's patient was a man, fifty-eight years old, who, at all events, had œdema, anæmia, and cachexia, with, however, only slight dyspepsia and a good appetite. Severe gastric symptoms did not appear until seventeen days before his death.

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 inflammations. Hampeln,† in a very interesting paper on the symptoms of obscure visceral carcinomata, 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 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 Sep-

---

* Muselier. Gaz. méd. de Paris, 1891, No. 1.

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

tember, 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 hypochrondrium 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 are dropsical swellings and effusions into the serous cavities; in very rare cases these may even occur as initial symptoms;* 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 as death approaches, so that a conscious death struggle does not occur.†

The *condition of the blood* deserves especial notice. Laache‡ was the first to describe a lessening of the number of the red blood-cells in this disease; Lépine# called attention to the temporary oc-

---

* Mey, *loc. cit.*, describes two cases in which no other cause could be found for the œdema and anæmia which occurred even at the beginning of the disease.

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

‡ S. Laache. Die Anaemie. Christiania, 1883.

Lépine et Germont. Note, etc. Gazette méd. de Paris, 1877, No. 14.

currence of numerous microcytes. Eisenlohr,* Schneider,† and Oppenheimer,‡ 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." Leichtenstern # and Häberlin ‖ believed that the diminution in the amount of hæmoglobin was a characteristic symptom, so that the latter would exclude the possibility of gastric cancer if the hæmoglobin was about 60 per cent. Laker △ urged that surgical interference ought to depend upon the percentage of hæmoglobin. Daland and Sadler, Mouisset,◊ and others, have corroborated the diminution in the percentage of hæmoglobin. At my request Osterspreyǂ studied this subject in reference to differential diagnosis; in 12 cases he found the number of red cells lessened in 7, an increase in the white cells in 5, a lessening in the amount of hæmoglobin in 11. In 2 cases, however, the red cells were increased in number with the formation of microcytes. These changes, although pathological, have unfortunately no diagnostic value, since similar changes, as shown by Osterspreyǂ, occur in ulcer of the stomach, and, as shown by other writers, are found in other wasting diseases like tuberculosis, anæmia, cirrhosis of the liver, chronic peritonitis, etc.

[It is claimed by some↕ that there is no digestive leucocytosis in gastric cancer, and attempts have even been made to use this as a

---

* Eisenlohr. Blut und Knochenmark. Deutches Archiv für klin. Med., Bd. xxx, S. 495.

† G. Schneider. Ueber die morphologischen Verhältnisse des Blutes bei Herzkrankheiten und bei Carcinom. Inaug. Diss. Berlin. 1888,

‡ Oppenheimer. Deutsch. med. Wochenschr., 1889, No. 42 *et seq.*

Leichtenstern. Untersuchungen über den Hämoglobingehalt des Blutes im gesunden und kranken Zustand. Leipzig, 1888.

‖ Häberlin. Münchener med. Wochenschr., 1888. No. 22.

△ Laker. Wiener med. Wochenschr., 1886, No. 18 *et seq.*

◊ Daland und Sadler. Fortschritte der Méd., 1891, No. 20.—Mouisset. Carcinome de l'estomac. Rev. de méd., 1891, No. 10.

ǂ Osterspreyǂ. Berl. klin. Wochenschr., 1892. Nos. 12. 13.

↕ [Hartung. Wiener med. Wochenschr., October 3, 1895.—Schneyer. Internat. klin. Rundschau, 1894, No. 39.—Ed.]

means of differential diagnosis. At present no reliance can be placed upon such vague signs.] *

The Changes in the Metabolism.—That patients with cancer excrete very little urea in spite of the ingestion of relatively larger amounts of food, and that there is a chronic deficit in the amount of nitrogen in the body—i. e., a wasting of the bodily albumen—require as little experimental demonstration as does the contrary proposition that the intestines act vicariously in digesting and absorbing food where the bodily weight remains constant and the general condition of the patient keeps good in spite of the deficiency of the gastric digestion. Both are absolute conclusions from the determinations of the loss and gain of the bodily weight. These self-evident relations have nevertheless been worked out experimentally.† Of far greater interest is the study of the relation of the urea (i. e., the decomposed bodily nitrogen) to the chlorides in the urine, because both factors are dependent on the energy of the HCl secretion in the stomach. But, as in all investigations of the metabolism, it is self-evident that these analyses are only of value when the ingesta as well as the excreta are determined. This has been neglected by Bouveret;‡ consequently, in spite of the fact that his results are based upon 28 analyses upon two patients with cancer of the stomach, his conclusion is not free from objection, namely, that the relation of the chlorides to urea in cancer of the stomach with absence of HCl is less than the normal—i. e., is less than 2·3 and may sink to 0·7. Laubenheimer,# acting upon the above postulate, has shown in a careful investigation upon 5 cancerous patients that the disease does not necessarily influence the excretion of the chlorides, and, if retention of the chlorides does occur, that this is due to no characteristic feature of the metabolism in cancer but to some accidental factors,

---

* [For further details upon the blood changes, see the recently published text-books on the blood by Grawitz and by Limbeck.—Ed.]

† Rommelaere. Journ. de méd., etc., de Bruxelles, 1883-1886.—Rawzier. De la diminution de l'urée dans le cancer. Paris, 1889 (contains full literature).—Fr. Müller. Zeitschr. für klin. Med., Bd. xvi, S. 496.—Klemperer. Berl. klin. Wochenschr., 1889, No. 40.

‡ Bouveret. Le rapport des chlorures urinaires a l'urée dans l'hypersecretion gastrique et le cancer de l'estomac. Revue de méd., 1891, No. 7.

Laubenheimer. Ausscheidung der Chloride bei Carcinomatösen. Zeitschr. für klin. Med., Bd. xxi, p. 535.

like the retention of water, etc. Katz,* without making such exhaustive analyses, but repeating and extending Bouveret's experiments upon a large series of other diseases, has also ascertained that in diseases of the stomach the chloride excretion depends upon the general metabolism, and the relation between urea and the urinary chlorides is abnormally high where there is an exudation or retention of fluid in the bodily cavities or in the tissues. As might have been anticipated, this shatters forever the hope that specific pathognomonic signs might be obtained from such variable factors as the changes in the metabolism. According to Rommelaere, 10 to 12 grammes of urea ought to be the highest amounts excreted in cancer. But, as was evident *a priori*, this hypazoturia by itself has no significance.†

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. 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 been reasonable to

---

* Katz. Ueber die Beziehungen der Chlorausscheidung zu Erkrankungen des Magens. Internat. klin. Rundschau, 1892, No. 10.

† Grasset. Nouveaux éléments de diagnostic, differential, etc. Gaz. hebdom., May 10, 1889.—Dujardin-Beaumetz, *loc. cit.*

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. 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.

Frequency of Various Symptoms.—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. 42) 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

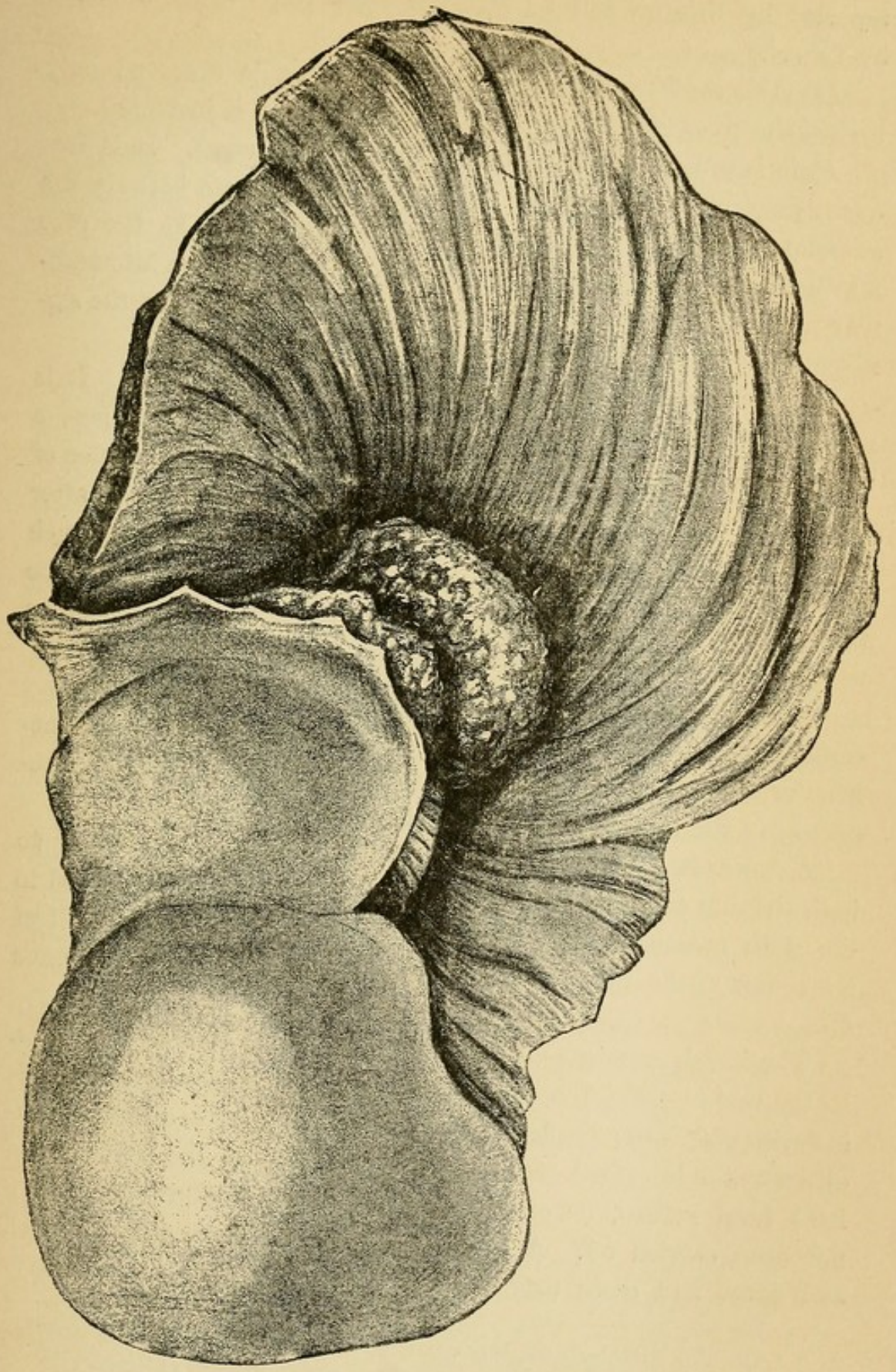


FIG. 42.—Colloid cancer of lesser curvature of stomach.

reported 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.

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 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, those 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

---

* Rampold. Hufeland's Journal, 5te Stück, 1836.

† Quoted by Henoch. Klinik der Unterleibskrankheiten. Berlin, 1863.

‡ Von den Velden. Ueber Vorkommen und Mangel der freien Salzsäure im Magensaft. Zeitschr. für klin. Med., Bd. xxiii, p. 369.

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 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

---

* 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.

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 most thoroughly investigated by a large number of physicians. To show 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 Mering, Jaworski and Gluczynski, Bamberger, Kraus, Dreschfeld, Rosenbach, Krukenberg, Rosenheim, and many others. Unquestionably the largest amount of material was collected by Riegel, who 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 has now been definitely settled that *the absence of HCl in cancer of the stomach has no special significance as such, but has only the value of a secondary symptom.* 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 cachetic conditions. Indeed, as has been specially urged by Rosenheim,† if the cancer has developed in the scar of an ulcer, there may be normal or increased amount of HCl at the beginning of the disease. [A number of such cases has been reported in which the presence of free HCl persisted almost to the end of the disease.] However, in the vast majority of cases one of

* Riegel. Zeitschr. für klin. Med., Bd. xii, p. 430.

† Rosenheim. Zur Kenntniss des mit Krebs complicirten runden Magengeschwürs. Zeitschr. für klin. Med., Bd. xvii, p. 116.

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. This I have demonstrated both as to the free and the combined HCl.* These include atrophy and amyloid degeneration of the mucous 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 Wolfram † 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, pernicious anæmia, many cases of pulmonary phthisis, valvular diseases of the heart, diabetes, etc.—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

---

* Ewald. Ueber Stricturen der Speiseröhre. Zeitschr. für klin. Med., Bd. xx, p. 562.

† Announced by Gluczynski. Ueber das Verhalten des Magensaftes in fieberhaften Krankheiten. Deutsches Arch. für klin. Med., Bd. xxxiii.

amount of acid produced. Normally, the amount of HCl secreted is regulated by the amount and kind of food, so that some free HCl is soon present. 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,* or there may even be an excess of HCl as occurs in the cases of carcinomatous degeneration of gastric ulcers.† 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, as the result of the carcinomatous intoxication, then the transition from the occurrence of hydrochloric acid to 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*

* Cahn. Verhandlungen des vi. Congress. für innere Medicin, 1887, S. 362 und 373.

† Thus, for example, Waetzhold (Charité Annalen, Bd. ix) has reported a case with 3 per mille HCl. In the two cases of Rosenheim the amount of HCl was 3·9 and 3·4 per mille.

acid, and small quantities of lactic acid, peptone, and propeptone. The stomach contents digested 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 gastrocolicum 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 scirrhous 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 hard nodular character of the cancer precludes the possibility of an antecedent ulcer; so that Rosenheim* is right in urging that the presence of free HCl does not of itself indicate the origin of a cancer from an ulcer, but that other symptoms of gastric ulcer, such as hæmatemesis (at the beginning of the disease!), cardialgia after eating, localized pain in the epigastrium, etc., must have been present.

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. Similar conclusions have been reached by Rosenheim‡ and by myself in

---

* *Loc. cit.*, p. 135.

* 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.

many examinations which I have not published. It is to be noted, however, that such atrophic processes are not the general rule, 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).

2. *Relations of the Ferments.*—For the other ingredients of the gastric juice, the *pepsin* and *rennet ferment* 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 ferment 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 ferment], 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. [No practical diagnostic results have thus far been gained by the tests for the gastric ferments in cancer of the stomach. Their absence is only indicative of atrophic conditions of the gastric mucosa. See page 67.]

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).

[3. *Significance of Lactic Acid.*—Boas was the first to lay stress upon the fact that, in most cases of cancer of the stomach, lactic acid is formed in such large quantities that this relation may be used for diagnostic purposes, especially in the early stages of the disease.† Boas urges that we must distinguish between the formation and occurrence of lactic acid. The acid occurs in many gastric disorders, especially since it is taken into the stomach with meat, bread, milk, etc. On the other hand, it is formed only in cancer. This is due to the stagnation of the stomach contents which results from the very early and increasing infiltration of the muscular layers by the neoplasm, combined with the absence of HCl. Nowhere else than in cancer do these two factors occur more often; hence the value of the test. Unless both of these factors are present large quantities of lactic acid will not be formed. Thus we do not encounter it when ulcer undergoes carcinomatous degeneration. Furthermore, the test is of value only from a positive standpoint—i. e., the absence of lactic acid does not indicate that a cancer is necessarily absent. Hence Boas does not claim that it is of service in all cases, but in many of them; and especially at an early period,

---

* I have given these conclusions exactly as they were stated in the earlier edition of this work. Their correctness has been shown by all researches which have since been published on this subject.

† [This relation was first pointed out by Cahn and Von Mering.—Langguth. Boas's Arch., Bd. i, p. 358.—Ed.]

before a tumor can be palpated and before the cachexia has become pronounced—a time, in other words, when radical measures can best be carried out. (For the exact details of the tests, see pages 41 and 54.)

Boas's claims have been corroborated by a number of writers, among whom we may mention Oppler, Cohnheim, Pariser, Friedenwald, Hammerschlag, Stewart, Manges, Schüle, De Jong, and others. Its value has been more or less recognized, but its claims as a specific denied by Riegel, Thayer, Rosenheim, Klemperer, Strauss, Bial, Langguth, and others. But Boas never claimed that it was absolutely pathognomonic of cancer, but only highly suggestive of this disease when combined with other symptoms; that the lactic acid must be formed in large quantities, and that the tests should be tried several times. A number of investigations which have since been published proves that lactic acid may be formed as well as occur in other conditions than cancer, which are accompanied by motor and secretory insufficiency of the stomach. Thus Strauss has reported a case of fat necrosis of the pancreas, and Riegel * one of invagination of the colon, in which large quantities of lactic acid were found. Still, even the opponents of the test admit that large quantities of lactic acid occur in from 78 per cent (Rosenheim) to 91 per cent (Strauss) of cases of cancer of the stomach.

It must be added that sometimes instead of occurring early in the disease it does not appear till later on.] †

4. *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

---

* [Quoted by Riegel, *op. cit.*, p. 137.—Ed.]

† [The German literature of this subject may be found in Langguth. Boas's Arch., Bd. i, p. 355. De Jong, ibid., Bd. ii, p. 53. Hammerschlag, ibid., Bd. ii, pp. 1 and 198. The American literature is given by Manges. New York Medical Record, April 27, 1895.—Ed.]

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

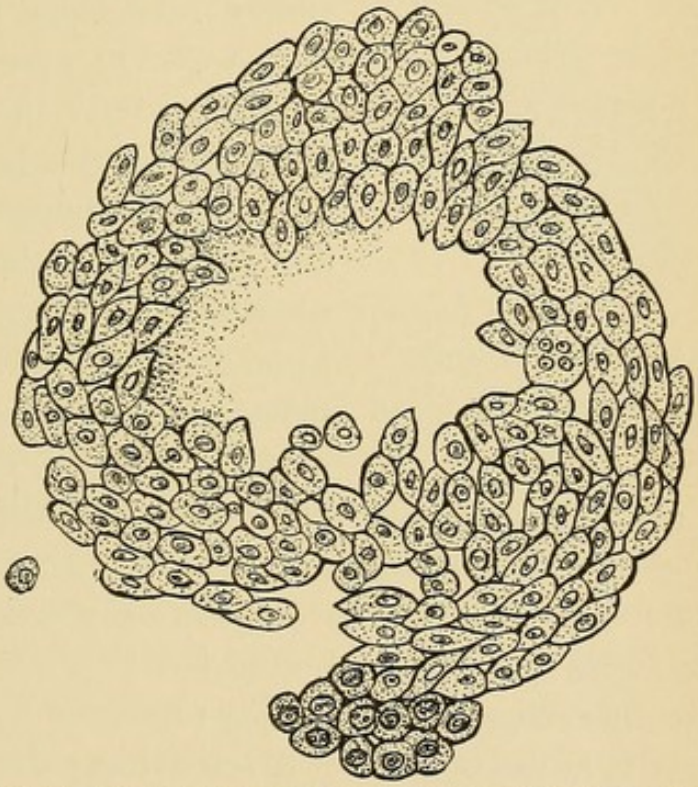


Fig. 43.—Cancerous cell-nest raised through stomach tube.
(From Mr. L., December 11, 1886. Sketched with camera lucida.)

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. 43. In the case from which this specimen was obtained it was even of decisive value.

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; hydro-

chloric 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. 44; 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. On page 196 I have already given similar but not such deceptive figures.

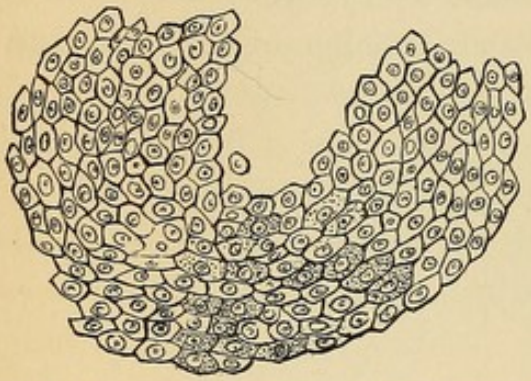


Fig. 44.—A piece of the epithelial covering of the mucous membrane of the stomach, resembling a cancerous cell-nest. (From Mr. K., March 10, 1887. Sketched with camera lucida.)

[Cohnheim * reports five cases of gastric cancer in which bits of tumor tissue were found and examined.]

5. *The cancerous tumor.* Concerning tumors of the stomach, 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. 42 was taken; and, finally, that tumors on the lesser curvature can only be palpated when the stomach occupies an abnormal position. It is equally ob-

* [Cohnheim. Boas's Archiv, Bd. i, p. 294.—Ed.]

vious that the palpation of gastric tumors may be rendered impossible by the development of ascites from any cause. For a long time it was considered an 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. I, as well as Fr. Müller, have repeatedly observed distinct respiratory movement of the stomach, which, as shown by autopsy, was totally carcinomatous, without any adhesions to the adjacent 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.

[The present views as to the respiratory movement of gastric tumors may be briefly formulated thus: Neoplasms at the pylorus act differently than those situated on the curvatures. Pyloric tumors move with respiration only after they have contracted adhesions to the liver. Those on the curvatures are movable, as a rule, at all times. A feature peculiar to them has been pointed out by Minkowski,* that their ascent with expiration may be retarded by fixing them; thus, if we press on the tumor after taking a full inspiration, it will not rise until the pressure is released. This feature is of value not alone in distinguishing gastric from other tumors, but also in distinguishing those on the curvatures from the growths at the pylorus.]

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,

* [Minkowski. Berl. klin. Wochenschr., 1888, No. 31.—Boas, *op. cit.*, Bd. ii, p. 174.—Ed.]

whether in the stomach or in one of the adjacent viscera, is not seldom only obtainable after the distention of the stomach or intestines; at times it may be necessary to examine the patient not alone while recumbent, but also by depressing the head deeply and elevating the pelvis, or in the knee-elbow position. 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 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,‡ wall-like 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. It is very difficult, and at times even impossible, to positively differentiate a pyloric tumor from carcinoma of the gall bladder or even gallstones which have not been accompanied by the typical symptoms of this condition—colic, icterus, hepatic enlargement, etc.—but which have

---

* [See Osler, *op. cit.*, Lecture II, for an instructive series of cases of cancer of the stomach, showing the various diagnostic features.—Ed.]

† Ott. Zur Pathologie der Magencarcinome. Zürich, 1867, S. 60.

‡ [See p. 376.]

Reinhard (Inaug. Dissert., Berlin, 1888) has collected 16 cases. According to my experience its occurrence must be much more frequent.

only given rise to a vague tumor in the neighborhood of the pylorus. 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 found after the test breakfast, we may say with tolerable certainty that the stomach is not involved, or at least that no well-marked cancer is present. An excess of HCl would indicate an indurated cicatrix after an ulcer, the possible carcinomatous degeneration of which we can not at once determine with certainty.

I shall relate two cases to illustrate how the examinations for HCl established the diagnosis beyond a 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, had lasted more than six 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 percussion 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:

---

* Virchow. Wiener med. Wochenschr., 1857, No. 26.

† Ewald. Berl. klin. Wochenschr., 1886, No. 32.

‡ [The phonendoscope promises to be very useful in determining delicate differences of this kind. My experience with this instrument in mapping out changes in the stomach outlines has been very encouraging.—Ed.]

Ott. *Loc. cit.*, p. 73.

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 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.

6. *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.

Some time ago I was called to see a patient in whom I could very easily palpate an immense nodular tumor occupying the entire epigas-

trium, and also adherent to the liver. The patient claimed to have been well up to two weeks before my visit 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 observed 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, we 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. Among these are aged persons with chronic catarrhal gastritis who often, especially if they were formerly plump, emaciate to such a marked degree that they look as if they had cancer. 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, who was a little over fifty years old; she 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 a 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 a 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 of and amyloid degeneration of the mucous membrane of the stomach, and marked cases of hysteria and neurasthenia; and, finally, neighboring tumors, especially of the liver, gall bladder, and pancreas. 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 (see page 346). I shall merely add that these views which were originally announced by me have since been generally adopted by the profession.

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 tumorlike thickening at the pylorus, gastroliths, and similar lesions (see pages 356 and 376). 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

---

* 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.

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 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 subsequently 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 chapter. 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 very little. As already stated, the condition of the tongue is quite 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 "pain in the small of the back"; 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 one is 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 one 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 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 [see page 376]. 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. The following case may serve as an example:

A year ago I was consulted by a Russian lady, fifty-two years old, who had had four children; she was of medium stature, and stout. Her complaint was that for some time she had been unable to swallow; the food could not pass two places: one was at the beginning of the œsophagus, the other just above the stomach. When this occurred she had severe pains, which ceased suddenly as soon as she felt that the food had entered the stomach. The pains were spasmodic. At the same time there was a profuse flow of saliva, and occasionally she also complained of shooting pains in the left scapular region. She had taken very little fluid nourishment during the past few weeks, and claimed to have run down very much.

On examination, nothing positive could be discovered except that the deglutition murmurs were absent. The largest œsophageal bougies could be easily passed without pain. Repeated passage of the instruments did not bring up any blood or pieces of tissue. No enlarged glands could be felt anywhere, nor could any tumor be palpated. Genital organs and rectum were found normal. There was absolutely no secretion of gastric juice, and neither free nor combined HCl could be detected. Although the age of the patient and the whole group of symptoms, especially the pain in the shoulder, caused one to suspect the possibility of some carcinomatous growth, yet it seemed by no means improbable that the case might be one of a hysterical spasm of the œsophagus. Cases giving symptoms similar

to these have been described by Osgood,* who has carefully studied this subject and collected six cases, the ages of which varied between twenty to fifty years.

The subsequent course of the case did not justify these views. The patient stayed in a sanitarium at Berlin, and within eight to ten days the administration of small doses of morphine and condurango caused the cessation of the difficulties in swallowing, the pains and salivation; a thick œsophageal bougie was also passed, to convince her of the permeability of the œsophagus. The marked anorexia disappeared more slowly; yet within about two months the patient was able to leave the sanitarium with a good appetite and only occasional gastric pains. She never even mentioned the dysphagia. During her stay in the sanitarium she was repeatedly examined, the stomach and intestines inflated, but never was a tumor detected by myself and the others who examined her.

The diagnosis thus seemed to be that of a nervous affection, although, bearing other cases in mind, I was quite skeptical about it. The patient had left us only about six weeks, when we received a letter from her family physician at home that a large tumor had appeared in the hepatic and epigastric regions, which had not been detected by the physicians who had examined her a fortnight previously. As I was called to see her at her home to determine the question of operative interference, I had the opportunity of convincing myself that she had a tumor, the size of which was larger than a fist, and which involved the stomach and liver and probably also the omentum. There could be no doubt of its malignancy, for a short time afterward the patient died.

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. Although no one now considers condurango as anything else than a good stomachic, yet the following analysis of 196 cases of gastric cancer by Riess† is nevertheless of some interest. The following table shows the result upon the mortality and the duration of the treatment:

---

* Osgood. A Peculiar Form of Œsophagismus. Boston Medical and Surgical Journal, April, 1889.

† L. Riess. Ueber den Werth der Condurangorinde bei dem Symptombilde des Magencarcinoms. Berl. klin. Wochenschr., 1887, No. 10.

	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; a similar analysis by Immermann gives the proportion of 1:1·3. 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.

Some 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! *

By means of condurango 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 in all those cases in which a true catarrhal condition of the gastric mucosa exists. Oser has expressed similar views.† The drug is best administered according to the following formula; it is to be noted that over-

* 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.

† Oser. Ueber den Werth der Condurangorinde in der Therapie des Magencarcinoms. Internat. klin. Rundschau, 1888.

heating will destroy the glucosides upon which the activity of the preparation depends:

℞ Cortic. condurango.....	20·0–30·0	[℥ vj–℥ j]
Macer. per horas xij cum Aq..	300·0	[℥ x]
Digere lent. calor. ad colatur..	250·0	[℥ viij ʒ ij]
Adde		
Resorcin. resublimat. (or tinct. nuc. vomic.).....	5·0	[ʒ j¼]
Acid. hydrochlor. dil.....	3·0	[ʒ ¾]
Syr. zingiberis (or syr. fœniculi, menthæ,* etc.).....	*ad* 200·0	[℥ vj ʒ vj]

M. Sig.: One tablespoonful every two or three hours.

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.] †

Resorcin is added to the above mixture to obtain its antifermentative effects; for some of the symptoms from which these patients suffer are not due to the neoplasm *per se*, but to the catarrhal changes, stagnation of the food, fermentation, etc. Much relief may therefore be afforded the patients by attending to these details. Hence in these conditions, as well as in vomiting, lavage may at times be of great service even though there is no actual dilatation of the stomach.

Vomiting ceases or is lessened by swallowing small pieces of ice

---

* [Syrup of fennel and of peppermint (Phar. German.) are both 10-per-cent solutions.—Ed.]

† [Sufficient time has not yet elapsed to pass a correct judgment on the value of *methylene blue*, which was proposed as a specific against inoperable malignant neoplasms by Prof. Von Mosetig-Moorhof (Wiener klin. Wochenschr., 1891, No. 6, p. 101; ibid., 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. In some cases analgesic effects are also obtained with it. Still, this does not warrant the great annoyances to which its use for a prolonged period subjects the patient. —Ed.]

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 better results are obtained by cold (swallowing 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 [ʒ 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 camomile infusion, warm poultices, affusions to the abdomen, etc. I have obtained no good results from

---

* [The capacity of the Pravaz hypodermic syringe is one gramme (15 minims). —Ed.]

† [For hypodermic use, good fluid extracts of ergot or ergotole, 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.—Ed.]

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 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 gramme [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.

The *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 (page 302). 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, tannin, etc.—because the diarrhœal passages are due to such extensive anatomical lesions that the mild astringents and the anticatarrhal remedies are absolutely useless.

In the chapter 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. Koumiss, matzoon, 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, Leube's beef solution, and Denayer's and Antweiler's albumose peptones). Meat-peptone chocolate is relished. [Somatose has been highly commended as a food in these cases.] Recently peptone beer—i. e., heavy beer to which albumose peptone has been added—has been introduced; the taste is fairly pleasant and the nutritive value quite high.*

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

* Ewald und Gumlich. Stoffwechselversuche mit Kraftbier. Berl. klin. Wochenschr., 1890.

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.

From the theoretical standpoint of their high caloric value, Von Noorden * has quite properly recommended generous supplies of fats in the dietary of patients with gastric disorders; he believes that good pure fat is better borne than is usually supposed. The actual results of a very large practical experience have shown that the greatest differences exist in different patients in this regard, and that one can not tell *a priori* how fat will be borne by patients. Everything depends on the reciprocal action of the stomach and intestines, how long the food remains in the stomach, and upon the individual idiosyncrasy of the patient. For a long time, taking the same ground as Von Noorden, I have been in the habit of recommending fats; but unfortunately they are usually poorly borne, just like eggs, the amount of fat of which is also high (12 per cent).

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

* Von Noorden. Ueber den Stoffwechsel des Magenkranken und seine Ansprüche an die Therapie. Berliner Klinik, January, 1893, Heft 55.

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."

[**Surgical Treatment.**—Theoretically speaking, the treatment of carcinoma of the stomach ought to be regarded just as cancer is considered in other parts of the body—i. e., excision as soon as a positive diagnosis has been made. The reduction in the mortality and the improvement in the diagnostic methods which enable us to recognize this condition at a much earlier period than formerly are encouraging features. To wait for a palpable tumor and cachexia

---

* [For further details on diet, see Thompson's Dietetics, pp. 525–529.—Ed.]

is often fatal to the patient's chances. And yet, even if a tumor is present, we must bear in mind that tumors always feel larger than they really are. If the patient's general condition is good and metastases have not yet formed, if extensive adhesions to the adjacent viscera (liver and pancreas) have not been contracted, if the glands and omentum are free, we may safely advise operative procedure. The possibilities of operative measures are well shown by Kocher's, Wölffler's, and Hahn's cases, which were still alive and comfortable 5½, 5, and 3 years after operation, and by Rosenheim's * report of twenty cases which were treated surgically; in 8 the pylorus was resected, in 12 gastroenterostomy was performed. Three of the resection cases died soon after the operation; of the other 5, three are alive and doing well (one 2 years, the other 4 years after the operation); the fourth was comfortable for a year, and then died of malignant peritonitis; the fifth, also died of the latter.

Of the twelve cases which were operated by gastroenterostomy none died of the operation. All recovered rapidly, were more or less free from symptoms, and gained in weight. Three died at the end of 1 to 4 months. The others lived from 9 months to 2 years. Rosenheim adds that in all of these cases the disease was well advanced, and hence even better results may be expected if the operations are performed earlier. Furthermore, we must expect that the improvement in the technique also means a lower mortality rate. Thus Hahn † did 15 successive gastroenterostomies without a death, 70 per cent of the cases being cancers. The improvement in the mortality rates after pylorectomy is well shown in a table given by Krönlein: ‡

Year.	Operator.	No. of cases.	Recovered.	Died.	Mortality per cent.
1890	Billroth	29	13	16	55·1
1895	Czerny	16	9	7	43·7
1894	Kappeler	13	8	5	38·4
1895	Mikulicz	18	13	5	27·7
1895	Krönlein	15	11	4	26·6
Total		91	54	37	40·6 average.

* [Rosenheim. Deutsch. med. Wochenschr., 1895, Nos. 1-3.—Ed.]

† [Hahn. Deutsch. med. Wochenschr., 1894, No. 43.—Ed.]

‡ [Krönlein. Bruns's Beiträge, Bd. xv, p. 315.—Ed.]

The latest statistics of gastroenterostomy are those of Hahn's above quoted, and Rockwitz, 12½ per cent. The respective indications, according to the present views, are that, taken all in all, gastroenterostomy offers the best chances for pyloric cancers. Cancers of the cardia are inoperable except by gastrostomy for feeding purposes. If the diagnosis has been made early, and there are no extensive adhesions, resection of the pylorus may be performed. In complicated or advanced gastroenterostomy, if in doubt, an exploratory laparotomy, with consent to do what is best, is the proper course.] *

[**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, myosarcomata, and lymphosarcomata.

The most important of these non-cancerous gastric tumors are the *sarcomata*. They are rarely found, as may be inferred from the fact that Krüger ‡ was able to collect only 19 cases, and Rosch # only 11. The small round-celled type is the most common. There is little tendency to ulcerate. Metastases are infrequent. A case of fibrosarcoma is reported on page 362.

Fibromata and *myofibromata* are also rare and are usually found at autopsies, as they are so small that they give rise to few or no symptoms, unless they assume a polypoid form. Tilger ‖ found them in 10 out of 3,000 stomachs.

---

* [See also the surgical treatment of dilatation of the stomach, pages 306 to 309. —Ed.]

† [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.—Ed.]

‡ [F. Krüger. Quoted by Rosenheim. *op. cit.*, p. 393.—Ed.]

[Rosch. Quoted in Boas's Arch., Bd. i, p. 113.—Ed.]

‖ [Tilger. Virchow's Arch., Bd. cxxxiii.—Ed.]

Lymphadenomata have already been discussed on page 323.

Cysts, including traumatic cysts, are also occasionally encountered. A case of the latter has been decided by Ziegler.* Foreign bodies, especially balls of hair and gastroliths, may simulate tumors. 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. Gastric calculi, or gastroliths, sometimes reach a very large size. A unique case of this kind was reported by Kooyker:

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 fecal 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.]

---

* [Ziegler. Münch. med. Wochenschr., No. 6, 1894.—Ed.]

† 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.—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.

[Another German case may be found in O. Bollinger. Eine seltene Haargeschwulst im menschlichen Magen. München. med. Wochenschr., 1891, Bd. xxxviii, S. 383. The case of Schönborn, alluded to above, may be found in Arch. für klin. Chirurg., Bd. xxix, S. 609; the ball of hair, which was mistaken for a movable kidney, was successfully removed by operation.—Ed.]

‡ [Zeitschrift für klin. Med., Bd. xiv, Heft 3.—An additional case of gastric shellac calculus of large size has recently been reported by Menasse, Berl. klin. Wochenschr., 1895, No. 33.—Ed.]

CHAPTER VIII.

ULCER OF THE STOMACH—ULCUS PEPTICUM SEU RODENS.

I SHALL preface the discussion of this disease by relating 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 88 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 systemic organs 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, he 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 bloody stools, 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. 45]:

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, threadlike bridge of serous membrane. In the center of the base of the ulcer the serous coat was somewhat thicker, becoming thin again, and also transparent like tissue paper, toward the cardiac end. At this situation there

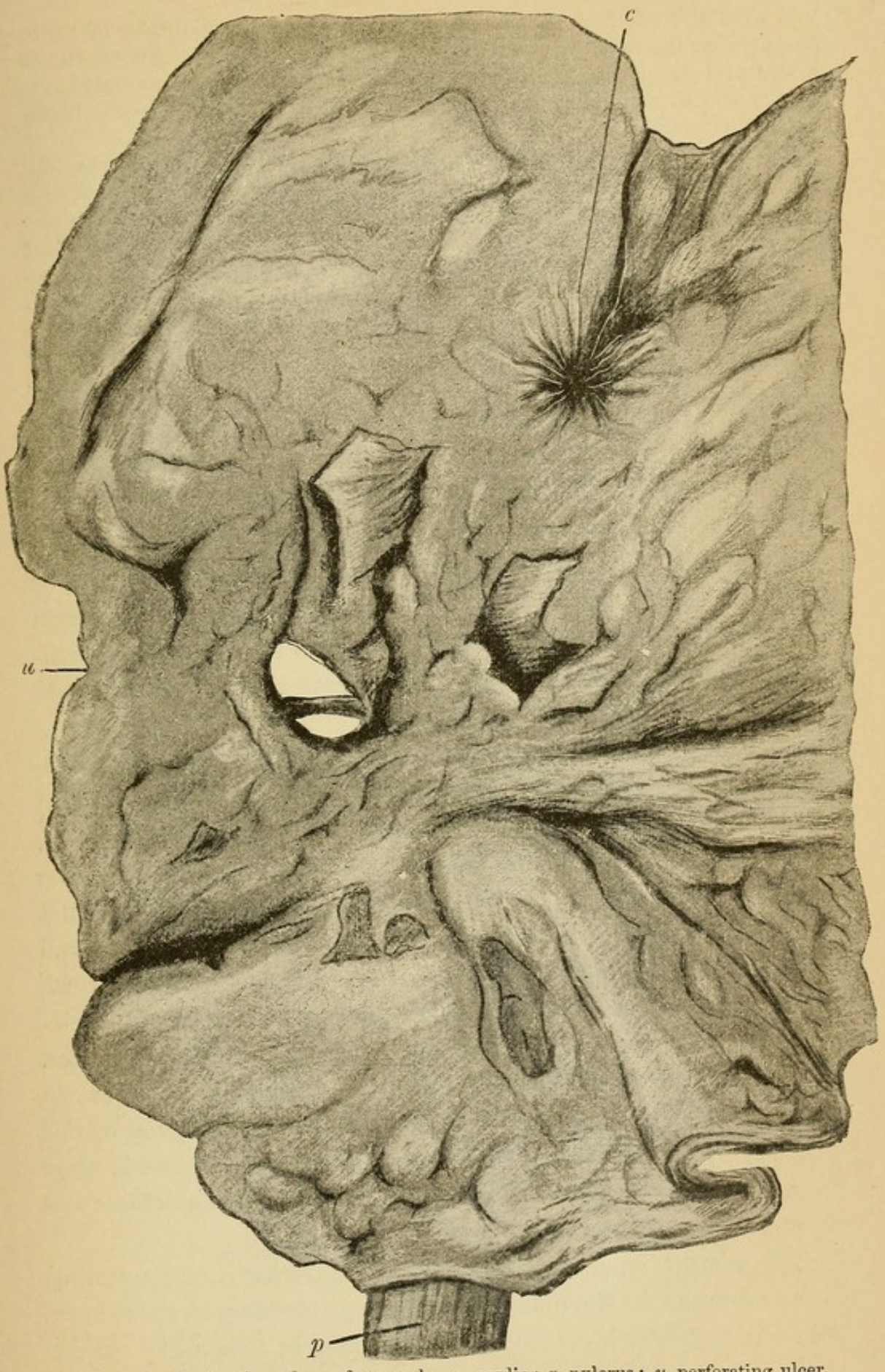


FIG. 45.—Perforating ulcer of stomach. *c*, cardia; *p*, pylorus; *u*, perforating ulcer.

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 have already been discussed in speaking of toxic gastritis [see Chapter IV]. 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 either an increased acidity of the former or a deterioration of the latter, or both factors may be present at the same time. Eb-

* L. Griffini und G. Vassale. Ueber die Reproduction der Magenschleimhaut. Beiträge zur pathologischen Anatomie, etc., von Zeigler und Nauwerck, Bd. iii, Heft 5, p. 425.

stein,* 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. Talma‖ 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. Talma also concludes that "a disturbance of nutrition must precede the ulceration, be it either a simple anæmia or a retardation in the movement of the nutritive lymph; or, finally, more profound changes in the tissues themselves."

* W. Ebstein. Experimentelle Untersuchungen über das Zustandekommen der Blutextravasate in der Magenschleimhaut. Arch. für exper. Pathol., Bd. iii, p. 183.

† Ewald. Klinik, etc., I. Theil, 3te Aufl., p. 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, p. 101.

O. Silbermann. Experimentelles und Kritisches zur Lehre vom Ulcus ventriculi rotund. Deutsche med. Wochenschr., 1886, No. 29, p. 497.

‖ Talma. Untersuchungen über Ulcus ventriculi simplex, Gastromalacie und Ileus. Zeitschr. für klin. Med., Bd. xvii, p. 10.

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 Rokitanski, 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 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

---

* C. v. Rokitanski. Lehrbuch der pathol. Anatomie, 3te 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 an inch and a half, 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."

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 could not be accounted for. One evening, six years later, he again swallowed 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 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. Becker† has succeeded in experimentally producing gastric ulcers in dogs by introducing hot gruel into their stomachs. 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. Leube‡

* Marcet. Med.-Chirurg. Transactions, vol. xii, p. 72.
† Becker. Berl. klin. Wochenschr., 1887, p. 369.
‡ Leube. Centralbl. für klin. Med., 1886, No. 5.

describes under the name of ulcus ventriculi traumaticum a typical case of an ulcer developed after a blow upon the epigastrium by the tongue of a wagon, in a man who had always been healthy, and who remained perfectly well after the ulcer was healed. Vanni* also 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 upon 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 Talma,† in which hæmorrhages of the stomach and ulceration resulted from severe general convulsions. But how many persons have had convulsions and received blows upon the stomach without developing ulcers! [After having made careful autopsies on three cases of severe internal injuries, Müller‡ maintains that traumatisms may cause gastric and duodenal ulcers.]

Changes in the Blood.—Evidently here, as well as in the examples given 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' ἐξοχήν 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 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 autodigestion of the gastric mucous

* Vanni. Sull' ulcera dello stomaco d' origine traumatico. Lo Sperimentale, Juglio, 1889.

† *Loc. cit.*

‡ [Müller. Ulcus ventriculi et duodeni traumaticum. Inaug. Dissert., Leipzig, 1894.—Ed.]

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 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 anima 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

---

* Pavy. On Gastric Erosion. Guy's Hosp. Reports, xiv, 1868.

† Edinger. Ueber die Reaction der lebenden Magenschleimhaut. Pflüger's Archiv, Bd. xxix, S. 247. See Ewald. Klinik, etc., I. Theil, 3te 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 und 45.

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 composition of the blood is always necessary to produce such a result.*

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 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 *hyperchlorhydria* of the gastric juice was first brought forward by the investigations of Von den Velden, Riegel, Ewald, Jaworski, Boas, Rosenheim, 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 mem-

---

* Miquel. Hannover. Zeitschr. f. prakt. Heilkunde.

† Crisp. On Perforation of the Stomach. Lancet, August 5, 1843.

‡ W. Fox. Chronic Ulcer of the Stomach. Reynolds's System of Med., vol. ii, p. 930.

brane, 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. 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, produced by hyperchlorhydria, as well as a change in the composition of the blood in the presence of the normal acidity.*

Riegel and Talma believe that this hyperchlorhydria is the underlying cause and efficient agent in the production of gastric ulcers. Korcynski and Jaworski claim that the "acid gastric catarrh" which they have described and which we have already mentioned [page

194] is the cause, and maintain that "ulcers are produced as the result of the action of the acrid gastric juice upon the altered mucosa of the pylorus." But why should there be circumscribed necroses when the entire membrane is changed? Riegel's views are much more acceptable: "On account of the hyperchlorhydria an erosion 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 hyperchlorhydria, 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 hyperchlorhydria 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 Rokitanski and Camerer believed that hyperacid gastric juice was secreted in these cases as a result of a paralysis of the vagi. Günsburg † directly postulated that the existence of a perforating gastric ulcer depended upon the production of a 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

* 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.

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, on closer investigation, shrink to very modest proportions.

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 2. The earliest period of its appearance was from four to six days after the burn. A possible clue to understanding this remarkable phenomenon has been furnished by W. Hunter,‡ who observed duodenal ulcers surrounding the orifice of the common bile duct after subcutaneous injections of toluylendiamide; he believes that the ulcers were due to excretion through the bile of substances which may provoke inflammation. It is possible that in burns some similar substances may be produced by decomposition of the blood or by absorption of toxic substances from the burned area which is then excreted in the bile. Ulcers in the stomach, of which Rokitanski, 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. Bötticher's observations on this subject were soon shown by Körte ^ to be inconstant and not convincing. Letulle ◊ found numerous streptococci in the veins of

---

* Curling. On Acute Ulceration of the Duodenum. Med.-Chirurg. Transact., vol. xxv, p. 260.

† Holmes. Syst. of Surgery, vol. i, p. 733.

‡ W. Hunter. The Pathology of Duodenitis. Transact. Patholog. Society of London, 1890.

Wilks. Cases of Death from Burns and Scalds. Case 77, quoted by Falk. Ueber einige Allgemeinerscheinungen nach umfangreichen Hautverbrennungen. Virchow's Arch., 1871, Bd. liii, p. 27.

‖ Pitt. Stomach with Numerous Superficial Erosions following after an Extensive Burn. Transact. Pathol. Soc. London, 1887, pp. 38, 140.

^ Körte. Beiträge zur Lehre vom runden Magengeschwürs. Inaug. Dissert., Strassburg, 1875.

◊ M. Letulle. Origine infectieuse de certains ulcères simples de l'estomac ou du duodénum. Compt. rend., tom. 106, No. 25.

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 Widal; 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. [The latest advocate of the microbic origin of gastric ulcers is Martin.* The general tendency, however, is against accepting any etiological relation of bacteria. The presence of numerous micro-organisms in ulcers means nothing. On the other hand, there is no doubt that some ulcers are caused by bacteria being transported by the blood and causing thrombosis. Such ulcers may occur in sepsis, acute rheumatism, possibly tuberculosis and other infectious diseases.† (See also page 183.)]

So much concerning the presumable cause of ulcers of the stomach. I have spoken of these views first because at present they are the center of interest, and because they are naturally of great importance in prognosis and therapy. I shall now review the clinical facts.

I shall first give 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 con-

* [Martin. Diseases of the Stomach, 1895, p. 418.—Ed.]

† [Rosenheim. *Op. cit.*, p. 350.—Ed.]

siderable 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.* [Fiedler † states that in 2,200 autopsies, ulcers or scars were found in 1·5 per cent of the men and 20 per cent of the women.] 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 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 Thüringen. 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, especially in Russia and Bavaria, is in general well nourished and strong. 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

* [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.—Ed.]

† [Fiedler. Sitzungsbericht d. Dresdener Vereins für Natur und Heilkunde, 1883.—Ed.]

‡ Von Sohlern. Der Einfluss der Ernährung auf die Entstehung des Magengeschwürs. Berl. klin. Wochenschr., 1889, No. 14.

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 Birsch-Hirschfeld and Henoch,# ulcers of the stomach are fairly frequent in children, and even in the newborn. 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

* 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, 2te Aufl., S. 61.

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 far less common in childhood. [A number of cases of ulcers in very young children have recently been published, of which I shall only quote the case reported by Colgan,* in a child two and a half years old. The patient was suddenly attacked with convulsions, the temperature rose to 106°, the pulse to 150; death occurred in 13 hours. There were no gastric symptoms. The autopsy showed a perforation on the posterior wall of the stomach at the cardia and near the greater curvature.]

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 chapter. 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 arise 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 simple and spasmodic contraction of the muscular layers, predispose to the rupture of the vessels. In a few cases Von Openchowski† has also observed hyaline degeneration of the walls of the smallest vessels in the

* [Quoted by Weir and Foote. Medical News, April 25, 1896.—Ed.]

† Von Openchowski. Zur pathologischen Anatomie der geschwürigen Processe im Magendarmtractus. Virchow's Archiv, Bd. cxvii, p. 347.

hæmorrhagically infiltrated area of the mucosa, and regards them as being the causes of the latter.

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 Rokitanski, 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 streaklike 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. But certainly not from every erosion, which, as Langerhans† has properly claimed, are distinguished from ulcers by the fact that they are

* [Carswell. *Loc. cit.*]

† R. Langerhans. Ungewöhnliche Art der hämorrhagischen Erosion des Magens. Virchow's Archiv, Bd. cxxiv, p. 273.

irregularly scattered over the mucous membrane in large numbers and coalesce, whereas ulcers occur singly and in certain localities only. Nevertheless Langerhaus and D. Gerhardt* give carefully described typical examples of such erosions which have been transformed into classical ulcers. Gerhardt also shows that we may also include among these the small ulcers which are formed by the swelling and bursting of lymphatic follicles.

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.

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 Rokitanski'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 steplike forms. Usually 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 [6⅔ inches] in length, and 8·5 centimetres [3⅔ inches] in width, is referred to as a prodigy; but I have found a case described by Habershon in which

* D. Gerhardt. Ueber geschwürige Processe im Magen. Virchow's Archiv, Bd. cxxvii, p. 85.

† Virchow. Cellular Pathologie, 4te Aufl., p. 537.

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.*

Langerhans's statement (*loc. cit.*) that the typical site of gastric ulcers is "along the lesser curvature" is opposed to these and my own experiences.

Number.—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." †

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 fully 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. It is also to be noted that at times several ulcers, which were originally distinct, may coalesce and form one large ulcer.

---

* [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. Peptic ulcers may also occur in the lower portion of the œsophagus (see page 115) or in the upper part of the duodenum (see page 432).—Ed.]

† Lange. Deutsche Klinik, 1860, p. 90. "In addition to this (i. e., the perforating ulcer) there was not only an immense number of scars of various sizes and 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 funnellike, that I had to give up the attempt to count them all."

In *microscopic sections* through the margin of a recent ulcer the ducts of the glands are seen to descend troughlike [*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. 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 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 pro-

* Witosowski. Ueber das Verhältniss der productiv entzündlichen Processe zu den Ulcerösen im Magen. Virchow's Arch., Bd. xciv, p. 542.

liferation 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 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. Korczynski and Jaworski† have examined pieces of gastric mucous membrane which were removed from the vicinity of an ulcer at operations on three cases, and in one case they studied large pieces which were obtained after death. They were able to demonstrate an inflammatory condition of the interglandular tissue as well as a disappearance of the peptic cells of the gastric tubules, the parietal cells being unaffected; there was also extensive loss of the superficial epithelium of the mucosa. They therefore conclude that this inflammatory—i. e., catarrhal—affection, which is in many cases accompanied by a coincident overproduction of HCl, is in many cases the primary cause of the ulcer. In my opinion the contrary would be much more probable; for mucous membranes surrounding the ulcer is liable to be put into an irritable condition which involves it to a variable extent and intensity.

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

---

* G. Hauser. Das chronische Magengeschwür. Leipzig, 1883.

† *Loc. cit.* Deutsch. Arch. für klin. Med., Bd. xlvii.

‡ After careful investigations this has been corroborated by Griffini and Vasale. Ziegler's Beiträge zur patholog. Anatomie, Bd. iii.

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. Girdlelike constrictions of the viscus occur, giving it the form of an hourglass or a gourd [the hourglass stomach]. 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. Thus, also, very peculiar cicatricial bands may be formed, which lead to the formation of a complete sac, of which Cruveilhier* gives an excellent drawing in his Atlas.

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 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.

---

* *Loc. cit.*, 20. Livrais, Pl. 6.

† Habershon. Lancet, June 2, 1883, p. 951.

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 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 pulmonary phthisis and vague gastric symptoms; on autopsy, an ulcer, 1½×3½ 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. Barbacci ◊ describes a similar case in which there were isolated tubercular ulcerations in the stomach, the primary tuberculosis being in the pharynx. Most of the cases reported by Musser occurred in children.] Nevertheless, these cases

---

* Eppinger. Ueber Tuberculose des Magens und Oesophagus. Prager med. Wochenschr., 1881, No. 51 und 52.

† M. Litten. Ulcus ventriculi tuberculosum. Virchow's Archiv, Bd. lxvii, S. 615.

‡ 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.—Ed.]

◊ Barbacci. Un nuovo caso di tuberculosi gastrica. Lo Sperimental, 1892, No. 13.

are quite rare, since Eisenhardt* found only one case of gastric tuberculosis in 567 cases of tuberculosis of the intestines. Marfan,† in a study of the gastric disturbances of pulmonary phthisis, also presents but few cases, some of them being doubtful. 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‡ [see page 418].

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.# [The relations of syphilis and gastric ulcer are discussed in some detail by Neumann,‖ who considers their occurrence in this disease by no means as rare as has been supposed. He believes that the ulcers which are found in syphilitic patients may be either true peptic ulcers or broken-down gummata (see page 417).]

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. [A very interesting case of latent ulcer has recently been published by Dieulafoy.^ There were absolutely no symptoms until perforation occurred; and yet there were two ulcers, one of which

---

* Eisenhardt. Ueber die Häufigkeit dar Darmtuberkulose. Inaug. Dissert., Munich, 1891.

† Marfan. Troubles et lésions gastriques dans la phthisie pulmonaire. Paris, 1887.

‡ [Full bibliography of tuberculosis of the stomach will be found in W. S. Fenwick, Dyspepsia of Phthisis, London, 1894, p. 198.—Ed.]

Galliard. Syphilis gastrique et ulcère simple de l'estomac. Arch. génér. de méd., 1886, pp. 66 *et seq.*

‖ [Neumann. Syphilis. Nothnagel's Encyclopædia, 1896, Bd. xxiii, p. 354.—Ed.]

^ [Dieulafoy. Presse méd., July 25, 1896. Full abstract in New York Medical Journal, August 15, 1896, p. 245.—Ed.]

was as large as a half-dollar. According to Stoll,* who has published statistics based upon 3,476 autopsies, gastric ulcers run a latent course in 27 per cent of the cases.]

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, 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 girdlelike 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; diar-

* [Stoll. Deutsch. Arch. für klin. Med., Bd. lii, Hefte 5 und 6.—Ed.]

rhœa, 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. [The pain in the back is usually localized, especially on the left side, at the twelfth dorsal and first lumbar vertebræ. Localized tenderness in this area is very frequently observed.] 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 stom-

ach, 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.

The Changes in the Chemical Functions of the Stomach.—At all

---

* Quoted by Copeland, Dictionary of Pract. Med, article Indigestion.

† Traube. Deutsche Klinik, 1861, S. 63.

events, the appetite of patients with gastric ulcers and their digestive power show that they are not lessened. To Riegel and his followers* is due the credit of having been the first to attach great importance to occurrence of *increased secretion of HCl.* Numerous investigations† have shown that this hyperchlorhydria is not constant, as was at first supposed by Riegel, but it is nevertheless found in the great majority of cases. The statement long ago made by me,‡ that "in cases of ulcer the gastric juice always contains HCl, and usually an excess of it," may to-day be generally accepted. Von Korczynski and Jaworski# in a few cases have also observed the untimely occurrence (i. e., on an empty stomach) of continuous acid hypersecretion; they have noticed that the acidity increased or diminished in the same degree as the patient's subjective symptoms, but it was greatest just before the occurrence of a hæmorrhage. But all authorities agree that the acidity due to HCl may reach 90 to 100, and even as high as 108 and 110. It is self-evident that the hyperacidity of the chyme will interfere with digestion, the digestion of proteids being more rapid and complete than of the starches. Thus in the stomach contents after a mixed meal one will find that all the meat has been digested, while a larger or smaller residue of starches will be found unchanged.

Changes in the Urine.—Such a hyperchlorhydria is necessarily caused by an abnormally large decomposition of the chlorides, which in turn causes a larger amount of the corresponding bases to appear in the urine—i. e., the urine becomes more alkaline. This has been systematically observed by Quincke, Maly, Sticker and Hübner,‖ and Ferrarini.△ Gluczynski◊ was the first to call attention to the

---

* F. Riegel. Beiträge zur Diagnostik der Magenkrankheiten. Zeitschrift für klin. Med., Bd. xii, p. 434, etc.; Volkmann's Sammlung klin. Vorträge, No. 289; Deutsch. med. Wochenschr., 1886, No. 52.—Vogel. Beiträge zur Lehre vom Ulcus ventriculi simplex. Inaug. Dissert., Giesen, 1887, and others.

† Rothschild. Inaug. Dissert., Strassburg, 1886.—Ewald. Berl. klin. Wochenschr., 1886, No. 23.—Ritter und Hirsch. Zeitschr. für klin. Med., Bd. xiii, p. 446.—C. Gerhardt. Deutsch. med. Wochenschr., 1888, No. 18.—Rosenheim. Ibid., No. 22, and others.

‡ Ewald. First American edition of this work, p. 230.

Loc. cit. Deutsch. Arch. für klin. Med., Bd. xlvii.

‖ Sticker und Hübner. Zeitschr. für klin. Med., Bd. xii, p. 114.

△ Ferrarini. Riforma medic., April 24, 1891.

◊ Gluczynski. Berl. klin. Wochenschr., 1888, No. 52.

complete absence of the chlorides from the urine, a fact which can be readily corroborated; hence a high alkaline reaction of the urine and the absence of chlorides indicate marked changes in the functional activity of the glands of the stomach. [See page 163.]

Condition of the Blood.—Most writers, such as Laache, Leichtenstern, Reinert, and Ostersprey,* have found changes in the blood which were independent of any hæmorrhages; the number of red cells and the percentage of hæmoglobin were diminished, while at times the number of white cells was increased. The contradicting observations of Müller and Oppenheimer,† however, show that although these results are common, yet they are not always found, and hence have not specific relations to gastric ulcer, and therefore depend upon secondary conditions, such as chlorosis, anæmia, etc. Immediately after a hæmorrhage we find the usual blood changes after such occurrences—i. e., a diminution of the red cells and hæmoglobin and a slight increase of the leucocytes.

The next symptom to be considered is *vomiting*, both of food and of blood. 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 are (for example, sarcinæ) very rare. At other times the vomit is watery, with a light greenish tinge, very acid, and on standing there is a mushy deposit which consists chiefly of starch granules, cellular detritus, and scanty, well digested fragments of meat. There may also be periods in which the vomit is very copious, when the stomach is absolutely intolerant toward food.

Hæmatemesis.—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, then it is changed to reddish-brown, granular masses. Small quan-

---

* Ostersprey. *Vide supra*, p. 327.

† Müller. *Vide supra*, p. 327.

tities 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, as has been shown by Schmauss, the blood in the stool can only be demonstrated by a microscopic, spectroscopic, or chemical examination. However, the detection of small quantities of blood in the stools is always a difficult task, because the red cells are usually so altered in the intestines that they lose their characteristic form. This difficulty, which is not encountered in large bleedings, is increased in small hæmorrhages, especially if the patient has taken preparations of mercury [iron, bismuth] and sulphur, which give a dark color to the fæces. 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 chapter. 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. 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. 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 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 Gerhardt saw it in 47 per cent of his cases; so we may assume that considerably more than half the patients do not have hæmatemesis.

In an interesting study of the records of Guy's Hospital from 1870 to 1890, Hood * has shown that the majority of cases of ulcers which occurred under the thirtieth year were women, and that death was extremely rare at this youthful period of life. Of 66 such cases, 29 were under thirty years old, of whom only 2 were men; whereas 11 of the 21 cases which occurred between the thirtieth and fortieth years were men. All cases recovered. Seven other cases which were fatal immediately after hæmorrhage were all over thirty years old; 4 of them were women, aged thirty-three, thirty-five, fifty, and fifty-three years. Although we must not infer that the prognosis of hæmatemesis suddenly changes with the thirtieth birthday, yet these statistics indicate that the prognosis of hæmatemesis in youthful women is not bad; on the contrary, after such catastrophes we often see a remarkable improvement, lessening of the distressing symptoms, and improvement of the blood. Thus in one of my cases within three weeks after hæmatemesis, the number of red blood-cells were from 1,900,000 to 3,040,000 and 4,070,000, and the percentage of hæmoglobin from 31 to 51. I have also repeatedly seen similar occurrences.

The bloody masses after hæmorrhage from ulcer contain no specific elements; and the red blood-cells are so abundant that the cellular structure of the gastric mucous membrane is scarcely or not at all to be seen.

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

* W. Charles Hood. Hæmatemesis, with Special Reference to that Form met with in Early Female Life. London, J. Bale & Sons, 1892.

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 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. We may also observe œdema of the lower extremities, especially at night, after the patient has been on his legs all day, and also amaurosis, which may occur soon, or some time after the bleeding. According to Fries,* amaurosis occurs in 65·5 per cent of all cases of bleeding from the intestinal tract; but its real relation to hæmatemesis has by no means yet been made clear.

Immediately fatal cases of gastric hæmorrhage from the vessels

* S. Fries. Beiträge zur kenntniss der Amblyopie und Amaurose nach Blutverlusten. Inaug. Dissert., Tübingen, 1876.

of the stomach, especially in youthful persons, as has been shown above, are comparatively rare. In most the cause has been perforation of the ulcer (see page 406), 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: *

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 394], 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 the chapter 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 conva-

---

* Finny. Ulcer of the Stomach opening in the Left Ventricle of the Heart. Brit. Med. Jour., 1886, i, p. 1102.

† Powell. Transact. Pathol. Soc. [London], vol. xxix, p. 133.

‡ Poisson. Bull. de la Soc. anat. de Paris, Febr., 1855.

lescence from an attack of typhoid, and might have occasioned its being mistaken for a typhoid hæmorrhage.

Hollevoet* describes a case of ulcer with hæmorrhage which was followed by marked purpura hæmorrhagica. But, as in this case (which recovered), there were also renal hæmorrhages. Scurvy may also have been present.

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 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 recognize 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 of 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

* Hollevoet. Arch. méd. Belges, 1892, No. 3.

† [Pick has recently reported a case of this kind; the true condition was only found at the autopsy. Zeitschrift für klin. Med., Bd. xxvi. Bibliography of 27 cases is given.—Ed.]

‡ [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).—Ed.]

S. West. Trans. Patholog. Soc., London, 1890, p. 147.

caused death from pylephlebitis. Those cases in which encapsulated abscesses containing air have formed beneath the diaphragm have been described under the name of pyopneumothorax subphrenicus. [Subphrenic abscess is by no means rare after perforation of gastric ulcers. Much has recently been written on this subject, especially by Maydl,* Meltzer,† Weir,‡ Beck,# Foote,‖ and others. In 110 cases of subphrenic abscess collected by Meltzer, 32 occurred after gastric ulcers and 9 after duodenal ulcers. The abscesses frequently contain gas, and are by no means easily recognized. Pyopneumothorax will also exist if the diaphragm has been perforated. The diagnosis may be made by the history of the case, the absence of Litten's "diaphragm phenomenon" before perforation of the diaphragm has occurred, the presence of dullness over the lower thorax, not due to the liver or spleen, and the use of the aspirating needle (Weir and Foote). The prognosis is very bad unless the condition is relieved by operation.] Perforation into the pleura[^] can be diagnosticated if it causes pneumothorax and empyema, or if it leads to direct communication with the lungs, and the coughing up of particles of food, which not only may occur, but actually has been reported.

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 occur in different ways. 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 of Budd, which I have already mentioned—in complete interference

---

* [Maydl. Der Subphrenische Abscess. Vienna, 1894.—Ed.]

† [Meltzer. N. Y. Med. Journal, June 24, 1893.—Ed.]

‡ [Weir. Internat. Med. Magazine, February, 1892.—Ed.]

[Beck. N. Y. Med. Record, 1896, vol. i, p. 217.—Ed.]

‖ [Weir and Foote. Med. News, May 2, 1896.—Ed.]

[^] [In a case reported by Muller, lumbricoid worms were found in the pleural cavity. Memorabilien, xvii, October, 1872. Quoted by Welch, *loc. cit.*—Ed.]

with the functions of the intestine, thus leading to permanent obstruction, progressive marasmus, and death.

Perforation into the peritoneal cavity is, however, by far the most frequent, 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 chapter, 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 gas, 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

---

* [Some uncertainty exists as to the existence of vomiting in perforation. Struve found it in two thirds of his cases, and says that it is liable to be absent in large perforations. Weir and Foote found it in 36 per cent of their cases, in 8 per cent it was absent; in the remainder (56 per cent) no reference is made to this symptom. "Certainly the presence of vomiting in no wise argues against the diagnosis of perforation of the stomach." Weir and Foote. Med. News, April 25, 1896, p. 461.—Ed.]

† Even unconscious individuals react still to severe painful sensations.

the introduction of the stomach tube. Faber * describes a case of perforation after vomiting brought on by the patient. According to Bouilleaud,† the normal act of defecation 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, air and blackish-brown stomach contents were found in the abdominal cavity. The stomach was enormously dilated, and the pylorus so narrow that a pencil could scarcely be passed through it. Just above this was an ulcer. It was about the size of a 2-mark [50-cent] piece, with wall-like and thickened (carcinomatous ?) edges, and in the center was a circular perforation with very smooth, sharp contour, not at all ragged or torn, and in no way suggesting 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 have had a similar experience in the case of a young woman, twenty-one years old, with an ulcer about the size of the palm of the hand, which had undergone carcinomatous degeneration. There was a perforation about as large as a 20-pfennig [5-cent nickel] piece on the lesser curvature, below the left lobe of the liver; the edges of the perforation were smooth, and there was no trace of recent inflammation in its vicinity. During the last weeks of her life she had vomited frequently, but the tube had never been introduced.

Cases which recover from such perforations are exceedingly rare. [Such a case has been published by Hall.‡ 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

* Faber. Emphysem des Mediastinums und der äusseren Haut in Folge einer Perforation eines Magengeschwürs. Württemb. med. Correspondenzblatt, 1885, No. 40.

† Bouilleaud. Arch. de méd., i, p. 534.

‡ [Hall. Case of Perforating Gastric Ulcer, Peritonitis, Recovery. Brit. Med. Jour., January 9, 1892.—Ed.]

four hours after eating, when the stomach was empty. Pariser* reports 15 authentic cases of recovery after acute perforation, without operation. He, too, insists that recovery in all these cases depended on the empty condition of the stomach at the time of perforation.] 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.

["Gastrocutaneous fistulæ are a rare result of the perforation of 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." "Of the 25 cases of gastrocutaneous fistulæ collected by Murchison,† 18 were the result of disease. In 12 of these cases the probable cause was simple gastric ulcer. 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."]

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. I have learned to fear these cicatrices even more than the original ulcer. It is not uncommon for such

---

* [Pariser. Deutsch. med. Wochenschr., 1895, p. 468.—Ed.]

† [Murchison. Med.-Chir. Transact., London, 1858, vol. xli, p. 11.—Ed.]

‡ [Middeldorpf. Wiener med. Wochenschr., 1860.—Welch, *loc. cit.*, vol. ii, p. 508.—Ed.]

patients to be regarded as "nervous dyspeptics." If the cicatrix is circular and at about the middle of the stomach, forming the hour-glass stomach, or large saccular dilatations may be formed, then it may happen that if for some reason lavage is performed 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 many 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 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 ulcerating gumma. Here the result of specific treatment can alone be conclusive. A number of such cases has 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

* G. Scherf (Beiträge zur Lehre von der Magendilatation; Inaug. Dissert., Göttingen, 1879) also observed this.

† [Lang. Wiener med. Presse, 1885, No. 11.—Ed.]

‡ Julien. Traité des maladies vénériennes. Paris, 1886, p. 880.

Hiller. Monatschr. f. prakt. Heilkunde, 1883.

‖ Galliard, *loc. cit.*

cases showing the signs of gastric ulcer together with the existence of syphilis [see page 402].

Tuberculosis and Ulcer.—As is wel lknown, 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. [Fenwick* believes that the rarity of tubercular disease in the stomach is also due to the small amount of lymphoid tissue which is deeply situated in the mucous membrane.] 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. Fenwick‡ says complete perforation is very rare, on account of the numerous adhesions which are formed about the base of the ulcer. He could find only one case reported, and this he considers doubtful.]

Diagnosis.—When all the classical symptoms are present the diagnosis of chronic gastric ulcer is easy and scarcely to be mistaken; 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.

* [Fenwick, *op. cit.*, p. 14.—Ed.] † [*Loc. cit.*] ‡ [Fenwick, *op. cit.*, p. 163.—Ed.]
# [The Nature and Treatment of Cancer. London, 1846, p. 289.]

Nervous Gastralgia.	Gastric Ulcer.	Gastric Cancer.
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.
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.

Nervous Gastralgia.	Gastric Ulcer.	Gastric Cancer.
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 which foreign bodies, such as hair, etc., are introduced.	Round, egg-shaped tumor to the right of the midline, if the ulcer is situated 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.	Tumor variable in size and form: knobbed or smooth; can readily be palpated; usually can be moved without resistance; at times its position changes with respiration. Secondary glandular enlargements. Metastases.
[*Hydrochloric acid* variable.]	Hydrochloric acid present and usually increased in amount.	[In the majority of cases no hydrochloric acid, but an excess of lactic 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.*

* [See also E. Kollmar, Zur Differentialdiagnose zwischen Magengeschwür und Magenkrebs. Berl. klin. Wochenschr., Bd. xxviii, pp. 119, 146.—Ed.]

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 it must not be forgotten that we undoubtedly find exceptions to this rule. 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 establishing the 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 tumorlike 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 involved, 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 hazelnut at the lower edge of the stomach. These have repeatedly caused me great trouble in diag-

nosis. 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 said 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, a man, twenty-seven years old, presented only the symptoms of an ulcer with hyperacidity of 104 and 101 per cent; this hyperacidity persisted in spite of the development of the tumor and the presence of well-marked signs of stenosis. Gastroenterostomy was performed; at the operation inspection of the tumor showed that it was undoubtedly a cancer. 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.

The Diagnostic Use of the Tube in Ulcer.—The question arises whether it is justifiable to introduce the stomach tube for diagnostic purposes in gastric ulcer. Many clinicians, of whom I shall only mention Leube among the Germans and Germain Sée ‡ among the French, condemn lavage and the use of the tube in this condition. Sée cites cases of Cornillon and Daguet in which lavage

---

* *Loc. cit.* † Berl. klin. Wochenschr., 1889, No. 47.

‡ G. Sée. Hyperchlorhydrie et atonie de l'estomac. Bull. de l'Acad. de méd., 1 mai, 1888.

was followed by fatal hæmorrhages. My own opinion is that the tube may be employed after preliminary cocainization of the fauces, and in connection with the aspiration method; but its use must be restricted to those cases in which a diagnosis can not be established in any other way. For scientific purposes we may risk the possible dangers in a clinic or 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 that in introducing the tube we may cause hæmorrhage, and 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 on page 377, 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 cocainizing the throat before introducing the tube in doubtful cases, and by using the utmost caution in aspirating with the aspirator 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 observed that severe hæmorrhages which could not be controlled in any other way have been checked by washing out the stomach with ice-cold water, as will be discussed later on under the treatment.

Differential Diagnosis of Hæmatemesis.—As the expression "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 produced, by blood accumulating and clotting in the throat during syncope. 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 exhaust-

* 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.

ive 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 vein, are liable not alone to well-marked varicosities but also to ruptures which may cause profuse and at times even immediately fatal hæmorrhages. If the blood flows into the stomach and is then vomited, it may simulate hæmorrhage from the stomach; if, then, an autopsy be performed on such a case without paying the proper attention to the œsophagus, the diagnosis of so-called idiopathic gastric hæmorrhage will be made. The number of such cases reported has grown remarkably since attention has been called to them. Blume, Stony Wilson, Litten, Sachs, Voelkel, and Ewald * have published and described cases of this kind. [At the May (1896) meeting of the Association of American Physicians Garland reported a case of œsophageal hæmorrhage with cirrhosis of the liver. In the discussion Osler described two cases. Graham mentioned a case of œsophageal hæmorrhage in a boy; at the autopsy œsophageal varicosities were found, but no disease of the liver or any other organ. Mitchell added another case of a child who died of unaccountable hæmorrhage after scarlet fever. The autopsy showed large "œsophageal piles," and also a group of dilated veins in the stomach, but no disturbance of any other organ.†]

Sachs's case is particularly interesting, as its clinical cause was very much like the one I have reported. A sixty-year-old man had for years repeated profuse hæmorrhages from the stomach; at first they were infrequent, later they occurred every half year, and finally every three months. Gastric symptoms, pain on pressure, and, in fact, all signs of any abdominal disease were absent. The hæmorrhages were preceded by vertigo, cold sweats, etc.; they were followed by a feeling of relief. Finally he became intensely anæmic and weak, and died immediately after a profuse hæmorrhage. The autopsy, the very interesting details of which I can only indicate, revealed an aneurism of the hepatic artery which had ruptured into a hepatic vein; thrombosis of the splenic vein, and a ruptured varix at the cardia. Manifestly the œsophageal veins were the source of the recurrent hæmorrhages.

---

* Blume. Om phlebectasia et varices œsophagi, etc. Copenhagen, 1868.—Stony Wilson. Brit. Med. Journ., December 27, 1890.—Litten. Verhandlungen des X. internat. med. Congresses zu Berlin.—Sachs. Deutsch. med. Wochenschr., 1892, No. 20.—Ewald. Ibid., No. 20, Verhandl. des Vereins f. innere Med.

† [Medical News, May 23, 1896, p. 595.—Ed.]

In a case of cirrhosis of the liver with fatal hæmorrhage, the diagnosis was made during life, because the hæmatemesis occurred without any nausea or gagging; indeed, there were no premonitory symptoms at all; this, together with the presence of the hepatic cirrhosis, rendered the liability of such an occurrence as rupture of an œsophageal varix very likely. At the autopsy I found a ruptured varicose vein in the lower portion of the œsophagus.

Vomiting of blood is also said to occur in intermittent and typhoid fevers, 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 woman, 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. No gastric symptoms occurred during the following three years.

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, purpura hæmorrhagica, helminthiasis, malaria, and exanthemata, so far as the hæmorrhage is

---

* M. Weiss. Magenblutungen bei Typhus abdominalis. Wiener med. Presse, 1887, No. 12.—Millard. L'Union Méd., 1877, No. 12.—Reimer. Jahrb. für Kinderheilkunde, Neue Folge, Bd. x, p. 39.

† Cited by Budd, *loc. cit.*, p. 364.

not dependent upon direct lesions to the vessels, or upon changes in their walls.

But large hæmorrhages undoubtedly occur in the stomach, in which no changes in the blood-vessels can be found.

In 1891 a young man, twenty-four years old, was admitted to the medical division of the Augusta Hospital; he complained of moderate dyspeptic symptoms; there was no fever, vomiting, or sign of a severe acute or chronic disease. On the third day he went into collapse with all the symptoms of internal hæmorrhage. At the autopsy the stomach was found distended with fresh and partly coagulated blood, but the most careful examination of *the entire digestive tract* failed to reveal any cause for the bleeding. Hepatic cirrhosis, typhoid fever, or any general disease which might be associated with the hæmorrhage was not present, and hence by exclusion the diagnosis of "parenchymatous" hæmorrhage was made.

Likewise the diagnosis of the following case is doubtful at least, in spite of repeated hæmorrhages, although in my opinion the occurrence of capillary or parenchymatous hæmorrhage is the most plausible.

The patient was a man, sixty-seven years old, in very good circumstances, and of a strong and vigorous constitution, who had come to Berlin for consultation on account of severe hæmatemesis which had occurred a short time previous. His physician wrote: "On January 25, 1890, I was suddenly called to see Mr. Q. on account of severe cardialgia, for which he wished a hypodermic injection of morphine. The latter at once stopped the pain, but he vomited acid stomach contents. In the evening there was coffee-ground vomit; on the next day over a litre of dark, fluid blood was raised. There was no fever; the pulse was 110; systolic murmur heard over the cardiac area. On the next day hæmatemesis occurred once; then the patient recovered so rapidly that he was scarcely a week in bed, and went out riding on February 2d. Soon after, the patient's appearance was excellent. Exactly one year previous he had had similar attacks of profuse hæmatemesis; went to Carlsbad and Baden Baden, and was perfectly well and exceptionally strong during the whole year of 1889. Every time the bleeding occurred while the patient *was perfectly well* after too great exertions, and each time was immediately followed by months of health. There are no alcoholic excesses, but his work is excessive and irregular."

On February 14, 1890, I examined him and was unable to make a positive diagnosis, for nothing was found except a systolic murmur at the apex of the heart. In my case book I entered the diagnosis ulcer (?) or varicosities (?).

At my request his physician sent me the following report on January 3, 1893: "Since his visit to you the patient has had a number of similar attacks of bleeding without his general condition being in any way

affected by them. This is all the more remarkable because he is very reckless. A trip to Italy and back within a fortnight in midwinter is a mere trifle to him. He is now seventy years old, and is apparently in good physical and mental condition. The only restraint he places upon himself is a proper diet and abstinence from alcohol."

Hood* has repeatedly observed such hæmorrhages with rapid recovery in young anæmic girls and women, without a typical history or symptoms of ulcer. He describes several excellent examples of this kind. In looking over my records I can also find a number of cases which I had diagnosticated as hæmorrhage from ulcers, but the histories of which are so little characteristic of ulcer that they may also be interpreted from this standpoint of Hood, provided we accept his views as correct. These cases occurred in anæmic women from eighteen to thirty years old.

3. *Direct traumatisms.* Hafner† reports the case of a boy who half an hour after a fall from a considerable height on hard ground, 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. Pointed bodies which have been swallowed may cause severe vomiting and hæmatemesis without causing any further injury to the stomach. Heilbrunn‡ reports a case in which blood was vomited after drinking a glass of beer; in the wash-water he found a sharp triangular piece of glass from the bottle, 1 ctm. [0·4 inch] long and 2 mm. [·08 inch] thick. The patient recovered.

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. 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. 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

---

* *Loc. cit.* † Cited by Henoch, p. 434.

‡ Heilbrunn. Centralbl. für Chirurgie, 1891, No. 6.

Letulle. Varices veineuses de l'œsophage dans l'alcoolisme. Jour. des sociét. Scient., 1890.

stomach. This will coincide with the above-described hæmorrhages in cirrhosis of the liver. I have found two cases reported by Galliard * 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. Additional cases have been reported by Sachs † and 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.

It is apparent that the recognition of the cause of the hæmorrhage, the difficulties of which I have already discussed (page 407), 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 hyperæmia, or a destructive process acting on the mucous membrane.

Here I wish to direct attention to an apparently secondary matter, but which to-day plays an important rôle in the examination of the fæces. 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 re-

* Galliard. Altérations peu connues de la muqueuse de l'estomac. Gaz. d. hôpit., 1884, p. 196.

† Sachs, *loc. cit.*

‡ Welch. Johns Hopkins Hospital Bulletin, No. 1.

mained 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 was a case of gastric or duodenal ulcer, and that the apparent "diarrhœa" was the resulting profuse hæmorrhage leading to fainting, for the other conditions causing hæmorrhage from the bowels, such as tuberculosis, ulcers, diseases of the portal vein and of the liver, etc., could 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 and renal 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, shooting pains along the ureters, hæmaturia, and the passage of biliary or renal calculi. 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. According to my conviction and experience, it is only possible 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" 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. Ulcers of the fundus which are 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 one considers 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 one will recall the case of perforation of a necrotic carcinoma of the lesser curvature accompanied by chills, cited on page 335; and, finally, if one knows that frequently numerous ulcers are situated in different places, the unreliability of these signs will be readily appreciated.

Duodenal Ulcers.—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 pres-

* *Loc. cit.*

sure, 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. Oppenheimer * reports a case in which Leube made the diagnosis. An absolutely certain case of this kind I have had reported by Reckmann.†

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

* H. Oppenheimer. Das ulcus pepticum duodenale. Inaug. Dissert., Würzburg, 1891.

† Reckmann. Inaug. Dissert., Berlin, 1893.

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 excellent 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, a course of 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. Fr., aged

---

* Ziemssen. Ueber die Behandlung des Magengeschwürs. Volkmann's Samml. klin. Vorträge, No. 15.

† Leube. Magenkrankheiten, S. 117.

‡ *Loc. cit.*, p. 944.

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 floating kidney. Urine negative.

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 time of her last report.

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 treatment 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

* Jaworski. Ueber Wirkung, therapeutischer Werthe und Gebrauch des neuen Carlsbader Quellsalzes. Wiener med. Wochenschr., 6–16, 1886.

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 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 short 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 gruels; later on I give leguminous soups, then leguminous vegetables and potatoes in the form of a *purée*, to which small

* [Oser cautions against giving too great 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.—Ed.]

† Cruveilhier was the first to recommend the milk diet. Gruels cooked with milk are preferable to pure milk, because the casein coagulates more flocculently than it does in pure milk.

quantities of meat-broth are added later; also rice [stewed], chestnuts, sago, tapioca, and the like. Later on we may allow raw or lightly boiled eggs, meat solution, calves' brain, finely scraped cold ham, white breast-meat of game or tender saddle of venison, etc. It is to be regretted that milk, the neutralizing action of which on acids is well known, and which has also recently been demonstrated by Leo and Von Pfungen, is so badly borne by many persons, no matter whether we add sodium bicarbonate, lime water, whisky, coffee, etc. In a number of such cases peptonized milk, the taste of which has been corrected with sweet cream, can be tolerated. De Bove* recommends meat powder to which an alkali has been added. 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 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 chlo-

---

* Quoted by Matthieu. Ulcère de l'estomac. Gaz. des hôpital, 1892, No. 99.

† [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, August 8, 1891, p. 155.—Ed.]

‡ Te Gempt. Ueber Behandlung des runden Magengeschwürs mit Eisenalbuminat. Berl. klin. Wochenschr., 1886, S. 240.

ride of iron, and which is 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 one has more confidence in any other and gets good results with it, its use ought not to be discontinued; for success does not depend upon the preparation, 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.] Much smaller but decidedly efficacious (as shown by metabolic investigations made by Dronke and myself†) doses of iron and arsenic may be administered with the waters of Levico and Roncegno, which are usually well borne.‡ 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

* [Dietterich's peptonate of iron and Gude's peptomanganate of iron are more common in this country.—Ed.]

† Ewald und Dronke. Berl. klin. Wochenschr., 1892, No. 19 und 20.

‡ [The dose of these waters is to begin with one teaspoonful and increase gradually to one or two tablespoonfuls.—Ed.]

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 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 successfully used by so many excellent

---

* Leube. Magenkrankheiten, S. 113.

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.

[The use of very large doses of bismuth has been recommended by Fleiner,* especially for the treatment of ambulatory cases of gastric ulcer. The technique is as follows: 10–20 grammes [ʒ ⅓–⅔] of bismuth subnitrate are suspended in 200 c. c. [f ʒ vj⅔] of lukewarm water. This is introduced into the stomach in the early morning after having washed out the viscus, if necessary. Fleiner advises that the bismuth mixture be introduced through the tube; this is, however, not essential, as equally good results may be obtained without it. Sixty c. c. [f ʒ ij] water are either drank or poured in through the tube to wash down any of the bismuth which may have adhered in its passage to the stomach. The patient then lies down for half an hour in the position in which the bismuth may deposit itself upon the ulcer. Fleiner states that it takes 5 to 6 minutes for the bismuth to be deposited upon the mucous membrane.

The bismuth acts mechanically in protecting the eroded mucosa and in lessening the irritation of the exposed nerve endings, and it also is an antiseptic.

A special diet is not absolutely necessary, neither is the patient confined to bed, but he may go about and attend to his ordinary duties.

Fleiner has reported excellent results, which have been corroborated by Rosenheim,† Matthes,‡ Savelieff,# Crämer,‖ and others. I have been well satisfied with the results which I have obtained in a number of cases of ulcer; it has also been serviceable in some cases of obstinate gastralgia. I have not used the tube; neither have I

* [Fleiner. Verhandlung. des Congresses für innere Med., 1893.—Ed.]

† [Rosenheim. Berliner Klinik, 1894, Heft 71, p. 15.—Ed.]

‡ [Matthes. Centralbl. für klin. Med., 1894, No. 1.—Ed.]

[Savelieff. Therapeut. Monatshefte, October, 1894, p. 485. This paper contains full bibliography.—Ed.]

‖ Crämer. Münch. med. Wochenschr., June 23, 1896.—Ed.]

withdrawn the supernatant fluid, as recommended by Fleiner. It is surprising how tenaciously the bismuth adheres to the mucous membrane; thus, if the stomach is washed 30 minutes after 15 grammes [℥ss.] have been introduced, and the bismuth which is obtained in the wash-water is filtered out, but 1·5 to 2 grammes [gr. xvij–xxx] can be obtained.

If good preparations of bismuth are used, no poisonous effects will be observed. My results agree with all those which have thus far been reported in the absence of all toxic effects. In several cases in which I have given 15 grammes [℥ss.] daily for several weeks, no bad effects were observed from these large doses. Neither need there be any fear of enteroliths from these large doses. Constipation is sometimes observed; if it occur, large oil enemata will relieve it. In some cases I have even observed diarrhœa. Savelieff also noted the absence of constipation, and states that it disappeared, if present, during the treatment.

The treatment is not to be employed in acute cases, but is to be reserved for the subacute or chronic forms.]

Ord* very highly recommends potassium iodide combined with sodium bicarbonate for the catarrh which accompanies gastric ulcer. It may be used thus:

℞ Potass. iodidi..... 2·0 [gr. xxx]
Sodii bicarbonatis..... 5·0 [gr. lxxv]
Acid. hydrocyan. dil..... gtt. iij
Inf. rad. gentian..... 3·0 : 150·0 [gr. xlv : f℥v]
M. Sig.: One tablespoonful three times daily.

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

* W. Ord. Gastric Ulcer. American Jour. Med. Sciences, June, 1889.

of 0·2 [gr. iij] argent. nitrat. in 150 [f ʒ 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 one of my cases I had to discard it because just the reverse occurred—namely, watery evacuations always followed almost immediately after taking it. [Boas * praises nitrate of silver very highly, especially in mild cases or in patients who can not undertake a rest cure. He begins with gr. iv to f ʒ iv of water (ʒ ss. t.i.d.), and gradually increases it to gr. vj to f ʒ iv of water.]

[Rankin † has reported ten cases in which good results were obtained from a combination of pepsin, iron, and cannabis indica, given combined in pill form. On the other hand, Grote ‡ has recently published the results of his experiments with papain; he found that this substance was not well borne, and increased the pain in hyperacidity and ulcerative processes in the stomach.]

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. 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

---

* [Boas. *Op. cit.*, p. 60.—Ed.]

† [Rankin. Lancet, February 9, 1895.—Ed.]

‡ [Grote. Deutsch. med. Wochenschr., July 23, 1896, p. 474.—Ed.]

for the relief of severe gastralgia. Solutions of chloroform (1 : 120, ℥ ss. every two hours) have at times an excellent effect, not only on the temporary pain, but altogether on the course of the process. [Stepp * highly recommends the use of

℞ Chloroformi purificati..... 1·0 [♏ xv]
Bismuth. subnitratis..... 3·0 [gr. xlv]
Aquæ..... 150·0 [f ℥ v]

M. Sig. : Tablespoonful, well diluted, every hour.]

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. I have been especially dissatisfied with cannabis indica, which has been so highly lauded by Germain Sée ; not alone did I repeatedly fail to obtain any analgesic or quieting effects, but, on the contrary, unpleasant conditions of excitement [see page 244]. I have no personal experience with strontium bromide, which has been highly praised by the same writer for its good effects in hyperchlorhydria.† [Atropine has also been recommended for the latter purpose ; it may be given in doses of gr. $\frac{1}{60}$ three times daily.] ‡

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 ex-

---

* [Stepp. Therapeut. Monatshefte, November, 1893, p. 540.—Ed.]

† G. Sée. Sur l'action du bromure de strontium dans les affections de l'estomac. Bullet. de l'Acad. franç., 1891, No. 42.

‡ [Therapeut. Monatshefte, 1895, p. 384.—Ed.]

ternal 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. 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 369.] However, I must add that in some persons ergotin causes very unpleasant symptoms of oppression and dizziness. I have never been able to convince myself of the reliability of the fluid extracts of hydrastis canadensis or hamamelis virginica. 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.

In two of my cases, hæmorrhages which recurred repeatedly for several days in spite of the means above mentioned were checked with washing out the stomach with ice water. After preliminary cocainization of the fauces and a small hypodermic injection of morphine, the soft tube was carefully introduced and the stomach was washed out a number of times with ice water, when the hæmorrhage at once ceased. In one of these cases this was successfully repeated three times in the course of a few weeks; in the second

* [Pravaz syringe; holds one gramme.—Ed.]

and third hæmorrhages this treatment was at once applied. [This treatment has also been highly praised by Minkowski. Operations have also been performed on account of hæmorrhage from the stomach. This was first done by Mikulicz,* without success, however. Subsequently Küster† was successful in two cases.]

As most of the blood passes on into the intestines and decomposes there, irritation may be caused there; hence, if there are no spontaneous stools, mild aperients, preferably rhubarb with sulphur, should be given.

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.‡ The best method is subcutaneous infusion with a large cannula [which is attached to the tube of an ordinary fountain syringe]. The salt solution [0·4 to 0·6 per cent] is heated to the temperature of the body and is allowed to run in simultaneously through two cannulæ; gentle massage being employed, a litre of water can be infused in a short time. I prefer the subclavicular region as the site of the infusion. In favorable cases the blood regenerates quite rapidly. In a twenty-five-year-old patient I found the number of red cells to be 2,100,000 on the day after the infusion; two weeks later it was 3,560,000, with a slight leucocytosis.

Peritonitis due to perforation demands the exhibition of large doses of opium, best given in suppositories or enemata, and also the

---

* [Mikulicz. Verhandlungen d. deutsch. Gesellsch. f. Chir., 1887, p. 337.—Ed.]

† [Küster. Ibid., 1894; Centralbl. f. Chir., 1894, No. 51.—Ed.]

‡ For instance, Michaelis, Heftige Magenblutung nach einer Magenausspülung (wahrscheinlich bei Ulcus). Erfolgreiche Kochsalztransfusion. Berl. klin. Wochenschr., 1884, No. 25.—I myself have seen three cases of subcutaneous salt-water infusion, in all of which the hematemesis had lasted till the patient was pulseless. All three women, aged twenty-six, nineteen, and twenty-three years, respectively, recovered quite rapidly.

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 every attempt at gagging and choking, since this may lead to the enlargement of the perforation. At times this treatment has succeeded in keeping the peritonitis localized and causing adhesions.*

Laparotomy has been proposed for the cases of perforations, and a successful one has been reported by Parsons.†

[Recently many operations have been reported, especially by English surgeons, in cases of acute perforation of gastric ulcers. In an excellent paper, Weir and Foote‡ have collected and analyzed 78 cases of laparotomy performed for this purpose, and also 9 laparotomies for acute perforation of duodenal ulcers. The average mortality was 71 per cent; great differences, however, were found, according to the time which had elapsed between perforation and operation. Thus the mortality of 23 cases operated within twelve hours was only 39 per cent; while in 17 cases operated within twelve to twenty-four hours it was 76 per cent; and in 32 cases operated after twenty-four hours it was 87 per cent.

Successful excisions of ulcers have also been reported by Czerny, Cordua, Keen, Lange, and others.#]

Finally, I wish to add 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

---

* 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 page 415.—Ed.]

† Parsons. Dublin Med. Jour., July, 1892.

‡ [Weir and Foote. Medical News, April 25, 1896, contains full bibliography. See also Barling. Brit. Med. Journal, June 15, 1896.—Ed.]

[Weir and Foote. *Loc. cit.*, May 2, 1895, p. 489.—Ed.]

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 those 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.

CHAPTER IX.

THE NEUROSES OF THE STOMACH.—THE PHYSIOLOGICAL RELATIONS OF THE STOMACH.

Before entering upon the many-sided and uncertain province of the nervous disorders of the stomach, I desire to preface the little which we positively know of the *innervation of the stomach.*

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 (and also using it in its broadest sense, chemical) 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. Not that there was a reaction to the old vital forces; not that every attempt at an explanation was rejected in despair; but experimenters beeame convinced 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. Un-

* [The form in which the following chapter is presented precludes any attempts at revision. Instead, I would refer the reader to the last edition of Foster's Physiology.—Ed.]

fortunately, 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.

While, on the one hand, the activity of the cells can be more and more distinctly differentiated from the processes which we have heretofore considered physical, on the other hand we are compelled to accord to the phenomena of cell life an always greater autonomy —i. e., independence of the nervous system. The nerves regulate the cellular activity, and cause them to act at the right time and with the proper energy; but in many cases this regulation may be absent without stopping the true activity of the cells.

I shall now endeavor to show how far these peculiarities and independence of the cellular phenomenon are concerned in the innervation of the stomach.

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 cell becomes even more obvious. Here, contrary to physical 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 we must naturally avoid physical explanations, since at all events they show that 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

---

* Ewald. Klinik, etc., I. Theil, 3te Auflage, S. 61 und 208 *et seq.*

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

* Among such conditions we may include, for example, the destruction of sections of the central nervous system when we obtain negative results before complete recovery of the animals. The same applies to all electrical stimulations which can not be confirmed by mechanical irritation, etc.

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 secretion, 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. On 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

* Jürgens states that this reflex from the mouth disappears completely after division of the vagi below the diaphragm.

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 that 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

---

* 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.

† Diminution in the secretion as well as changes in the composition of the gastric juice, for example, lessening of the amount of pepsin, after low division of the vagi (Jürgens), have been frequently reported.

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 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

* [See page 75.]

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 contains 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 from 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 450, 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 reddening 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 inferred 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 im-

pulses 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 (page 453), 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 different 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 stimulat-

ing 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 (page 453). 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 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

* [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."—Ed.]

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 ha dpreviously 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, Bastianelli).

Probably the action of the different nerves depends upon the condition of the stomach (Contejean). If the stomach is in motion as the result of stimulation from the vagus, the action of the sympathetic will be inhibitory; but it will provoke peristaltic action if the stomach is at rest. On the other hand, the stimulation of the vagus has no effect on movements which have been called forth by the sympathetic.

Yet all these experimental stimulations in mammals have an in-

definite 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 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

---

* 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. ccxi, S. 244; and Bd. ccxv, S. 12.

† *Vide* Ewald. Klinik, etc., I. Theil, 3te 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 œsophagus 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.—Ed.]

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 sensitive 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 thermocautery as it touches the stomach from without. The sensitiveness

---

* Openchewski makes a distinction between central and peripheral emetics. The latter, the most important of which are cupric sulphate and tartar emetic, may produce their effects from any part of the digestive tract. Apomorphine acts centrally, but ceases when the corpora quadrigemina are destroyed. The center for the movements of the cardia and the stomach proper has been located here. Openchewski believes that the inhibitory center for the cardia is situated at the junction of the anterior inferior extremity of the caudate nucleus with the lenticular nucleus. (See Ewald, Klinik, etc., 3te Auflage, I. Theil, p. 77.)

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.*

---

* [An elaborate study of the sensibility of the stomach and its influence on digestion has been made by Sollier. Kellogg's translation may be found in Modern Medicine, 1895, vol. iv, pp. 142 *et seq.* This subject is destined to play an important part in the future investigations on the neuroses of the stomach.—Ed.]

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 newborn 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 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; but otherwise it is an exactly analogous eccentric transfer of a sensation.

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! It is certainly an interesting fact that the appetite may be extinguished by psychical influences, 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 orgin, 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 (page 467), we have a distinct perception. Whether the stomach feels especially full or not depends on the usual size of the meal. 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 oversated when his stomach is uncommonly distended, even if he has taken less nourishment than usual. Hence the feeling of oversatiation 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 overhungry 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 overhungry, 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 mere 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 overindulgence 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, and 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.

CHAPTER X.

THE NEUROSES OF THE STOMACH.

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, a description which was excellent for the time in which it was written may be found in Comparetti (1790).* 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 I may mention Stiller, Rosenthal, and Oser,† have endeavored to establish the manifold manifestations of the disturbed innervation of the organ upon a basis cor-

* Occursus medici de vaga ægritudine infirmitatis nervorum Andreæ Comparetti. Venetiis, 1790.

† Stiller. Die nervösen Magenkrankheiten. Stuttgart, 1884.—Rosenthal. Magenneurosen und Magenkatarrh. Wien, 1886.—Oser. Die Neurosen des Magens und ihre Behandlung. Wiener Klinik, 1885.

responding 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*.

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 might thus be obtained.

THE NEUROSES OF THE STOMACH.

a. *Sensory.*	b. *Secretory.*	c. *Motor.*
I. Conditions of Irritation.		
Hyperæsthesia.	Hyperchlorhydria.	Eructation.
Nausea.	Hypersecretion.	Pyrosis.
Hyperorexia.	(Gastrosuccorhœa.)	Vomiting.
Anorexia.		Hyperkinesis.
Parorexia.		Colic.
Gastralgia.		Tormina ventriculi.
II. Conditions of Depression.		
Anæsthesia.	Anachlorhydria.	Atony or hypokinesis.
Polyphagia.		Insufficiency of the pylorus and cardia.
		Rumination.
III. Mixed Form.		
Gastro-intestinal neurasthenia (dyspepsia nervosa.	Anorexia mentalis.	Gastroptosis and enteroptosis.

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.

Taken all in all, the above classification, which has since been adopted by other writers,* will suffice. However, in view of the very varying and interchangeable clinical pictures it is often difficult to decide how some are to be classified. Thus, ought rumination to be grouped among the atonic or irritative hyperkinetic processes? Where shall mental anorexia be placed? etc. Still, this is of no significance when compared to the much more important fact to which attention has already been drawn, that all these various conditions 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.

Occurrence and Etiology.—To prevent needless repetitions, let it be said, once for all, that these conditions occur most frequently in women, and especially in the younger rather than those further advanced in years. It is hardly necessary 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 as these 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 expendi-

* Similar classifications have been published; for example, by Garland, Gastric Neurasthenia, Boston Medical and Surgical Journal, October 3, 1889; Cimbali, Le maladie nervose dello stomaco, Morgagni 1, 1891.

ture 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 pleasures; 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 is 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 the present 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 important 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 (page 548).

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 must 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 diag-

nosis 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,

---

* *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.

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 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 become empty; 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 sometimes 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.

For a similar case I am indebted to Dr. Steyerthal, of Bruel:

B., nineteen years old, of a large and powerful build, had always enjoyed good health until about six weeks previously, when he began to complain of severe pains in the left hip, which were said to have set in after a wound of the foot which he had received while skating. As extension did not relieve the pains, resection of the hip joint was decided

upon. The pains were so agonizing that transportation to the hospital was only possible under chloroform narcosis. On February 6, 1889, the operation was performed. Only a very slight caries was found in the joint; no osteomyelitis. The prolonged chloroform narcosis was well borne. On February 7th, without any cause, the patient began to vomit all the food and drink which he took. Morphine, ice, antifebrine, and antipyrin had no effect. The vomiting continued until his death, shortly after midnight on February 8th. The autopsy on February 10th showed that all the organs were absolutely normal excepting a marked dilatation of the stomach. There was no peritonitis. Chemical analysis of the chloral-chloroform which had been used showed it to be absolutely pure.

In these cases 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 concretiones benzoarticæ,* and worms. In many cases the causal factors will be sought for in vain. Thus, I have recently had under my treatment a strong 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 vague nausea, combined with singular excitation of the cutaneous nerves, pruritus, erythema, and the formation of wheals [urticaria]; even headache and slight 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 shellfish, crabs, lobsters, oysters, etc.,

* [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, etc., *vide supra*, p. 376.—Ed.]

sometimes also 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.

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 to 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 seashore, 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 *défaillance*. 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*. 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.

---

* This etymology is according to Roth-Gessler's Klinische Terminologie. Erlangen, 1884.

† 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.

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 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 goitre. 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 bulimia 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, 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

* Guipon. Des dyspepsies boulimiques et syncopales. Bull. de thérap., 1864, 15 août.

also corroborated by the cases already cited, in which the malady followed severe cerebral injury.

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 woman 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 prove that there is no uniform condition in this respect. But the first case mentioned shows how easily such conditions may become aggravated if the patient is at all liable to psychical changes; for within a few months he was attacked with acute insanity, and committed suicide. I have observed another case of bulimia in a man with sexual perversion.

Anorexia (ἡ ὄρεξις, the desire) denotes a lack of appetite or a repugnance toward food. These two conceptions do not correspond 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

* Leo. Verhandlungen des Vereins für innere Med. Berlin, 1889.

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.

We may therefore, as has been proposed by several writers, make a distinction between mental and nervous anorexia; in the former the primary factor is an abnormally irritable condition of the mind; in the latter the primary irritation is in the gastric nerves, which is reflected inward toward the central nervous system. But a sharp distinction is hardly feasible, and, moreover, both of these conditions frequently develop into gastric neurasthenia, a neurosis which will be discussed later on.

Furthermore, a vicious chain is formed, 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. They would like to eat, but every morsel causes them pain. If hungry, there is an unbearable sweetish taste in the mouth, but if they eat they are annoyed by a sharp, burning sensation. On the tongue we may frequently see smooth, bright red insular areas, or it is traversed by deep fissures, giving it the appearance of a recently plowed field. The organ seems to be too large, and causes the patient to swallow incessantly. Small vesicles, or loss of the epithelium on the edges, cause the patients much annoyance, and make them fear that a cancer is developing. Numbness, or loss of sensation, burning, or dryness, are frequently complained of, although the tongue is

smooth and moist. Frequently it seems to be bluish white, as if coated, but in reality it is only anæmic. In other cases we see peculiar linear hypertrophy of the epithelium, giving the tongue the appearance of a cornfield. In one of my cases this hairy layer exfoliated from time to time, and then gradually reappeared. Microscopical examination showed that there was an epithelial proliferation similar to what has been described as "black tongue." * 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 chain; 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

---

* Dirkler. Ein Beitrag zur Pathologie der sogen. schwarzen Haarzunge. Virchow's Archiv, Bd. cxviii, p. 46.

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 a constitutional disease, 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 a number of cases of severe nervous anorexia for years; 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, 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 in-

* Fenwick. On Atrophy of the Stomach and on the Nervous Affections of the Digestive Organs. London, 1880, p. 99.

† I avoid the expression cardialgia, because it localizes the pain at a definite spot in the stomach without our being able to prove it.

frequently 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.

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 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 Kruckenberg. 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.

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 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 in-

* Delamare. Des troubles gastriques dans l'ataxie locomotrice. Thèse de Paris, 1866.

† W. Gull. Cases of Paraplegia. Guy's Hospital Reports, 1856, p. 161.

‡ 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.

tervals; 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.*

[The contents of the stomach during gastric crises have been carefully studied by Cathelineau,† whose results agree with those already given. The vomit varied in amount from 800 to 2,600 c. c. [f ℥ 27 to 87] in the twenty-four hours. Günzburg's and the biuret tests were always positive. After a test breakfast free HCl, erythrodextrin, and peptones were present. Hayem and Winter's test showed hyperchlorhydria. During the crises the results were not so constant, but free HCl was always present.]

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.

In the course of time I have seen quite a large number of cases of gastric crises in tabes. The diagnosis is readily made as soon as the symptoms of locomotor ataxia are well marked. But if the crises are among the initial symptoms we may be in doubt for a long time, and it is possible that the only valuable symptoms present may be changes in the pupils, or Westphal's symptom, anæsthesia of the pharynx, etc. Thus it may happen that a patient who originally consulted us on account of a "gastric catarrh with cramps of the stomach," may finally die of tabes. But gastralgias may be caused not alone by sclerosis of the posterior columns, but also by other lesions which involve the vagus nucleus. Thus Leyden includes

* Von Noorden. Pathologie der gastrischen Krisen. Charité Annalen, 1890.

† [Cathelineau. Arch. gén. de méd., avril, 1894.—Ed.]

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.

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 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* neuras-

* Oser, *loc. cit.*, p. 42.

thenia 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 cause 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 radiated up to the epigastrium. Burkart claims to have found these points 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.

Here I may also classify the condition which Buch # has de-

---

* R. Burkart. Zur Pathologie der Neurasthenia gastrica. Bonn, 1882.

† Verhandlungen des Congresses für innere Medicin, 1884, S. 232.

‡ Richter. Ueber nervöse Dyspepsie und nervöse Enteropathie. Berliner klin. Wochenschr., 1882, No. 13.

Buch. Wirbelweh, eine neue Form der Gastralgia. St. Petersburger med. Wochenschr., 1889, No. 22.

scribed 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 493, 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 ordinary means of physiatric treatment, including cold rubbings, douches, baths, gymnastics, diet, etc.

The following case may serve as a typical example of this kind:

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

* Hornbaum. Ueber die Pulsation in der Oberbauchgegend als begleitendes Symptom der Indigestion. Hildburgshausen, 1836.

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 to exclude the presence of biliary colic. Even in the above case this point is not definitely settled. Undoubtedly there are cases of biliary colic without icterus, distention of the gall bladder, and fever, and in which the diagnosis between an affection of the liver and the stomach can not be made. Among the cases of pure gastralgia under my care quite a number 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 for a long time 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 her stomach; at other times she imagines she has swallowed a needle, or that she has a tumor; at times she also has attacks of hysterical hoarseness and aphonia. Occasionally she also has attacks of true gastralgia.

Some time ago 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 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 fetor; 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, 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 upstairs 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 upstairs 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.

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.

In these cases the chemical functions of the stomach were normal, so far as could be determined. On pages 216 *et seq.*, while considering chronic gastritis, I have already discussed the

nervous symptoms and psychoses which may accompany or follow well-marked disturbances of the functions of the stomach. The views there expressed have been corroborated by Alt,* who has described a number of excellent examples of agoraphobia, melancholia, and conditions of fear which sometimes even became hallucinations, in which improvement or cure followed suitable treatment directed to the gastric disturbances present. Most of the cases were gastrectases with disturbances of secretion. Alt's observations led him to fully accept my views of agoraphobia.

As excessive or perverted sexual intercourse may be regarded among the psychoses, we may also include here the cases in which gastralgias occur after frequent pollutions. I have repeatedly seen examples of this in young men.

---

* K. Alt. Ueber das Entstehen von Neurosen und Psychosen auf dem Boden von chronischen Magenkrankheiten. Arch. für Psych. und Nervenkrankheiten, Bd. xxiv, p. 403.

CHAPTER XI.

THE NEUROSES OF THE STOMACH (CONTINUED).

I CONSIDER **hyperchlorhydria** 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 in 1882 and 1883; yet it is an error to suppose that these conditions were unknown formerly. Even Riegel makes this mistake in his last publication,* in spite of what I have already said on this point. 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.

Hyperchlorhydria is an increase above the normal of the amount of hydrochloric acid secreted; it is due to the stimulation of the

---

* Riegel. Deutsch. med. Wochenschr., 1892, No. 21.

† As early as 1820, Pemberton (Treatise on 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."

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 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*, *gastrosuccorrhœa* (the *Magensaftfluss* of Reichmann), may occur in two forms, the periodic and the continuous. The acidity is not increased, as a rule, in the former, but it is in the latter. In the *periodic form* it usually occurs after eating, rarely while fasting, yet it does not seem to

---

* 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.

have a direct connection with the introduction of food. Wilkens* reports a typical case of this kind.

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. I can therefore not understand why Riegel† denies the nervous nature of this condition. That it occurs in all classes, as has been correctly claimed by Riegel, is no argument against this, for it is well known that neuroses occur in all classes of society.

In *continuous hypersecretion* (*continuirliche Magensaftfluss*) there is a continuous secretion of gastric juice which is usually hyperacid,‡ so that even while fasting the stomach may contain smaller or larger 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, like free acid, in spite of the absence of organic acids and

---

* S. A. Wilkens. A Case of Hypersecretion in Intermittent Attacks. Lancet, August 27, 1887.

† Riegel. Ueber chronisch-continuirliche Magensaftsecretion. Deutsch. med. Wochenschr., 1892, No. 21.

‡ 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.

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. Swallowed saliva or bronchial secretion may take an active part in this; they are usually found in stomach contents in the form of greenish masses.

It is found that the digestion of starches is delayed, but is very prompt in albuminoids, so that after a meal consisting 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. Other writers, especially among the French, for example, Matthieu, agree with the latter. My own experience would lead me to make the proportion even less, notwithstanding the fact that in the last few years I have examined in reference to this point every patient whose symptoms lead me to suspect this condition. 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. Under certain conditions, as observed by Talma,† the stomachs of neurasthenics may react abnormally toward acids.

---

* 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. viii, S. 407.

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, heartburn, vomiting of sour masses, gastralgias, and similar digestive disturbances which constitute the symptoms of a chronic inflammatory condition, which occur not alone during the day, but also at night and morning when the stomach is empty.

The absence of the signs of a catarrh is characteristic—i. e., coated tongue, foul breath, and loss of appetite; on the contrary, the tongue is usually clean, 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 urine is alkaline, contains few chlorides; but phosphates are often in excess. The bowels are usually obstinately constipated.]

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*. [Reichmann and Riegel recommend that the stomach be washed out in the evening, after which nothing is to be eaten. The tube is then passed early the next morning, 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

* Honigmann, *loc. cit.*

symptomatic one; but fermentation may be controlled and prevented by specific measures.

[Much has been written during the past few years on the subject of Reichmann's disease, as gastrosuccorrhœa is sometimes called. In spite of the long and bitter controversy in which Schreiber and Riegel * have been engaged, much uncertainty still prevails as to how much is to be included under this term. Neither is it yet certain whether it is a disease *sui generis*, or simply a symptom of various gastric disorders, or whether the gastrosuccorrhœa, atony, or gastrectasis is the primary factor of these three conditions which are so frequently associated together. This may readily be appreciated by the fact that Reichmann states that in years he has seen only 6 cases, while Boas states that in his large experience he has only encountered 10 genuine cases of the chronic form.† On the other hand, Bouveret ‡ maintains that he has seen many cases of it, and devotes over sixty pages to its consideration. Riegel, Jaworski, and others also consider it a frequent disease.

Much of this uncertainty is due to the fact that for a long time we did not really know what the contents of the stomach were while fasting. It is now acknowledged that acid gastric juice may be frequently found at this time (see page 20). Another reason which may be given is that, as above stated, many conditions in which hypersecretion occurs as a complication, as cases of dilatation, atony of the stomach, gastric ulcer, gastric neurasthenia, etc., with hyperchlorhydria, are regarded as examples of Reichmann's disease.

Pathologically, some observers, as Hayem,# Korczynski, and Jaworski ‖, have found special changes in the gastric mucous membrane to which the term *gastrite hyperpeptique* has been applied; the peptic cells undergo degeneration, but the parietal cells are unchanged. They would also connect this disease with the so-called acid catarrhal gastritis.

---

* [See files of Deutsch. med. Wochenschr., 1893.—Ed.]

† [Quoted from Boas, *op. cit.*, Bd. ii, p. 130.—Ed.]

‡ [Bouveret. Traité des maladies de l'estomac. Paris, 1893, pp. 161-221.—Ed.]

[Hayem. Allgemeine Wiener med. Zeit., 1894, No. 2, etc.—Ed.]

‖ [Korczynski und Jaworski. Deutsch. Arch. für klin. Med., Bd. xlvii, p. 578. —Ed.]

The main diagnostic features have already been considered. At present it is not expedient to give any points of differential diagnosis; this will only be possible when all are agreed as to what is understood under the term Reichmann's disease. It is also important to bear in mind the warning given by Boas,* that the finding of large quantities of acid stomach contents while fasting is not sufficient to make the diagnosis of chronic gastrosuccorrhœa, but that the patient must also have the clinical symptoms of this condition—i. e., heartburn, eructation, occasional vomiting, pain in epigastrium and back, increased appetite, constipation, and emaciation; besides, the excessive quantities of hyperacid gastric juice must be of constant occurrence.

The treatment, being different than that of the neuroses in general, will be considered separately. Bouveret† divides this into several indications, of which we may mention: 1. To stop the flow of gastric juice. This may be effected by lavage with a solution of argentic nitrate, 0·1 or 0·2 per cent as an intragastric spray, or 150 to 200 c. c. [f ℥ v to vjss.] are introduced every other day, and are allowed to remain ten or fifteen minutes; it may also be presented in pill form. Simple lavage has also been recommended. We may also give Carlsbad salts, large doses of alkalies, or atropine. My own experience with atropine has been favorable. It may be given in tablets of gr. $\frac{1}{100}$ three times daily after meals.

2. To suppress all causes of excitation of the secretory apparatus. This includes mental quiet, hydrotherapy, regulation of the diet—i. e. avoidance of salt, alcohol, and highly seasoned food. The diet must be so regulated that small meals are given at frequent intervals; albuminoids should be in excess; starches and sugars are to be avoided.

3. To combat the effects of the excessive amount of HCl, especially of the pain, vomiting, and the dilatation of the stomach. These have already been considered in the previous chapters.]

Among these neuroses I also classify the condition called **Gastroxynsis** [γαστήρ, stomach, ὀξύς, acid] by Rossbach, which differs

* [Boas. Zur Lehre vom chronischen Magensaftfluss. Berl. klin. Wochenschr., 1895, No. 46.—Ed.]

† [*Loc. cit.*, p. 212.—Ed.]

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 overexertion 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* and Westphalen have also observed very similar states. [Boas† considers that this condition ought to be included among the periodical cases of hypersecretion.]

[Dauber‡ has recently reported a case of chronic continuous secretion of mucus—gastrosuccorrhœa mucosa. At first the symptoms were those of a chronic catarrhal gastritis with a moderate hyperacidity; later on, while expressing the stomach early in the morning, he obtained 60 c. c. [f ℥ ij] of a turbid milky fluid which contained a trace of HCl and much mucus. Fragments of food and saliva were absent. Subsequent examinations yielded the same results. Dauber considers this condition a secretory neurosis analogous to gastrosuccorrhœa.]

Nervous Belching, Eructatio.—It is only in hysterical persons that 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 exhaustive 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

---

* Jürgensen. Ueber Abscheidung neuer Formen nervöser Magenkrankheiten. Deutsch. Archiv für klin. Med., Bd. xliii, S. 9 und 20.—Westphalen. Kopfschmerzen gastrischen Ursprungs. Berl. klin. Wochenschr., 1891, No. 37.

† [Boas, *op. cit.*, Bd. ii, p. 132.—Ed.]

‡ [Dauber. Ueber kontinuirliche Magenschleimsekretion. Boas's Arch., Bd. ii, p. 168.—Ed.]

Weissgerber. Ueber den Mechanismus der Ructus und Bemerkungen über den Lufteintritt in den Magen Neugeborener. Berl. klin. Wochenschr., 1878, No. 35.

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 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 duration, 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 investi-

---

* Bristowe. Clinical Remarks on the Functional Vomiting of Hysteria. Practitioner, 1883, p. 161.

† P. Cartellieri. Eine seltene vorkommende Magenneurose. Wiener allgemeine med. Zeitung, 1885, S. 3.

gated. It is worthy of note that I have observed nervous eructation quite as frequently in men as in women. These cases are always neurasthenics in whom suggestion is of value.

Pyrosis denotes the raising of sour masses from the stomach, a symptom which is well known under the name of heartburn. In the nervous forms of this condition 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.

Next in order is the consideration of a very annoying condition called **Pneumatosis**, or **Tympanites**. 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, 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 fetor 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 gallstone; 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 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 under my observation for a number of years, 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). 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

---

* Tuckwell. On Vomiting of Habit. British Med. Journal, March 22, 1873.

† Barras. Traité sur les gastralgies et entéralgies. Paris, 1827.

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 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.

---

* Leyden. Ueber periodisches Erbrechen (gastrische Krisen) nebst Bemerkungen über nervöse Magenaffectionen. Zeitschr. für klin. Medicin, 1882, Bd. iv, S. 605.

[Kelling* has recently reported a case of periodical vomiting associated with diarrhœa and vasomotor disturbance which was hereditary; the patient was a woman, forty-two years old, whose grandmother and mother suffered in the same way. The attacks were brought on by emotional disturbances and were not relieved by any drug except morphine, which, however, only slightly delayed and lessened the attacks. The urine passed during the paroxysms was more acid and toxic than that passed afterward.]

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. Hanssen† describes a case of spastic stenosis which produced a palpable tumor at the pylorus the size of a thumb, and which disappeared under a soothing treatment.

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

---

* [Kelling. Zeitschr. für klin. Med., Bd. xxix, p. 421.—Ed.]

† Hanssen. Quoted in Virchow-Hirsch's Jahresber. für 1890, p. 241.

‡ Kussmaul. Volkmann's Sammlung klinische Vorträge, 1880, No. 181. [Also Boas, Deutsch. med. Wochenschr., October 17, 1889.—Ed.]

so well marked that it may readily be perceived through the relaxed abdominal parietes, and which may at times be accompanied by 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 reported by Desnos (Wiener med. Presse, 1891, No. 51, S. 1958). The case was that of a man who

persons stroking the finger nail rapidly and sharply across the epigastrium will produce distinct peristaltic movements.

Here we must also include the cases of **hyperkinesis of the stomach**—i. e., increased motor activity—which causes the chyme to pass on into the intestines too soon. In such cases the stomach is found absolutely empty one hour after the test breakfast, and water which is introduced through the tube returns practically without any fragments of the roll. The same is true of the larger test meals. This is usually associated with an increased secretion of HCl. Leo * and Weinert † have endeavored to construct a new disease out of these cases. Such cases I have seen and described years ago.‡ It is an open question whether the cause is only an increase in the motor functions and an abnormally rapid solution and absorption of the food, or whether it is due to an insufficiency of the pylorus.

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 Chapter 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 overexcitation of centers in the brain, then satiation must be considered an inhibition of hunger,

---

was found on the street in an epileptic attack; the saliva which flowed from the mouth was apparently mixed with fecal matter. Upon inquiry, the patient 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.—Ed.]

* Leo. Ueber Bulimie. Deutsch. med. Wochenschr., 1889.

† Weinert. Ein seltener Fall von Hyperkinese des Magens. Inaug. Dissert., Berlin, 1892.

‡ Ewald. Diseases of the Stomach. Translated by Manges, p. 435.

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 (or **anachlorhydria**) **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, page 498). I have also observed it in neurasthenics in whom there was no reason for suspecting an organic disease of the stomach. 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 after taking 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.

I have observed quite a number of similar cases of even longer duration, one of which which was of particular interest, I have published.* The following is another case which is also a good example of the relation between nervous dyspeptic conditions to the true psychoses (see page 499).

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 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."

---

* Ewald. Ein Fall chronischer Secretionsuntüchtigkeit des Magens. Berl. klin. Wochenschr., 1892, No. 26.

I have treated this gentleman a long time, and have tested his gastric juice for hydrochloric acid twenty-nine 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. Much 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. 27). 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?

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.

I have already given my opinion on the significance of the absence of free hydrochloric acid [p. 343 *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 508). 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], 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 ani-

* 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.

mals*; or even that "they had sinful intercourse with a cow." For a long time the opinion prevailed that these persons certainly had stomachs 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

---

* 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.

† 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.

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 substances 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

* 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. Deutsch. Archiv für klin. Med., Bd. xxxiii.

Ducasse. Mém. de l'Acad. royale de Toulouse, tome iii. Quoted by Schneider, *loc. cit.*

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 disease 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 second deglutition murmur "which, according to the generally accepted view of the origin of this murmur, can not be present when the cardia is paralyzed" [see footnote, p. 93]. 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 deglutition murmurs. 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. [Singer† believes that the relaxation of the cardia is due to the mechanical dilatation of the lower portion of the œsoph-

* K. Dehio. Ein Fall von Ruminatio humana. St. Petersburger med. Wochenschr., 1888, No. 1.

† [G. Singer. Deutsch. Archiv für klin. Med., Bd. l.—Ed.]

agus which results from swallowing too large morsels. This dilatation can be demonstrated with the œsophagoscope.] Unfortunately, in the patient who was able to swallow two live goldfish, respectively 6½ and 5½ centimetres [2⅗ and 2⅕ 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 cardia and œsophagus, since it is scarcely possible that the delicate fish could have been squeezed through the narrow passage alive. Decker reports five cases in which the stomach was repeatedly inflated; as the cardia was always found to be competent, the possibility of a permanent paralysis or paresis of the cardia is excluded.

The chemical processes in the stomach have been studied by Alt, Boas, Jürgensen, Sievers, Leva, Decker [and Runge].† The variable results obtained—all degrees of acidity, from hyperacidity to anacidity, were found—agree with the statement I made 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." This latter supposition has since been verified by Leva, who found all the various degrees of secretion of HCl in a ruminant.

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 cases 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

---

* K. Alt. Beiträge zur Lehre von Merycismus. Berl. klin. Wochenschr., 1888, Nos. 26 and 27.

† Alt, *loc. cit.*—Boas. Berl. klin. Wochenschr., 1888, No. 30.—Chr. Jürgensen. Ibid., No. 36.—Sievers. Finske Lakares Allskapt, 1889.—Leva, Münch. med. Wochenschr., 1890, Nos. 20, 21.—Decker. Ibid., 1892, No. 21.—Freyhan. Deutsch. med. Wochenschr., 1891, No. 41.—Einhorn. Medical Record, May 17, 1890.—[Runge. St. Louis Medical Review, August 18, 1894.—Ed.]

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 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

* 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.

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 occurrence. 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.

Atony of the stomach is an important neurosis to which sufficient attention has not yet been paid. 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 simply wish to distinctly state once more that I consider "atony" to include a disturbance of the gastric motor function only, not of

* Zeckendorf. Ueber die Pathogenese der Bauchtympanie. Dissertation, Göttingen, 1883.

its secretory; in other words, it is a lack of agreement between 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 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

---

* R. Freiherr v. Pfungen. Ueber Atonie des Magens. Klinische Zeit- und Streitfragen. Vienna, 1887.

† *Vide* Ewald. Klinik, etc., I. Theil, 3te Auflage, S. 78.

‡ *Loc. cit.*, p. 261.

is so closely associated with it; consequently, the muscular power of the remainder of the stomach can easily overcome the resistance of the "inert 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.

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

* Kussmaul. Deutsch. Arch. für klin. Med., Bd. vi, p. 470.

† Leube. Ueber nervöse Dyspepsie. Deutsch. Arch. für klin. Med., Bd. xxiii, 1879. Also Spec. Diagnostik der innerer Krankheiten. 3te Auflage, 1891, p. 265.

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. 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 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. Important discoveries of this kind have been reported by Jürgens, Blaschko, and Sasaki. 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." Inasmuch as severe forms of anæmia are also accompanied by gastro-intestinal symptoms which are unusually pronounced, especially

* Jürgens. Verhandlungen des iii. Congresses für innere Medicin, S. 253.

at the beginning of the disease, and may thus simulate nervous dyspepsia, the findings of Blaschko and Sasaki are of importance. In severe anæmias both of these observers have found marked degeneration of the nervous plexuses of the intestines, and at times also fatty degeneration of intestinal muscular layers and atrophy of the mucosa.

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.

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

* 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.

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 one 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 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. But we must not forget that the term "nervous dyspepsia" is so expressive and in such general use that it may safely be retained.

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.

The same is true of the *etiology*. Undoubtedly there are cases

---

* 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.

† Ewald. Verhandlungen des iii. Congresses für innere Medicin.

‡ E. Leyden. Ueber nervöse Dyspepsie. Berl. klin. Wochenschr., 1885, No. 30.

in which no cause can be discovered—Fenwick* claims this for the majority of his 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 conditions 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 pessimis-

* Fenwick. On Atrophy of the Stomach and on the Nervous Affections of the Digestive Organs. London, 1880.

tic, 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. A description by Freud * is quite typical, and agrees very well with my own experiences:

A patient, who was originally healthy, committed the usual sexual errors at puberty, overworked while a student, acquired a gonorrhœa, and was then suddenly attacked with dyspepsia accompanied by obstinate constipation. He was relieved of the latter after months, and then had oppression in the head; was moody, and unable to do any work; the character changed, he grew intensely egotistical, and finally became a great burden to his family.

Here we continually encounter fresh surprises and apparently the most wonderfully various moods of the stomach. Many patients can only retain ice-cold fluids, but at once vomit the same fluids if they are slightly warmed. Others have peculiar idiosyncrasies toward special articles of diet which cause them the most intense pain. Thus one of my patients, a young man eighteen years old, was completely absorbed in regulating the choice and quantity of his food:

About midday he became so weak that he could not eat, and the very thought of food caused palpitation and cold sweats. He continually had the sensation of a lump in his stomach. For days weakness compelled him to lie on the sofa. In the evening he ate (as he thought) too much. He was always constipated, and every cathartic made him feel very weak. He kept a voluminous diary about himself. As a youth masturbated a great deal, and overworked himself mentally. Was cured, although the condition had lasted a number of years.

---

* S. Freud. Ein Fall von hypnotischer Heilung, etc. Zeitschr. für Hypnotismus, 1892, Heft 3, p. 102.

I have already called attention to the fact, which I shall emphasize once more, that many of these patients gradually weaken themselves to such a degree by adhering too long to a rigorous diet which was necessary for a gastric catarrh, etc., but which was not discontinued at the proper time, that very energetic measures are necessary to restore the normal tone of the weakened nervous system.

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 the 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.

Leube‡ divides the cases of nervous dyspepsia into those with normal, excessive, and lessened secretion of HCl. I do not wish to argue with this distinguished clinician who was the first to direct attention to nervous dyspepsia, yet I would state that in so doing

* Richter. Ueber nervöse Dyspepsie und nervöse Enteropathie. Berliner klin. Wochenschr., 1882, No. 13.

† Leyden. Ueber periodisches Erbrechen (gastrische Krisen). Zeitschr. für klin. Med., Bd. iv, 1882.

‡ Leube. Spec. Diagnose der innerer Krankheiten. 3te Auflage, 1891, pp. 265 *et seq.*

he has become untrue to his original definition, the chief feature of which was this very absence of marked changes in the chemical functions of the stomach. It has therefore seemed proper to me to separate and classify as independent conditions or neuroses some of the cases which Leube includes under the head of "nervous dyspepsia."

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 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.

This is also true of R. Burkart's painful points in the abdomen,

which have already been described [page 494]. 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.

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. Of not infrequent occurrence are, however, the membranous, flattened, vermicelli-like or tubular masses, sometimes grayish white, at others brownish in color, which at times are passed in enormous quantities in the stools. This condition has incorrectly, I believe, been described as membranous enteritis and colitis, because these products have nothing to do with an inflammatory condition of the intestinal mucosa. On the contrary, as has also been shown by Kitagawa,† they consist of numer-

* Nothnagel. Beiträge zur Physiologie und Pathologie des Darmes, Berlin, 1884.

† Kitagawa. Beiträge zur Physiologie und Pathologie des Darmes. Berlin,

ous broken-down cells and brownish fragments and detritus, which are imbedded in a fibrinous and somewhat tenacious basement-substance, in which remnants of organized tissue can never be detected, but which, on the contrary, on adding acetic acid give the characteristic reaction of mucin. In all probability they are formed from an overproduction of intestinal mucus.

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 state that the initial stage of a neoplasm in the stomach may simulate a neurosis, and, on the other hand, that a chronic, distinctive process like phthisis or carcinoma may be diagnosticated where really only a neurosis exists. It may happen that a long time may be required before a positive diagnosis can be made.

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 other conditions. 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.

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 422, 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.

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

---

1884. [This subject has been carefully studied by Akerlund. Boas's Archiv, 1896, Bd. i, p. 396.—Ed.]

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 are cured in a relatively short space of time, while seemingly simple ones persist 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.

Possibly this is the best place to discuss a group of symptoms which, unlike nervous dyspepsia, is due to a distinct pathological cause; I refer to the condition described by Glénard as **enteroptosis** and **gastroptosis** [see p. 89].

In this condition, which I have studied very carefully,* there is a relaxation of the ligaments of the abdominal viscera, especially of the stomach, intestines, and the large abdominal glands, which allows these organs to descend, and thus produces changes in the circulation with their consequences. The clinical picture is well known to all; it consists of distinct dyspeptic disturbances combined with nervous symptoms which may arise sympathetically in the entire organism.

The digestive symptoms are disturbances of appetite, anorexia or false sensations of hunger, a sense of fulness in the epigastrium, belching, acid taste and dryness of the mouth, burning or shooting pains in the epigastrium after eating. Constipation alternating with so-called false diarrhœa is common, scybalæ, which are almost as hard as stone and frequently coated with mucus, being passed after severe straining and after taking strong purgatives or enemata; large fragments of membrane, as in membranous enteritis, are often observed. At the same time the abdomen, especially its lower por-

* Ewald. Ueber Enteroptose und Wanderniere. Berl. klin. Wochenschr., 1890, No. 13. A full bibliography is given in this paper.

tion, is somewhat distended; dragging pains and abundant flatus are complained of.

The general nervous symptoms include general weakness, changeable and depressed moods, headaches and fulness of the head, vertigo, heaviness of the limbs, the hands and feet feel cold, palpitation, disturbance of sleep and frequent pains in the back which are referred to definite localities. Further general symptoms are emaciation, rapid loss of weight, pallor, falling out of hair, eczema, and the like. The loss of weight may at times be so marked that the patient or his friends fear cancer or malignant diseases. [On the other hand, there are many cases of gastroptosis which give rise to no clinical symptoms. When symptoms are present, they need not always be constant but may occur in paroxysms. Chlorosis is said by Meinert to be a constant symptom of this condition; indeed, he maintains that gastroptosis is the chief cause of chlorosis in women (see p. 571).]

On examination we find a more or less marked mobility or displacement of the kidneys, sometimes of the liver, and downward displacement of the stomach, i. e., gastroptosis, a symptom which may readily be demonstrated. If the stomach be distended by means of the methods described on page 85, it will project on the anterior wall like an air cushion so that the upper border may be seen in the middle line a little above the umbilicus, the lower border being between the latter and the symphysis. Besides this there is also usually a dislocation of the liver and transverse colon, while the small intestines sink deeply into the pelvis.

Arguing from a theory which need not now be discussed, because it has no sufficient pathological basis and because it is not verified by clinical observations, Glénard * assumed that these various displacements were caused by a bending of the transverse colon near the ligamentum colico-hepaticum. As the result of this the colon, lying to the other [left] side of this place, collapses and becomes contracted into a sausagelike mass which can be felt extending from the left to the right. Glénard lays great stress on this symptom,

* Glénard. De l'Enteroptose. Paris, 1885, and numerous articles and theses by Trastour, Féréol, Cuilleret, Chéron, Raoult, Blanc-Champagnoe, Ott, Meinert, Chlapowski, etc.

which he calls the *corde oblique*. As the result of this the mesenteries become relaxed so that the small intestines sink into the pelvis and drag down the stomach, kidneys, and sometimes even the liver itself. However, my own experience is that in the majority of cases the contracted colon can not be palpated; on the contrary, what is

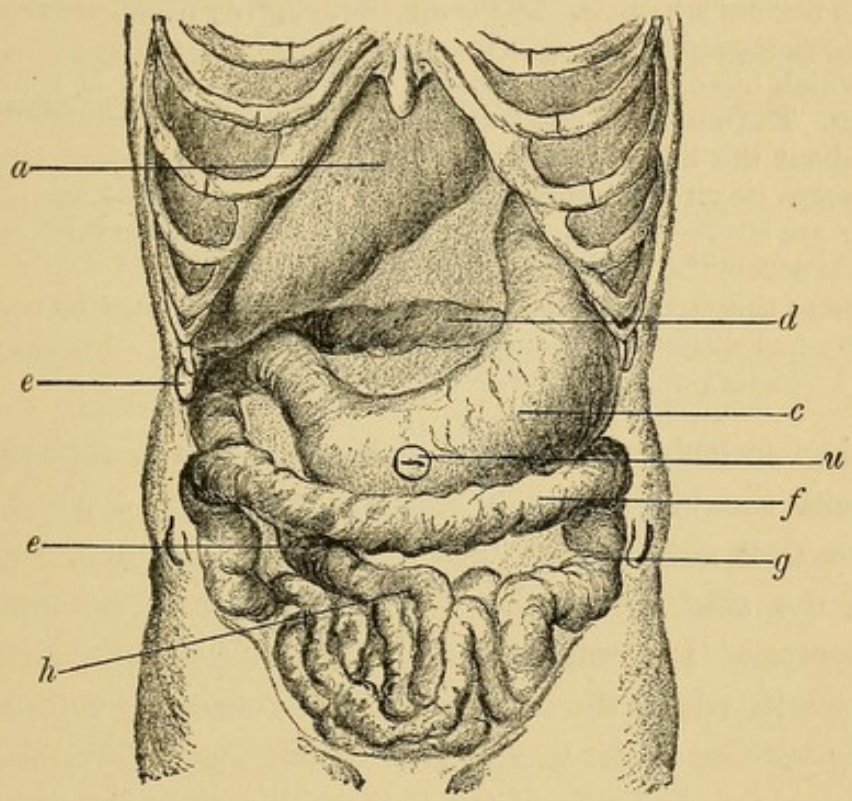


FIG. 46.—Sketch of positions of abdominal viscera in splanchnoptosis. *a*, liver; *c*, stomach; *d*, pancreas; *e*, *e*, duodenum; *f*, transverse colon; *g*, descending colon; *h*, small intestines; *u*, umbilicus.

felt is the pancreas, the horizontal portion of which, as is shown in the accompanying sketch (Fig. 46), can be felt above the lesser curvature because it is now no longer covered by the stomach, as occurs under normal conditions.

I shall cite the following instructive case to demonstrate these relations. It, together with the sketch (Fig. 46), is taken from a dissertation by Poltowicz,* of Prof. Roux's clinic in Lausanne. The sketch is of especial value because it is drawn from the condition found at a laparotomy.

The patient was a fifty-year-old woman who gradually became ill with dyspeptic symptoms accompanied by vomiting (at times it was black and

* Poltowicz. Contribution a l'étude de la maladie de Glénard, etc. Inaug. Diss. Lausanne, 1892.

once consisted of two tablespoonfuls of blood), obstinate constipation, and marked emaciation. Dislocation and dilatation of the stomach could be made out, but no tumor was palpable; but as a neoplasm was suspected, after a time an exploratory laparotomy was performed. The operation must have been very "thorough" as the following report will show: "The liver is completely dislocated and is somewhat rotated on its axis, so that the gall bladder lies in the axillary line. The right kidney lies below the liver in its normal situation. The stomach is slightly filled, has thin walls, is but little distended in the pyloric region, but is enormously dilated at the fundus, which has sunk down into the pelvis. The same is true of the duodenum. The omentum and small intestines are in the pelvis. The pancreas is about the lesser curvature. Nothing but the mesentery and abdominal aorta lie on the lumbar vertebræ. The transverse and descending colon are strongly contracted, the former being in the form of a cord which runs across the abdomen below the umbilicus."

In spite of this somewhat extensive laparotomy, as must be confessed, the patient was discharged "cured" at the end of five weeks, and was reported to be feeling well and having a good appetite.

It is inconceivable how simple manipulation, etc., of the abdominal viscera should cure such marked symptoms, a point which the writer does not discuss. The description, however, which he gives of the situation of the viscera is an excellent picture of splanchnoptosis. I myself have observed a similar very typical case in a corpse in which the kidneys were also movable and in which absolutely nothing in the way of old inflammatory adhesions could be discovered; I shall refrain from describing it, as the above case will suffice. Meinert* has photographed a number of typical cases of gastroptosis; Krez,† of Leube's clinic, has also published a typical case with a detailed account of the autopsy; the interesting feature of the case was that the pancreas was palpated during life, as described above, and the finding was corroborated at the autopsy.

The fact that such displacements of the intestines may possibly occur even during fœtal life, or may be predisposed to during childhood, can not be denied;‡ yet in this connection we must distinguish two classes of cases:

---

* Meinert. Dresdener Jahresbücher, 1891–'92. [A large number of photographs of cases of gastroptosis will be found in Meinert's monograph. Volkmann's klinische Vorträge, Nos. 115 and 116, January, 1895.—Ed.]

† L. Krez. Zur Frage der Enteroptose. Münch. med. Wochenschr., 1892., No. 34.

‡ [Thus, according to Meinert, a long and narrow thorax predisposes phthisical patients to splanchnoptosis. Rickets also predisposes even young children. See Figs. 10–14 in Meinert, *loc. cit.*—Ed.]

1. This group includes those cases in which the displacement of the viscera is the demonstrable result of antecedent inflammatory processes, especially such as proceed from the genital organs in women. Such conditions have formerly been repeatedly described, and Virchow, in discussing my paper on enteroptosis, stated that these changes were known long ago. It was equally well known that such conditions could be followed by the above-mentioned subjective symptoms to a greater or less degree. But the disorder does not consist so much in an exclusive downward displacement of these viscera, as it does in the distortion and displacements which may at times also lead to the sinking down of the organs.

2. However, splanchnoptosis as regarded by Glénard and myself has nothing to do with these cases; it includes a group of cases which are entirely independent. In the dislocations after old inflammatory processes, only isolated coils of intestines or organs are involved, but in Glénard's disease, as splanchnoptosis is sometimes called, there is a general descent of all the abdominal organs above mentioned, and in the histories of these cases there is absolutely no reference to any such antecedent inflammation. If any etiological factors can be discovered at all, they will be severe bodily exertion, concussion of the abdominal viscera, protracted and frequent labors, tight lacing, and, finally, antecedent prolonged dyspepsias which have occasioned the enteroptosis as the result of the change in the pressure and tension. Thus enteroptosis may cause dyspepsia or *vice versa.*

Enteroptosis occurs far more frequently in women than in men. In Glénard's 404 cases, 306 were women. [Tight lacing and pregnancy are the chief causes of this great difference in the two sexes.]

I would not be understood as having stated that only true enteroptosis can lead to the above-mentioned symptoms. For the secondary displacements of the abdominal viscera, and especially of the stomach and intestines, may give rise to exactly similar clinical pictures, in which it is natural that the chief place should be occupied by the primary causal factor.

Concerning the relation between floating kidney and dilatation of the stomach, I would refer to what has already been said on page 275.

Here it will suffice to say that the existence of gastroptosis and enteroptosis has now been corroborated by many writers,* and that the simple method of distending the stomach and intestines, combined with palpation of the abdominal organs, have enabled us to isolate from the great mass of cases of nervous dyspepsia a group of cases in which palpable anatomical changes which can be demonstrated during life are the causal factors. In discussing the treatment, I shall be able to show that we are now able to treat these conditions better than formerly.

[On the other hand, many cases of gastroptosis exist which give absolutely no symptoms at all; but if, however, for some reason or another, the general health is impaired, the compensation which has been established will be disturbed and the examination will then reveal the displacement of the viscera.]

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 of a more chronic nature. 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 plex-

---

* Ott. Ueber die Glénard'sche Krankheit. Prager med. Wochenschr., 1892, No. 46. and the works already quoted. [This subject is fully discussed in the recent monographs of Meinert, *op. cit.*; Kelling, Volkmann's klin. Vorträge, No. 144, February, 1896; Fleiner, Ueber die Beziehung der Form und Lageänderung des Magens. Münch. med. Wochenschr., 1895, Nos. 42–45.—Ed.]

uses, 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-apparatus. 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.* 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 seasickness, 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

---

* Quoted by Budd, *loc. cit.*

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 disorder 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 in 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

* F. Kretschy. Beobachtungen und Versuche an einer Magenfistelkranken. Deutsches Archiv für klin. Med., Bd. xviii, 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. civ.

H. Kisch. Dyspepsia uterina. Berl. klin. Wochenschr., 1883, No. 18.

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 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.

Reflex gastric neuroses from the generative organs occur in men as well as in women, a relation which occurs much more commonly than is usually supposed. I have already referred to the effects of sexual errors (onanism, sexual perversion, and excesses). At present I refer to local affections, such as chronic urethritis, urethral strictures, spermatorrhœa, pollutions, etc., with reflex gastric neuroses. These include any of the conditions already described, i. e., gastralgia, vomiting, eructation, cramps, bulimia, gastrosucchorea, etc.; but far more frequent than any of these is nervous dyspepsia. In these cases the relation between the genital lesion and the gastric symptoms is established by the fact that after the treatment and cure of the former, the latter often—but, alas! not always—disappear. In the course of months I have seen quite a number of these cases, but, as I have already hinted, the relief of the gastric trouble by no means always follows the cure of the local disease, as might easily

be inferred from the excellent monograph of Peyer;* on the contrary, the gastric neurosis may persist long after the disappearance of the local disease.

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 brickburners.† 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 tapeworm!

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 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 hypoder-

* A. Peyer. Ueber Magenaffectionen bei männlichen Genitalleiden. Volkmann's Samml. klin. Vorträge, No. 356.

† [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 brickburner's anæmia.—Ed.]

mic 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. ½ to ⅚] each, or 0·1 to 0·15 [gr. j½ to ij¼] 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. ⅚ 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 hysterial 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 j¼–ijss.]
Aquæ amygdalæ amaræ	25·0	[f ʒ vj¼]

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. 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.

℞ Codein phosphatis ..... 0·2 [gr. iij]
Pulv. rad. ipecacuanhæ..... 0·5 [gr. vijss.]
Bismuth subnitratis..... 10·0 [℥ijss.]
Natrii bicarbonatis,
Sacchari albi.....āā 15·0 [℥ss]
M. Sig.: One teaspoonful every two hours.

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 tablespoonful at intervals during the day. H. Hirschberg claims that cane sugar in large doses (40 to 50 grammes [℥ j$\frac{1}{8}$–℥ j$\frac{2}{8}$] dissolved in water) has temporary analgesic properties.

Rosenthal, Leube, Vizioli, and Rosenbach have repeatedly observed the lessening and even disappearance of gastralgias by the anodal action of the constant current. [Einhorn* has called especial attention to the value of intragastric galvanization in gastralgia. This method has also given me excellent results. The intragastric electrode is the anode, the current strength being about 8 to 15 milliampères. The sittings last 5 to 10 minutes, and are daily at first, the intervals being made longer as the pain abates.] 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† (see p. 99). 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 stomach douche in the following conclusions, although in the case quoted below only the last

---

* *Loc. cit.*

† 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.

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:

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.

Recently, Rosenheim has also given several examples of this kind (see page 7). Cases have also been reported by Everett,* in which incessant pains were relieved by lavage of the stomach. I myself have also reported similar cases. Undoubtedly, as in electrical treatment, a large part of the good effect is due to suggestion.

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 hy-

* Everett. New York Medical Record, 1891, No. 25.

† Oser. Wiener Klinik, 1875, S. 257.

pochondriacs. 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 compresses upon the epigastrium, either in the form of the simple Neptune's girdle or sedative cataplasms of chamomile, valerian, etc.

The bromides are the most important of the agents which act centrally; we may use either the salts of potassium, sodium, ammonium [or strontium], 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, the 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 the 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. In several cases in which I employed this remedy no special benefit was obtained.

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—also of caffeine chloral and of nitroglycerin, which Talma valued so highly. The former have more of a general action on the exhausted nervous system, and are at the same time cardiac. In chloral caffeine the sedative and analgesic effect of the chloral is marked; it also has the advantage of being suitable for subcutaneous use. I have discarded nitroglycerin on account of the frequent oc-

currence of unpleasant after effects, headaches, and vascular excitation. It may be used in doses of 0·5 milligramme [gr. $\frac{1}{120}$] in oil or in tablets.

In nearly all 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 most frequently, yet now, in accordance with Liebreich's recommendation, I employ arsenous acid almost exclusively, either in solution :

℞ Acidi arsenosi..... 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 arsenosi..... 0·075 [gr. j$\frac{1}{4}$]
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. $\frac{1}{6}$ to $\frac{1}{4}$] per day—without any bad effects. [Sawyer* has also highly commended the use of arsenic in gastralgia ; he prefers to use it in pills of arsenous acid, gr. $\frac{1}{24}$, with 2 to 3 grains of extract of gentian, three times daily between meals.]

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

* [Sawyer. London Lancet, July 4, 1896.—Ed.]

hour after the midday meal, and gradually increase up to two to three tablespoonfuls (see page 438).

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 [0·55]
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 cool sitz-

* [Other organic iron preparations are also useful; they may be given alone or in combination with Fowler's solution, detannated 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.—Ed.]

† [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

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.

At this place I wish to add a few words about the *treatment of gastroptosis and enteroptosis*. The object of the treatment is twofold, mechanical on the one hand and medicinal and dietetic on the other. The former indication is met by means of a properly constructed support which will lift up and hold the displaced organs in place. According to Glénard, the indication for such supports is given by the immediate cessation of the symptoms and a decided feeling of relief which follow when the abdominal viscera are lifted up even momentarily. This is accomplished by standing behind the patient, grasping the abdomen with both hands, and exerting pressure from below upward and inward. This often occurs, and is especially marked in cases of pendulous abdomens, but it may also be observed in others who are not stout. For the latter it is often difficult to obtain a comfortable support, because as the result of their leanness the abdomen is usually sunken in while the pelvic bones are very protuberant. Kuttner and myself have devised a supporter which consists of a slightly curved tin shield, the size of which varies according to that of the abdomen; this is padded heavily in such a way that the thickness diminishes from below upward. This truss is retained by means of suitable springs and thigh and abdominal strips; the lower border is about two centimeters [0·8 inch] above the symphysis pubis, the sides the same distance from the iliac crests, the pressure being exerted obliquely

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 the skin. Thus, it is a powerful adjuvant to electricity and massage of the abdomen. Ziemssen, Klinische Vorträge, No. xii, 1888.—Ed.]

from below upward. The tension of the abdominal walls is increased, and thus the peristalsis of the stomach and intestines is rendered easier by the increased support which is thus afforded to them. We can thus easily explain the surprising improvement which is often seen after wearing such supporters; a good proof of this is the fact that the patients never do without them, for as soon as they do so the old symptoms return. [Treves * has recently reported the complete cure of a very severe case of gastroptosis by laparotomy and stitching the stomach.]

In the way of drugs, we may use mild vegetable aperients and the neutral salts [*Mittelsalze*] to secure proper evacuation of the bowels, and as intestinal disinfectants, creosote, benzo-naphthol, and bismuth salicylate. Furthermore, we may employ the general tonic, dietetic, and gymnastic measures and electricity, all of which have already been discussed.

By means of these measures excellent results may frequently be obtained in suitable cases.

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*

* [Treves. British Med. Journal, January 4, 1896, p. 1.—Ed.]

from his family and keep him at a sanitarium. I must confess that I did not formerly lay as much stress on treatment in a sanitarium as I do now, after having had a much more extended experience. This is not alone true in cases of the rest-cure, but also in many other neuroses, which offer far greater chances for cure when they are under the direct care of the physician and are removed from the disturbing influences of home life. I therefore insist more and more upon treating these cases away from home. I also lay stress upon the cure being supervised or carried out by only one physician. Two doctors, no matter how well they harmonize, may in giving orders easily disagree on trivial details which, however, appear to be very important to the anxious and distrustful patient, and may thus occasion doubts and uncertainty. It is just in this class of cases that absolutely consistent, certain, and unerring lines of treatment are essential.

The object of the dietetic measures is to overfeed the patient—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.

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 2¾ 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, heartburn, 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. As an example, I may mention a case 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 grains]. At first she received as food 114·42 grammes [1765 grains] of albumen, which was gradually increased in four weeks to 195·77 grammes [3020 grains]. She was kept isolated from December 5th to January 26th; on that day the conversion of albumen was 124·06 grammes [1914 grains]—i. e., a gain of 71·71 grammes [1106 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.

The important factors which have already been mentioned above, and which have also been emphasized in the various pub-

lications 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. Nevertheless, I adhere to what I have already said about the great advantage of treatment in sanitaria. But one must not imagine that all the rest-cures, even in sanitaria, run so smoothly and favorably as the case above mentioned. Many patients, in spite of the best intentions, are unable to take the amount of food prescribed; for they either vomit it or they may even be unable to swallow solids. In such cases peptone enemeta also are of no avail, and it is often a riddle how and from what the patients manage to survive. Treatment by suggestion (see page 561) I have always found useless. Other patients look strong, have good complexions, and gain correspondingly in weight; and yet in spite of all this they have the same lack of physical and mental strength as before. One of my patients reported as follows: "Every mental relation, for example, the writing of this letter, is a very severe exertion, and walking is a torture to me on account of the weakness of my spine." Others keep up by using all their energies, but, nevertheless, make no real progress. Another patient wrote to me: "Your orders that I should not yield to the moods of my stomach are my best aid. I force myself to eat, and eat my beefsteak with resignation and shudders, in order to keep up my strength until I shall feel better." *

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

* [For further details, see Weir Mitchell, Fat and Blood; J. M. Mitchell, Hare's System of Therapeutics, vol. i, p. 227; Thompson's Dietetics, p. 578.—Ed.]

stationary condition of the weight according to the axiom, "Stand-still 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 3⅓ 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 ought always to be employed in all kinds of stomach diseases, but especially in the neuroses.* 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 seashore, 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

* See Transactions of the Naturforscherversammlung zu Berlin, 1887.

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, 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 in 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.

To-day it is impossible to conclude the treatment of neuroses without reference to *suggestion therapy*. Among the strict adherents of this method I have the reputation of being an outspoken antagonist because I endeavored years ago to estimate the procedures at their true value, and therefore was led to deny to hypnotism and suggestion the qualities of remedial agents as understood in scientific medicine. I did this because their successful application demand the active coöperation of the patient to a far greater degree than is usually required in prescribing a remedy, and, furthermore, because we all make more or less use of psychotherapy without the procedures of hypnosis and suggestion. I have never denied that occasionally, after an unusual expenditure of such psychical influences, we may obtain unusual effects, but such effects are usually only of transitory duration. Nevertheless, I have employed suggestion in so many cases, either trying it myself or with a competent "hypnotiseur," that I have formed a practical opinion. This is, that just in the cases of severe hysteria in which we have the greatest need of suggestion we are left in the lurch, as is also admitted by Binswanger,* after a very large experience, because hysterical subjects can only be suggested insufficiently or not at all. At

* Binswanger. Congress für innere Medicin, Leipzig, 1892.

times they apparently can be brought into the first stages of hypnosis, but, as may easily be ascertained by careful observation, they never relinquish their own wills, the autonomy of their minds does not cease, and the suggestion fails to accomplish its object. In other nervous patients, however, without resorting to hypnosis we can succeed, with the good will of the patient, by employing that part of suggestion which consists in energetic and firm action, and may thus dispense with this procedure, which always is scarcely edifying to an earnest man. Still, I will not deny that occasionally suggestive influences may be of value; but, as I have already said, these results are not permanent in the majority of cases, and then, as I have also observed, a second and third suggestion no longer produces any effect.

CHAPTER XII.

THE CORRELATION OF THE DISEASES OF THE STOMACH TO THOSE OF OTHER ORGANS.—THE PRACTICAL VALUE OF THE MODERN CHEMICAL TESTS.

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, my present aim is not to discuss 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 pernicious anæmia, and also of carcinomatous tumors of other organs,

* W. Fenwick. Ueber den Zusammenhang einiger krankhafter Zustände des Magens mit anderen Organerkrankungen. Virchow's Archiv, 1889, Bd. cxviii, S. 187.

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, 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 be discussed.

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 11 out of 15 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 succeed in finding a few tubercle bacilli, and thus at once corroborate our diag-

* B. Marfan. Troubles et lésions gastriques dans la phthisie poulmonaire. Paris, 1887.

nosis. 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, which are based upon 64 cases, give an approximate and not an absolute idea of the relative frequency of the conditions under discussion. After careful study, with reliable methods, Grusdew◊ and Bernstein‡ also

---

* 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.

◊ [Grusdew. Wratsch, 1889, Nos. 15, 16. Centralblatt für klin. Med., 1890, S. 92.—Ed.]

‡ Iwan Bernstein. Die Dyspepsie der Phthisiker. Inaug. Dissert. Dorpat, 1889.

come to the conclusion that "hydrochloric acid is either absent or reduced to very small quantities."

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 81), 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.

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 began; 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. 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.

[Fenwick* has made a very careful study of the condition of the stomach in pulmonary phthisis. He distinguishes a prodromal, initial and final dyspepsia of phthisis, and has presented data concerning the forms as he found them in an analysis of a large number of cases. The prodromal dyspepsia he subdivides into the atonic and irritable varieties, the former occurring usually in young females from thirteen to twenty-five years of age, the latter in men from twenty-five to forty years old. The atonic form usually follows convalescence from some acute febrile disorder, or may begin insidiously. The difference in the symptoms in the two groups is sufficiently expressed by their names.

The initial dyspepsia is that which ushers in and accompanies the first stage of pulmonary phthisis, and is that which is usually known as the dyspepsia of phthisis. It seems to be much more common in women than in men. Pain is a very constant feature, since it was noted in 92 per cent of the cases; vomiting also occurs frequently; the appetite is distended, especially toward evening. There is a marked repugnance toward fat. Other symptoms are flatulence, acidity, constipation, large, flabby, indented tongue, and profound anæmia. The symptoms stand in a direct relation to the condition of the lungs, and may even be arrested if the pulmonary disease is cured.

The final dyspepsia is that which occurs after the formation of

* [W. Soltan Fenwick. The Dyspepsia of Phthisis, its Varieties and Treatment. London, 1894.—Ed.]

cavities in the lungs. Here also women seem to be more frequently attacked, the ratio being 62 per cent in women, 25 per cent in men. The chief symptoms are anorexia, thirst, painful sensations in the epigastrium, and nausea. Vomiting and flatulance are not constant as in the other forms. The bowels are irregular.

Fenwick lays great stress on the fact that the stomach is not alone involved, but the entire intestinal tract as well. It is really a gastro-enteritis which begins in the chronic interstitial form, which is due to the absorption of certain toxic substances. Later on the glands are also involved. This condition can always be demonstrated after cavities have been formed in the lungs. For further details, this excellent monograph may be consulted. For tubercular ulcers of stomach, see pages 401 and 418].

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. [Osswald # has recently examined 21 chlorotic patients; free HCl was present, usually in excess; at times the percentage was as high as 160. The motor functions were normal]. 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 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

---

* Hayem. Des altérations du chimisme stomacal dans la chlorose. Bulletin médic., 1891, No. 87.

† Buczlygan 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. Wochenschr., 1891, No. 50.

[Osswald. Ueber den Salzsäuregehalt des Magensaftes bei Chlorose. Münch. med. Wochenschr., 1894, No. 27.—Ed.]

has been improved by appropriate treatment. The histories of many patients attest the truth of this.

[Meinert * maintains that many cases of chlorosis are due to gastroptosis. He does not include all young women with chlorosis, as has been generally supposed, but only such girls who up to the time of puberty had been apparently in good health. In all of these cases Meinert states that inflation of the stomach has always demonstrated the presence of gastroptosis. The prolapse of the stomach produces a stretching of the gastric nerves, which in turn irritates the solar plexus. The latter giving off sympathetic branches to the spleen, may disturb the blood formation which occurs in the latter organ. The most fruitful cause of gastroptosis is tight lacing. Meinert's monograph is most elaborate, and contains many typical examples of this condition.

This subject has been studied by Kelling,† Brüggemann,‡ and Meltzing,# all of whom agree that Meinert is too sweeping in his assertions, and that gastroptosis is not present in all cases of "typical chlorosis," as described by him. They agree, however, that downward displacement of the stomach is of frequent occurrence in chlorosis, and seems to be found more frequently in these subjects than in non-chlorotic girls.]

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.

---

* [Meinert. Volkmann's klinische Vorträge, Nos. 115 and 116, January, 1895.—Ed.]

† [Kelling. Ibid., No. 144, February, 1896.—Ed.]

‡ [Brüggemann. Ueber den Tiefstand des Magens bei Chlorose. Inaug. Dissert. Bonn, 1895.—Ed.]

[Meltzing. Wiener med. Presse, 1895, No. 30.—Ed.]

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 10 cases of the above kinds, mostly valvular lesions, total absence of hydrochloric acid and almost negative digestion of albumen were found 9 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. I also have had a patient with mitral insufficiency at the Augusta Hospital, the acidity of whose stomach contents was 62; the acidity was entirely due to HCl.

But it appears that insufficiency of the gastric secretion is not as constant as Hüfler supposed; for, in 20 patients with heart disease, Adler and Stern† found that free hydrochloric acid was always present in 16, variable in 2, and always absent in 2 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 intes-

---

* Hüfler. Ueber die Functionen des Magens bei Herzfehlern. Münch. med. Wochenschr., 1889, No. 33.

† Adler and Stern. Ueber die Magenverdauung bei Herzfehlern. Berl. klin. Wochenschr., 1889, No. 49.

tines, 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 me ‡ in recommending peptonized milk in these cases.

[Zipkin # and Alapy ‖ have recently studied the condition of the stomach in renal diseases. The former found no constant relation between the two organs; Alapy, on the contrary, asserts that the results of treatment show that the stomach suffers in chronic nephritis, probably through the excretion of the retained nitrogenous substances through the gastric mucosa. He therefore advises the examination of the urine of all patients over fifty years of age with chronic gastric symptoms.]

Renal tumors, especially carcinoma of 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

---

* 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.

[Zipkin. Ueber das Verhalten des Magenverdauung bei Nephritis. Inaug. Dissert. Würzburg, 1894.—Ed.]

‖ [Alapy. Verdauungstörungen bei der chronischen Harnretention. Wiener klinik, 1894. No. 9.—Ed.]

^ Colleville. Progr. méd., 1883, No. 20.

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 been considered while discussing gastroptosis, gastrectasis, and gastralgia.

The liver stands in such close relationship to the stomach [as has already been discussed in Chapter IV] 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-evident 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.

[A case has recently come under my observation in which gastralgic attacks existed for eight years before the real nature of the disease was discovered. At present the symptoms of tabes are absence of patellar reflexes, Argyll-Robinson pupils, Romberg's symptom, occasional shooting pains in the lower extremities, and attacks of severe gastralgia, which come on at varying intervals and last from a few hours to a few days. Repeated examination of the stomach contents shows normal conditions in the intervals between the attacks, but during them there is marked subacidity. For a long time the only other symptom present was the myosis, which caused her to be unjustly regarded as a morphinist.

Wolff† has also carefully described three cases of tabes which had been under his observation for a long time, in which the gastric crises were not alone the initial but also were the most prominent symptoms throughout the disease. At all times, both during and between the attacks, he found either lessening or absence of HCl.]

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,

---

* G. Werner. Gastrische Krisen als Initialsymptom einer Tabes dorsalis. Inaug. Dissert. Berlin, 1889.

† [L. Wolff. Abstract in Boas's Arch., Bd. i, p. 110.—Ed.]

either accidentally or on account of the development of the specific symptoms of emaciation, pruritus, etc. [Gastric crises, which are at times very painful, have also been reported in this disease.*]

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 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

---

* [Leube. Münch. med. Wochenschr., 1895, No. 7.—Ed.]

† Rosenstein. Berlin. klin. Wochenschr., 1890, No. 13.

‡ Edg. Gans. Ueber das Verhalten der Magenfunctionen beim Diabetes mellitus IX. Congress für innere Medicin. Vienna, 1890.

Burney Yeo. On the Treatment of the Gouty Constitution. British Med. Journal, January 7 and 14, 1888.

‖ Pidoux. Rapport d l'herpétisme et des dyspepsies. Union méd., 1886, No. 1.

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 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. The routine use of the thermometer will occasionally aid in recognizing these cases. In the treatment, Warburg's tincture will be found to be especially useful.]

Conclusion.—The Practical Value of the Modern Chemical Tests.—In the course of this book 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 absolute 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

* Leube. Beiträge zur Diagnostik der Magenkrankheiten. Deutsch. Archiv. für klin. Med., Bd. xxxiii.

† Glax. Ueber die Neurosen des Magens. Vienna, 1887, S. 206.

‡ *Loc. cit.*

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? It is known 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 may regret 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 gastric 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. 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 ferments 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.

It has always been my belief, as I have stated in the earlier editions of this book that 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]. We must also add other chronic enfeebling morbid processes which may cause the disappearance of HCl, such as profound anæmia, tuberculosis, cardiac diseases, diabetes, etc.

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 (hyper-

chlorhydria); 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.

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,* and as has since been corroborated by Salkowski, Rosenheim, and others, 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 all 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 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 it will have been 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

---

* C. A. Ewald. Ueber den "Coefficient de partage" und über das Vorkommen von Milchsäure und Leucin im Magen. Virchow's Archiv, Bd. xc, S. 349.

duty to warn against a one-sided overestimation of their value. As I have already stated in Chapter I, time has since shown the correctness of my views. We have gradually sailed into smoother waters; indeed, a reaction has already set in, so that the results of the chemical examinations are even valued less than they ought to be. This negative view is just as erroneous as the one-sided overvaluation of these methods. 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 today the old saying is true that—

"Ubi ratio sine experimentis mendax,
Ita experientia sine ratione fallax."

INDEX.

Abelous, 187.
Abercrombie, 127, 402.
Abscess of stomach, 181.
Absorption in stomach, 60, 75, 455; character of, 75; test of, 75.
Achlorhydria, 24, 26. See Hydrochloric Acid, Absence of.
Achylia gastrica, 205, 221.
Acid, acetic, tests for, 44.
  butyric, tests for, 44.
  hydrochloric. See Hydrochloric Acid.
  lactic, in stomach contents, 27, 29; in cancer, 30, 351; fermentation–, 41; meat–, 41; quantitative estimation of, 54; tests for, 29, 30, 41, 44, 55; varieties of, 41.
  salicyluric, test of, in urine, 79.
  sarcolactic, 41.
Acid salts, 25; quantitative estimation of, 55; tests for, 34.
Acidity of gastric juice, cause of, 27; variations of, 24, 580; determination of, 24.
  of stomach contents, 25; stages of, 25 testing of, 30, 47.
  percentage of, 34.
  total, tests for, 31.
  quantitative determination of, 46.
Acids, fatty, in stomach contents, 44; tests for, 44.
  free, tests for, 34.
  organic, in stomach, 44, 578; tests for, 40.
  See also Contents of Stomach.
Acoria, 517.
Adamkiewicz, 320.
Adenopathies in gastric cancer, 329.
Adler, 572.
Agoraphobia in chronic gastritis, 216.
  in gastric neuroses, 476.
Air, distention of stomach with, 85, 87.
Akerlund, 538.
Akinesis of stomach, 276.
Alapy, 573.
Albertoni, 375.
Alberts, J. E., 315, 317, 318, 320.
Albu, 159.
Albumen, digestion of, 60.
  disks, 65.
  putrefaction of, in stomach, 288.
  reaction on aniline dyes, 36.
  reactions of, 60, 61.
Albumoses, 60.
Albutt, 261, 291.
Alcohol in contents of stomach, 44.
Alderson, 4.
Alimentation, rectal, 150, 434, 436.
Alt, 500, 525.
Anachlorhydria, 26, 518. See also Hydrochloric Acid, Absence of.
Anacidity of gastric juice, 24, 343, 579.
  nervous, 518.
  See Hydrochloric Acid, Absence of.
Anadenia of stomach, 203, 217; diagnosis, 221; from cancer, 223; lavage in, 223; pathology, 199; relation to pernicious anæmia, 220, 563; stomach contents in, 222; treatment, 224.
Anæmia, condition of stomach in, 570.
  pernicious, condition of stomach in, 220, 563.
Anæsthesia of skin in gastric ulcer, 405.
  of stomach, 517.
Andeer, 233.
Andral, 181, 276, 281, 317, 328, 417, 545, 564.
Aniline dyes in stomach analyses, 35.
  objections to, 36.
Anorexia, 484.
  in cancer of stomach, 331.
  in catarrh, 172.
  in dilatation, 282.
  in phlegmon, 183.

Anorexia in tumors of kidney, 573.
in tuberculosis, 487, 564.
in ulcer of stomach, 403.
nervous, 484.
Antiperistaltic unrest of stomach, 516.
Antrum pylori, 91.
Apepsia, 192.
Appetite, 470.
in gastric cancer, 331.
lack of. See Anorexia.
perverse, 483.
ravenous, 482. See Bulimia.
Ardor ventriculi, 209.
Aretæus, 478.
Arnold, 522.
Arnott, 4.
Asiatic pills, 553.
Asp, 216.
Aspirator, stomach, 12; Boas's, 13.
Asthenia of stomach, 276.
Asthma, dyspeptic, 215, 510.
Atony of stomach, 192, 527.
in chronic gastritis, 211.
in dilatation, 276.
Atrophy of stomach. See Anadenia.
of muscularis of stomach, 203.
Audhui, 262.
Auerbach's plexus, 453, 459.
Aura vertiginosa, 216.
Autenrieth, 314.
Autointoxication, intestinal, 159.
Autoscope, Kirstein's, 125.

Bacillus coli communis in stomach contents, 46.
Bacillus gastricus, 185.
Bacteria in acute gastritis, 166.
in gastric cancer, 75, 331, 333.
in gastric phlegmon, 181.
in gastric ulcer, 390.
Bamberger, 255, 277, 345.
Baraduc, 104.
Barbacci, 401.
Barbei, 320.
Barlow, 401.
Barnes, 117.
Barras, 473, 478, 513.
Barry, Du, 284.
Bartels, 220, 275.
Basch, Von, 216.
Bastianelli, 461.
Battistini, 233.
Baum, 305.
Beatson, 161.
Beau, 330, 473.
Beaumont, 164, 240, 383.
Beck, 413.
Becker, 384.
Behrens, 87.
Belching, nervous, 508.
Belladonna in cancer of stomach, 370.
Benecke, 560.
Benedict, 102.
Bennet, 446.
Bernstein, 216, 566.
Berrez, 115.
Berthold, 392.
Best, 376.
Betz, 45, 288.
Bial, 187, 352.
Bianchi, 263.
Bidder, 49, 53.
Biedert, 57.
Billroth, 306.
Biernacki, 73, 573.
Bile, cause of chronic gastritis, 208.
in stomach contents, 73.
taste of, 172.
test for, 73.
Binswanger, 556, 561.
Birchner, 307.
Bird, Golding, 344, 347.
Birsch-Hirschfeld, 393.
Bismuth in gastric ulcer, 439.
Bitters, 229.
Biuret reaction, 60.
Blaschko, 218, 530, 531.
Blass, 31, 32.
Blatin, 4.
Blondeau, 216.
Blood, condition of, in cancer of stomach, 336.
condition of, in ulcer of stomach, 385, 407.
in stools, 408, 409, 411, 424.
vomiting of. See Hæmatemesis.
Blume, 425.
Boas, 7, 8, 13, 14, 18, 21, 28, 30, 32, 35, 38, 39, 44, 45, 48, 63, 68, 69, 70, 75, 153, 195, 196, 208, 213, 229, 239, 246, 261, 267, 288, 290, 298, 333, 350, 351, 352, 387, 442, 506, 507, 508, 515, 525, 546.
reagent of, 28.
Bocci, 105.
Boerhave, 318.
Bollinger, 376.

Bötticher, 390.
Bouchard, 159, 263, 294.
Bouilleaud, 415.
Bourdon, 564.
Bourneville, 521, 522.
Bouveret, 274, 293, 294, 295, 338, 506, 507.
Bovis, De, 192.
Braam-Houckgeest, 278.
Bräutigam, 315.
Bradypepsie, 192.
Braun, 49, 229.
Bramann, Von, 307.
Brieger, 233, 566, 567.
Brinton, 112, 121, 181, 184, 195, 313, 318, 321, 324, 328, 329, 330, 331, 340, 342, 353, 391, 409, 576.
Briquet, 478, 516, 537.
Bristowe, 509.
Brochet, 452.
Brock, 106.
Bromide-water, 552.
Broussais, 192, 276, 492.
Brown, 71, 492,
Brown-Séquard, 178.
Brück, 216.
Brüggemann, 571.
Brunner, 305.
Brunton, Lauder, 157, 173.
Brush, stomach, 4.
Buch, 494, 495.
Buczlygan, 570.
Budd, 244, 400, 411, 413, 424, 426, 433, 440, 473, 501, 545.
Bukler, 183.
Bulimia, 481; etiology, 483; forms, 484; occurrence, 482; peristalsis in, 484; treatment, 483, 548.
Bull, E., 215.
Bull, W. T., 306.
Bunge, 78, 160.
Burettes, forms used in titration, 33.
Burkart, 106, 494, 536, 556, 559.
Bush, F., 4.
Bussel, 376.

Cachexia, in gastric cancer, 334, 359.
in hysteria, 360.
Cahn, 29, 49, 64, 65, 118, 180, 255, 271, 280, 290, 291, 347, 349, 351.
Calculi, gastric, 480.
Callow, 185.
Camerer, 389.
Camus-Corrignon, 205.
Canstatt, 4.
Cancer of stomach. See Carcinoma.
Canula, permanent, of œsophagus, 143.
Caragiosiadis, 105.
Carbonic acid gas, distention of stomach with, 85.
Carcinoma of stomach, 313.
bacteria in, 75, 331, 333.
blood in, 336.
course, 339.
diagnosis, 343; absence of hydrochloric acid, 343; cachexia in, 359; cancerous tumor, 354; from atrophy, 223; lactic acid in, 30, 351; pieces of tissue obtained by washing out stomach, 352.
differential diagnosis, 361; between gastric ulcer and cancer, 331, 362, 363, 418.
etiology, 317.
ferments in, 350.
localization, 323.
lymphadenitis, 329.
metabolism, changes in, 338.
occurrence, 313; age, 313; duration, 339; heredity, 315; locality, 314; primary or secondary, 327; relations to gastric ulcer, 318; sex, 314.
pathological anatomy, 320; varieties, 321.
perforation, 330.
position of stomach in, 324.
prognosis, 339.
propagation, 327.
sarcinæ, absence of, 334.
shape of stomach in, 325.
site, 324; sequelæ of, 325.
symptoms, 330; anorexia, 331; bowels, 342; cachexia, 334; pain, 331; presence of tumor, 334; tongue, 331; vomiting, 331, 332, 334; vomiting of blood, 331.
thrombosis, 328.
treatment, 366; analgesics, 369; condurango, 366; diet, 371; mineral waters, 373; of constipation, 370; of hæmatemesis, 369; of vomiting, 368; surgical, 373.
tuberculosis occurring with, 328.
ulceration, 329.
Cardia, cancer of, 121, 152; stomach contents in, 153.
closure of, 460; in rumination, 524.

Cardia, contraction of, spastic, 116.
function of, 460.
neoplasms of, 120; cause of, 121.
paresis of, 520.
relaxation of, 509, 520, 524.
spasm of, 116, 515.
stenosis of, 109.
stricture of, 109; dilatation of, 132; feeding in, 149; gastrostomy in, 146; organic, 114; pain in, 116; passage of bougies in, 124, 141; symptoms, 109; treatment, 140.
Cardialgia, 209, 487.
in gastric cancer, 231.
in stricture of cardia, 116.
Carlsbad water, action of, in chronic gastritis, 250; in gastric neuroses, 561; in ulcer, 434, 435.
Carron, 116.
Carswell, 324, 328, 395, 424.
Cartellieri, 509.
Catarrh, acute, of stomach, 163. See Gastritis, Simple Acute.
subacute, 181.
chronic, 192. See Gastritis, Chronic Glandular.
Catarrhus atrophicus, 203.
Cathelineau, 491.
Chlapowski, 540.
Chambers, 402, 473.
Chantemasse, 391.
Charcot, 490.
Chemical tests, value of, 577.
Cherchewsky, 531.
Chéron, 540.
Chiaje, Della, 145.
Chiari, 115, 206, 393.
Chittenden, 60, 70, 232, 240.
Chlorine. See Contents of Stomach.
Chlorosis, condition of stomach in, 570.
relation to gastroptosis, 571.
Chomel, 193.
Chovstek, 184, 417.
Cimbali, 475.
Cirrhosis ventriculi, 195.
Clapotement, 262.
Cloquet, 314.
Clostrydium butyricum, 161.
Clozier, 276.
Cohn, 28, 160, 161, 516.
Cohnheim, 8, 155, 169, 180, 196, 200, 223, 327, 352, 354, 399.
Coin, 116.
Cold-water treatment, 108.
Colgan, 394.
Colleville, 573.
Colloid cancer of stomach, 321, 322, 323.
Colic, biliary, 430.
stomach, 515.
Coma dyspepticum, 292.
dyspnœic, 336.
Comby, 213, 282.
Comparetti, 473.
Concretiones benzoartices, 480.
Condurango in gastric cancer, 366.
Congo red, 35.
Contejean, 461.
Contents of stomach, 6.
acetic acid in, 44.
acetone in, 45.
acidity of, 36, 37, 47, 387, 406, 580.
alcohol in, 44.
ammonia in, 45.
bacteria in, 46, 75. See Bacteria.
bile in, 73.
butyric acid in, 44.
carbonic acid in, 45.
chlorine, estimation of, 52.
chlorides, estimation of, 52.
examination of, 24.
fatty acids in, 44.
filtration of, 31.
fungi in, 185.
in acute gastritis, 167.
indol in, 46.
in gastric crises, 491.
in gastric cancer, 343.
in gastric catarrh, 221.
in gastric dilatation, 283.
in gastric ulcer, 387, 406, 422.
in mucous gastritis, 222.
intestinal parasites in, 187.
lactic acid in, 44.
larvæ in, 181.
marsh gas in, 45.
methods of obtaining, 12.
micro-organisms in, 187. See Bacteria.
microscopical examination of, 74.
olefiant gas in, 45.
organic acids in, 44.
pepsin in, 66, 67, 226, 350.
ptomaines in, 45.
reaction of, 25.
rennet in, 67, 350.
routine examination of, 56.
sulphuretted hydrogen in, 45.

Contents of stomach, sugar in, 73.
taste of, 172.
while fasting, 73.
Contraction of stomach, 325.
Cooper, 390.
Copland, 192, 405, 501.
Cordes, 216, 217, 251.
Cordua, 446.
Cornil, 417.
Cornillon, 422.
Cough, stomach, 214.
Couteret, 193.
Cramps of stomach, 477, 515; in gastric dilatation, 292.
Crämer, 8, 440.
Cravate de Suisse, 460.
Crises, gastric, 490, 535, 574.
Crisp, 387.
Cruveilhier, 181, 205, 269, 279, 380, 396, 400, 411, 436.
Cuilleret, 540.
Cullen, 209.
Cure, rest, 434, 556.
Schroth's dry, 299.
Curling, 390.
Cynorexia, 482.

Da Costa, 437.
Daettwyler, 382.
Daguet, 422.
Daland, 337.
Damaschino, 193.
Danger of stomach tube, 8, 127, 422.
Darwin, 522.
Dastre, 208.
Dauber, 508.
Daumann, 546.
Debove, 424, 437.
Decker, 525.
Defecation by mouth, 516.
Défailliance, 481.
Degeneration, colloid, of stomach, 279.
Degeneration of nervous plexuses of intestines, 530.
Deglutition murmurs, 93.
in dilatation of stomach, 264.
in rumination, 524.
Dehio, 82, 88, 260, 524.
Deininger, 184, 185.
Deiters, 269.
Dejerine, 491.
Delamare, 490.
Demange, 491.
Depressive neuroses of stomach, 474.
Desnos, 516.
Dettweiler, 567.
Devic, 293, 294, 295.
Dextrin, 70.
varieties, 70.
test for, 71.
Diabetes, condition of stomach in, 575.
Diarrhœa due to terror, 454.
Diastase, 69; taka diastase, 227.
Diemerbroeck, 290.
Diet in gastric cancer, 371.
in gastric catarrh, 238.
in gastric ulcer, 437.
Dietrich, 123, 422.
Dieulafoy, 402.
Digestion of albumen, 60; test of, 65.
of starch and sugar, 60, 69.
effect of alcohol on, 232.
in absence of hydrochloric acid, 162.
reflex disturbances of, 544.
test in gastric neuroses, 530.
Dilatation of œsophagus, 111, 132.
Dilatation of stomach, 211, 254.
atonic, 276.
course of, 296.
diagnosis of, 255, 295; Boas's method, 261; auscultation, 262; Dehio's method, 260; inspection, 255; Leube's method, 261; measuring capacity of stomach in, 264; murmurs of deglutition in, 264; palpation, 261; percussion, 258; peristalsis in, 256, 257; use of phonendoscope in, 263; Rosenbach's method in, 264; succussion, 262.
etiology, 266; atony of stomach, 276; exclusion of limited areas of muscular fibres of stomach, 278; feebleness of motor nerves, 277; polyphagia, 277; stenoses of pylorus, 268; wandering kidney, 275.
occurrence, 280; with biliary calculi, 274.
pathology, 279.
physical signs, 255.
prognosis, 296.
symptoms, 280; acidity, 288; chemical functions of stomach, 285; coma, 292; constipation, 291; delayed absorption, 289; dryness of tissues, 291; fermentations, 277, 283, 286; inflammable gases, 286; peristalsis,

291; sarcinæ and bacteria, 283; stagnation of stomach contents, 283; sulphuretted hydrogen in, 45; tetany, 292; urine, state of, 293, 294; vomit, 283; vomiting, 282.
treatment, 299; dry diet, 299; resection of pylorus, 306; use of cathartics, 301; faradization, 305; hydrochloric acid, 300; massage, 305; size of tube for, 11; strychnine, 301; washing out stomach, 302.
Dimethylamidoazobenzol, 40.
Diphtheritic gastritis, 166, 180.
Dirkler, 486.
Dirksen, 93, 95.
Distention of stomach, with air, 85, 87.
with carbonic-acid gas, 85.
with water, 82, 87.
Dittrich, 181, 317, 318, 327, 330, 339.
Diverticula of œsophagus, 119.
Douche, Scotch, 305, 554.
stomach, 99, 550.
Dreschfeld, 345.
Dronke, 438.
Drozda, 417.
Dubujadoux, 196.
Ducasse, 523.
Dujardin Beaumetz, 193, 194, 225, 263, 292, 301, 339.
Dunglison, 405.
Duodenum, ulcer of, 390, 430, 432.
Duplay, 262, 301.
Dupuytren, 390.
Duzan, 313.
Dyspepsia, 156.
asthénique, 276.
atonic, 192.
buccal, 72.
cardiaca, 215.
flatulent, 532.
habitual, 192.
in gastric cancer, 331.
in gastric dilatation, 282.
in stricture of cardia, 110.
irritable, 192.
nervous, 529.
peristalsis of stomach in, 162.
reflex, 530, 546.
salivary, 72.
uterina, 546.
Also see Gastritis, Chronic Catarrhal.
Dyspnœic coma in gastric cancer, 336.
Dyspeptic asthma, 215, 510.

Eating, slow, 238.
repugnance toward, 484.
Ebstein, 86, 169, 188, 205, 381, 526, 527.
Edleffsen, 214.
Edinger, 16, 18, 169, 179, 386, 566.
Egeberg, 146.
Eichenberg, 242.
Einhorn, 16, 23, 40, 82, 96, 97, 98, 102, 103, 106, 134, 196, 205, 218, 220, 221, 525, 550.
Eisenlohr, 204, 218, 337.
Eisenhardt, 402.
Electrization of stomach, 102, 305.
effect on muscular fiber, 104.
effect of, 105.
Electrode, stomach, 103.
Elixir peptogène, 225.
Ellenberger, 70.
Ely, 327.
Emminghaus, 9, 45, 288.
Emptiness of stomach, 481.
Engel, 417.
Enemata in chronic gastritis, 206.
Enemata, nutritive, 150, 151, 436.
Enteroliths after bismuth, 441.
Enteroptosis, 539.
treatment of, 555.
Eppinger, 401.
Epstein, 14.
Eras, 115.
Erichsen, 390.
Ergot, in hæmatemesis, 369, 444.
Erlmeyer, 552.
Erosions of stomach, 196; hæmorrhagic, 335.
Eructation, foul-smelling, 286.
hysterical, 508.
nervous, 508.
Escherich, 211.
Etat mammeloné, 280.
Ether, extraction of stomach contents with, 42.
Euchlorhydria, 27.
Everett, 551.
Ewald, C. A., 5, 7, 8, 14, 21, 28, 32, 37, 54, 58, 60, 63, 65, 70, 72, 73, 77, 78, 79, 93, 94, 111, 116, 150, 152, 158, 161, 162, 169, 178, 190, 195, 220, 225, 226, 229, 240, 246, 253, 278, 286, 288, 320, 321, 345, 346, 358, 371, 382, 386,

387, 406, 425, 438, 450, 462, 463, 517, 519, 528, 532, 539, 546 573, 580.
Ewald, R., 448.
Expression, Ewald's method of, 12.
contraindications to, 15.
Eyeselein, 216.

Faber, 75, 415.
Fabricius ab Aquapendente, 4, 521.
Fagge, Hilton, 291.
Falk, 160.
Falkenheim, 284.
Fames canina, 482.
Fauvel, 417.
Favus of stomach, 185.
Fawizky, 49.
Feeding by rectum, 150, 151, 436.
Fenwick, S., 199, 204, 220, 304, 418, 473, 486, 487, 533.
Fenwick, W. S., 15, 169, 179, 402, 563, 564, 569, 570.
Ferber, 259.
Féréol, 540.
Fermaud, 187.
Fermentation (alkaline) of albuminoids in stomach, 211, 288.
in stomach, 167, 235, 299.
lactic acid, 41.
Ferrarini, 406.
Fiedler, 392.
Finkler, 227.
Finny, 411.
Fischl, 321.
Fistula of stomach, making of, 146.
Fistulæ after perforation of gastric ulcer, 416.
Flatow, 319.
Fleiner, 248, 273, 293, 304, 309, 440, 441, 544.
Fleischer, 43, 546.
Flint, 220.
Food, taking of, 471.
refusal of, 484.
Foote, 394, 413, 414, 446.
Forster, 434.
Fothergill, 473.
Fouquet, 516.
Fox, Wilson, 314, 387, 434.
Frank, 522.
Fränkel, E., 186.
Frerichs, von, 4, 85, 127, 284, 417, 561.
Freud, 534.
Freund, 199.
Freyhan, 525.
Friedenwald, 31, 40, 44, 58, 69, 352.
Friedheim, 51.
Friedreich, 339, 366.
Fries, 410.
Full stomach, 477.
Fungus hæmatodes of stomach, 321, 322.
Fürstner, 106.
Fungi in stomach contents, 285.

Gaertig, 123.
Galliard, 402, 417, 429.
Gallois, 522.
Ganglion cells of stomach, 452.
Gans, 576.
Garland, 425, 475.
Gastralgia, 210.
genuine, 488.
hysterical, 497.
diagnosis from ulcer and cancer, 418.
differential diagnosis between gastralgia due to ulcer and colics, 430.
in diseases of central nervous system, 490.
in gastric cancer, 331.
in gastric ulcer, 403, 404.
in gastric neurasthenia, 492.
in nervous dyspepsia, 537.
in psychoses, 499.
reflex, 544.
treatment of, 369, 443, 548, 549.
Gastrectasis. See Dilatation of Stomach.
Gastric crises, 490, 535, 574.
Gastric fever, 173.
Gastric juice. See Juice, Gastric.
Gastric neurasthenia, 529.
Gastrite hyperpeptique, 506.
Gastritis acida, 195.
Gastritis, simple acute, 165; glandular, 165; idiopathic, 165; sympathetic, 178: acidity in sympathetic, 179.
diagnosis, 174; etiology, 165; fatty acids in, 167, 173; fermentation in, 167; hydrochloric acid in, 173; lactic acid in, 167, 173: micro-organisms in, 166; occurrence, 165; pathology, 168: psychical factor in, 166; stomach contents in, 167; symptoms, 171; treatment, 176; varieties, 172.
chronic glandular, 192; agoraphobia in, 216; anadenia in, see Anadenia; antifermentatives in, 227, 235; ano-

dynes in, 244; atrophy of mucous membrane in, 199; bitters in, 229; bromelin in, 227; constipation in, 213; course, 224; diagnosis, 221; diet in, 238; drugs in, 233, 234; dyspeptic asthma in, 215; electricity in, 229; enemata in, 247; etiology, 206; hydriatic treatment of, 237; exfoliation of mucous membrane in, 8, 196; hydrochloric acid in, 221, 225, 235; hygiene in, 243; lavage in, 200, 227; mineral waters in, 249; minute anatomy of, 197; orexin in, 232; papoid in, 227; pancreatin in, 227; pathology of, 195; pepsin in, 226; prognosis of, 224; pulse in, 215; purgatives in, 245; stomach cough in, 214; symptoms, 208; synonyms, 192; tongue in, 209; treatment, 224; urine in, 214; varieties, 200; vertigo in, 216; vomiting in, 210.
diphtheritic, 166, 180.
emphysematous, 186.
membranous, 166, 180.
mucous, 208, 222; lavage in, 222.
mycotic, 185.
parasitic, 185.
parenchymatous, 169.
purulenta phlegmonosa, 181; diagnosis, 184; etiology, 181; occurrence. 181; pathology, 182; symptoms, 183; treatment, 185; varieties, 181.
toxic, 188; diagnosis, 189; symptoms, 189; treatment, 189.
Gastroadenitis, 164.
Gastrodiaphane, 96.
Gastrodynia, 487.
Gastroentérite, 192.
Gastrograph, 82.
Gastroliths, 376.
Gastromalacia, 389.
Gastroptosis, 89, 539.
treatment of, 555.
Gastroscope, 95.
Gastroscopy, 95.
Gastrostomy, 146.
feeding after, 152.
technique of, 148.
Gastrosuccorrhœa, 24, 502.
mucosa, 508.
Gastroxynsis, 507.
Gavarett, 328.
Geigel, 31, 32.
Gempt, Te, 437.
Georges, 231.
Gerhardt, 187, 330, 392, 396, 406, 409, 431, 432, 441.
Germont, 336.
Gersung, 144.
Gigglberger, 240.
Gilles-Sabourin, 401.
Girandeau, 262.
Gläser, 184.
Glax, 181, 255, 516, 577.
Glénard, 539, 540, 543, 555.
disease of. See Gastroptosis.
Gluczinsky, 345, 346, 406, 570.
Gmelin, 18, 73.
Goldschmidt, 108.
Goldstein, 417.
Goltz, 455, 462.
Gombault, 196.
Goodhart, 554.
Goodsir, 284.
Gothard Tunnel disease, 548.
Gout, condition of stomach in, 576.
Graf, 316.
Graham, 425.
Grande, 79.
Grasset, 339.
Graves, 210.
Griesinger, 314.
Griess, 392.
Griffini, 381, 399.
Grote, 227, 442.
Grünfeldt, 393.
Grützner, 229.
Grundzach, 162, 274.
Grusdew, 566.
Günsburg, 389.
Günzburg, 17, 38.
reagent, 38.
Guipon, 483.
Guiteras, 115.
Gull, 490.
Gumlich, 63, 371.
Gussmann, 174.
Guttmann, 233.
Gyromele, Turck's, 4, 236.

Haafewinkel, 227.
Habershon, 181, 396, 400.
Häberlin, 75, 314, 316, 319, 327, 337.
Hacker, Von, 115, 306.
Hæmatemesis, 407, 423.
causes of, 424.

Hæmatemesis, diagnosis from hæmoptysis, 423.
in cardiac diseases, 424.
in cholera, 426.
in direct traumatism, 428.
in diseased gastric blood-vessels, 428.
in epilepsy, 424.
in fever, intermittent, 426.
in fevers, exanthematous, 426.
in gastric ulcer, 407.
in gastritis glandularis chronica, 426.
in helminthiasis, 426.
in hysteria, 426.
in liver, acute yellow atrophy of, 424.
in liver, cirrhosis of, 424.
in miliary aneurism, 429.
in œsophageal varix, 425.
in progressive anæmia, 428.
in purpura hæmorrhagica, 426.
in scurvy, 426.
parenchymatous, 427.
treatment of, in cancer, 369; in general, 429; in ulcer, 443.
Hæmoptysis, 423.
Hafner, 428.
Hahn, 306, 307, 374, 375.
Hair tumors in stomach, 376, 480.
Hall, 415.
Haller, 465.
Hamburger, 160, 161.
Hammerschlag, 67, 200, 352.
Hampeln, 335.
Hanot, 121, 196.
Hansemann, 320.
Hanssen, 515.
Hart, Ed., 33.
Hart, Wheatley, 133.
Hartung, 337.
Hasselmann, 114.
Hauser, 317, 319, 320, 399.
Hayem, 27, 49, 169, 194, 196, 204, 208, 250, 506, 570.
Heart, condition of stomach in diseases of, 571.
Heart-burn, 209, 510.
Heberden, 225.
Heddaeus, 119.
Helmer, 49.
Heidenhain, 170, 395, 454.
Heilbrun, 428.
Heinecke, 306, 308.
Heintz, 181.
Heitler, 319.
Hellwig, 306, 307.
Hemialbumose, 60.
Hemmeter, 7, 82.
Henle, 395.
Henne, 232.
Henoch, 175, 215, 329, 343, 393, 428, 510.
Henry, 564.
Heredity of cancer, 315.
Heron, 71.
Herpes labialis in acute catarrhal gastritis, 172.
Herschell, 163.
Heryng, 96.
Herzen, 225.
Heynsius, 287.
Hildebrand, 187, 566, 568.
Hiller, 417.
Hilton, 446.
Hippocrates, 478.
Hirsch, 29, 389, 406.
Hirschberg, 550.
Hirschfeld, 28.
Hirschspring, 269.
Hoesslin, von, 35.
Hoffmann, F. A., 49, 50, 51, 164, 165, 209.
Hofmeister, 70, 528.
Hollevoet, 412.
Holmes, 390.
Hood, 291, 409, 428.
Hoppe-Seyler, 58, 178, 287.
Honigmann, 501, 506.
Hornbaum, 495.
Huber, 80, 151.
Hubert, 306.
Hübner, 406, 501.
Hüfler, 572.
Hüppe, 286.
Hufeland 366.
Hughes, 446.
Hugounang, 231.
Hunger, 465.
causes of, 465.
center of, 466, 471.
feeling of, 466; deviations from, 481; inhibition of, 468; localization, 467; voracious, 481.
Hunter, 4, 387, 390.
Hutchinson, 564, 567.
Hydrochloric acid, absence of, in Addison's disease, 346; in amyloid degeneration of gastric mucosa, 346; in anadenia, 222; in fever, 179; in gastric cancer, 345; in gastric neuro-

ses, 346; in menstruation, 546; in mucous catarrh of stomach, 346; permanent, in healthy persons, 579; in pulmonary phthisis, 346, 567; in valvular diseases, 346.
antiseptic action of, 160.
free and combined, 25, 26, 47.
free, estimation of, 47.
influenced by electricity, 105.
in fever, 179; in phthisis, 566.
loosely combined, method of determining, 49.
percentage of, 24, 31.
permanent lessening in gastric neuroses, 580.
relation to acidity of urine, 162.
relation to indican in urine, 163.
secretion of, 25, 27.
tests for, 36, 37, 47.
use of, 221, 225, 235, 300.
Hydrops in gastric cancer, 336.
Hydrotherapy, 108, 554.
Hyperacidity, 24, 27, 194, 501, 502.
in gastric ulcer, 387, 406.
in nervous disorders, 502.
occurrence, 502.
test of, 36.
treatment, 507.
Hyperæsthesia of stomach, 477.
after chloroform narcosis, 479.
Hyperchlorhydria. See HYPERACIDITY.
Hyperkinesis, 16, 517.
Hyperorexia, 482.
Hypersecretion of gastric juice, 501, 502.
diagnosis, 505.
forms of, 502.
in cerebral disorders, 545.
periodical, 502.
symptoms of, 505.
Hypersecretio acida, 24, 501, 502.
Hypochlorhydria, 27.
Hypochondria, 483.
Hysteria, 365, 477, 487, 492, 497.

Idiosyncrasy of stomach, 480.
Immermann, 220, 367, 368, 566, 567.
Indigestion, 192.
Innervation of stomach, 448.
Insufficiency of stomach, 254. See PYLORUS and CARDIA; see DILATATION.
Invert sugar, 69.
Iodoform reaction, Lieben's, 44.
Intestines, disturbed digestion of, 531.
Intestines, electrization of, 105.
hæmorrhage in, 408, 411, 424.
in diseases of stomach, 157.
tympanites of, 527.
vicarious action of, 77, 351, 218, 580.
Irritative gastric neuroses, 474, 477.
Israel, 324.

Jacobson, 97, 98.
Jaksch, von, 29, 45, 391, 392.
Jaccoud, 516.
Jaworski, 22, 24, 67, 78, 194, 222, 223, 225, 226, 229, 237, 250, 265, 298, 308, 321, 345, 387, 388, 399, 406, 435, 501, 502, 503, 504, 505, 506, 567.
Johannessen, 521.
John, 70.
Johnson, 68, 478.
Jolles, 49.
Jolly, 502.
Jones, A., 105.
Jones, H., 424, 564.
Jong, De, 30, 58, 352.
Juice, gastric, acidity of, 19, 24.
acidity while fasting, 20.
changes in, significance of, 578.
flow of, 501; continual, 503; in cerebral affection, 545; periodical, 502.
hyperacidity of, 501, 502.
hypersecretion of, 501, 502.
in gastric catarrh, 221.
in gastric cancer, 343.
in gastric dilatation, 285.
in gastric ulcer, 387, 406.
in rumination, 525.
parasecretion, 502.
secretion of, 19, 24.
Julien, 114, 417.
Jung, De, 44.
Jürgens, 218, 453, 454, 530.
Jürgensen, 299, 508, 525.

Kabrehl, 160.
Kaczarowski, 238.
Kahlden, 196.
Kahler, 37, 38, 491.
Kahn, 345.
Kalmus, 180.
Kast, 189.
Katzenellenbogen, 324, 329.
Kaufmann, J., 75, 82, 161, 187.
Kaufmann, W., 333.
Keen, 446.

Kelling, 93, 98, 120.
Kellog, 74, 464.
Kelynack, 319.
Kering, 259.
Key-Aberg, 304.
Kidney, condition of stomach in diseases of, 564, 572.
Kietz, 345.
Kinnicutt, 19, 306.
Kisch, 546, 577.
Kitagawa, 537.
Klebs, 159, 185, 417.
Kleinert, 33.
Kleist, 246.
Klemperer, G., 22, 68, 81, 119, 123, 179, 231, 298, 338, 352, 566, 567.
Klinkert, 204.
Kobert, 462.
Koch, 382.
Kocher, 148, 374.
Kollmar, 319, 420.
König, 21.
Körte, 390.
Kooyker, 376.
Körner, 118, 120, 523.
Korczynski, 194, 298, 321, 388, 399, 406.
Kornfeld, 16.
Kossel, 547.
Kossler, 50, 51, 53.
Kraus, 32, 345.
Kretschy, 546.
Krishaber, 143.
Kronecker, 93, 115.
Kronfeld, 232.
Krönlein, 374.
Krukenberg, 37, 345, 490.
Krüger, 375,
Kuhn, 287, 301.
Kulcke, 319.
Kulneff, 46, 159.
Kumagawa, 65.
Kundmann, 4.
Kundrat, 185, 213.
Kunze, 375.
Kupffer, 197.
Kuttner, 7, 96, 97, 98, 265, 275, 555.
Kussmaul, 4, 106, 150, 248, 254, 263, 271, 280, 283, 291, 292, 294, 302, 303, 343, 515, 516, 526, 529, 550.
Kühne, 63.
Küster, 445.

Laache, 336, 407.
Labastide, 225.
Lab-enzyme, 68.
Lab-ferment, 67.
Lab-zymogen, 68. See Rennet.
Labastide, 225.
Laboulbène, 189.
Lactic acid. See Acid, Lactic.
Laenggries, 316.
Laker, 264, 337.
Lambl, 537.
Lanceraux, 417.
Landau, 276.
Landerer, 269.
Landouzi, 491.
Lang, 417.
Lange, 327, 328, 397, 446.
Langebach, 162.
Langerhans, 395, 396, 397.
Langermann, 51, 57.
Langguth, 30, 55, 352.
Laprevotte, 292.
Large stomach, 255.
Laubenheimer, 338.
Lauenstein, 306.
Lavage of stomach, 98, 200, 227, 302.
  dangers of, 304.
Lebert, 165, 172, 173, 183, 193, 279, 313, 316, 318, 324, 327, 329, 331, 339, 340, 342, 353, 373, 391, 392.
Ledoux-Lebard, 314.
Leichtenstern, 133, 253, 264, 337, 407.
Lemaître, 205.
Lenhartz, 275.
Leo, 14, 19, 25, 29, 49, 50, 51, 54, 55, 56, 67, 68, 437, 484, 517.
Lépine, 329, 336.
Lesser, 189.
Lesshaft, 117.
Letulle, 390, 391, 428.
Leube, 3, 4, 5, 8, 9, 22, 69, 77, 80, 106, 150, 168, 184, 246, 261, 275, 356, 384, 421, 422, 433, 434, 435, 439, 441, 473, 529, 530, 533, 535, 536, 550, 567, 572, 577.
Leucin, reaction of, 28.
Leudet, 417.
Leury, 199.
Leva, 525.
Lewin, W., 183, 184.
Lewy, 318.
Leyden, 143, 491, 514, 532, 535, 556, 567.
Lichtheim, 219.
Liebermeister, 283, 300, 567.
Liebreich, 438, 537, 553.

Lienteric stools, 186, 250.
Lindeman, 182.
Lippman, 33.
Lische, 169.
Litmus-paper, 22.
Litten, 220, 275, 293, 401, 413, 425.
Liver, action on peptones, 158.
condition of stomach in diseases of, 574.
relation of diseases of stomach, 157.
Lorenz, 45.
Loreta, 295, 306.
Loewenthal, 23, 225.
Löffler, 160.
Lösch, 169.
Louis, 564.
Low, 390.
Loye, 105.
Lublinski, 114, 187.
Lücke, 306.
Lugol's solution, 71.
Lung, hæmorrhage from, 423.
Luschka, 110.
Luton, 324.
Lüttke, 14, 28, 29, 30, 31, 47, 49, 50, 51, 54, 58.
Lymphadenoma of stomach, 323.
Lyon, 26.

Macfadyen, 161, 187.
Mackenzie, 111, 141, 143, 147, 244.
Macleod, 183.
MacNaught, 210, 287.
Magendie, 462.
Maier, 269.
Malaria, condition of stomach in, 577.
Malbranc, 208, 275, 550.
Malibran, 282.
Maltose, 71.
Malvoz, 375.
Maly, 406.
Manges, 99, 234, 333, 352.
Marcet, 384.
Marcone, 230.
Marfan, 169, 402, 565.
Marten, 295.
Martin, 6, 186, 304, 391.
Martin, St., 152.
Martius, 14, 20, 28, 29, 30, 31, 47, 49, 50, 54, 98.
Massage of stomach, 108.
Matthieu, 81, 163, 278, 299, 321, 437, 504.
Matthes, 440.
Maydl, 413.
Mayem, 180.
Mayer, 216.
Mazotti, 113.
McNaught, 161.
Meat-juice, 300.
Meat peptone, 299; chocolate, 300.
Kemmerich's, 299.
Koch's, 299.
solution, Leube's, 114.
Medullary carcinoma of stomach, 321, 322.
Megalostria, 254.
Meinert, 86, 98, 540, 542, 544, 571.
Meissner's plexus, 453, 459.
Melæna, 424.
Melænemesis, 332.
Melanotic carcinoma of stomach, 322.
Meltzer, 76, 94, 107, 115, 117, 413.
Meltzing, 98, 571.
Menasse, 376.
Menassein, 169, 178.
Menche, 233.
Mendel, 232.
Mendelsohn, 243.
Mering, von, 29, 49, 71, 76, 289, 345, 349, 351.
Merycismus, 521.
Meschede, 187.
Methyl violet, 35.
Mey, 332, 336.
Meyer, A., 48, 51.
Meyer, C., 318.
Meyer, E., 125.
Meyer, G., 169, 200, 203, 218, 552.
Meyer, John, 183, 184.
Meyer, R., 280.
Meyer, W., 148, 368.
Meyerhof, 114.
Michaelis, 445.
Middeldorf, 416.
Mikulicz, 95, 306, 308, 445.
Milk diet, 241.
peptonized, 299, 371.
Millard, 426.
Miller, 160, 161, 287.
Mineral springs, treatment at.
in gastric cancer, 373.
in gastric catarrh, 249.
in gastric neuroses, 561.
in gastric ulcer, 446.
Mineral waters in gastric neuroses, 553.

Minkowski, 160, 274, 277, 293, 303, 355, 445.
Mintz, 47, 48, 54, 58, 184, 309.
Miquel, 160, 387.
Mislowitzer, 330.
Mitan, 243.
Mitchell, J. M., 559.
Mitchell, Weir, 324, 425, 556, 559.
Möbius, 531.
Models of stomach, 91.
Mohr, 33, 37.
Montegre, 523.
Moritz, 76, 107.
Mosetig-Moorhof, 368.
Motility, 60. See Movements of Stomach.
Mouisset, 337.
Movements of stomach, 77, 459.
  in bulimia, 484.
  in chronic catarrhal gastritis, 212.
  tests of, 78, 81.
Mucous gastritis, 208, 222.
Mucous glands of stomach, 171.
Mucous membrane of stomach, atrophy of, 199, 563.
  degeneration of, granular, 199.
  fungi of, 185.
  hæmorrhage in, 395.
  polypi of, 205.
  structure of, 163.
  vacuoles in cells of, 199.
Mucus, excessive secretion of, 508.
Müller, Fr., 123, 292, 293, 338, 355, 385, 407, 413.
Müller, Joh., 449.
Murchison, 343, 416, 417.
Murmur, deglutition, 93, 264, 525.
  absence of, 95.
  aids to diagnosis, 93.
  gurgling, 118.
  nature of, 93.
  press, 93.
  splash, 262.
  squirt, 93.
  succussion, 262.
Muscularis of stomach, atrophy of, 203, 279.
  feebleness of, 276.
  hypertrophy of, 279.
  paresis of, 218.
Muselier, 335.
Musser, 401, 418.
Myalgia of abdominal muscles, 478.
Natanson, 93.
Naunyn, 214, 277, 303.
Nausea, 477.
Nauwerck, 186, 273.
Nencki, 78.
Neptune's girdle, 514, 551.
Nerves of stomach, 451.
Nervous system, condition of stomach in diseases of, 574.
Neschaieff, 153.
Neumann, 114, 402.
Neurasthenia, 492.
  irritative, 492.
  depressive, 493.
  gastric, 529.
  gastro-intestinal, 532.
  vago-sympathetic, 532.
Neuroses of stomach, 448, 473.
  conditions of depression in, 474, 517.
  conditions of irritation, 474, 477.
  classification of, 474.
  etiology, 475.
  mixed form, 474, 529.
  occurrence, 475.
  reflex, 474, 544.
  relations to other neuroses, 474.
  treatment, 477, 548.
Nicaladoni, 133.
Niemeyer, 216.
Nolte, 392, 397.
Noorden, Von, 162, 372, 491, 501, 502.
Normal soda solution, 33.
Nothnagel, 32, 203, 214, 220, 275, 537.

Obalinski, 308.
Obrastzow, 88, 89.
Oddi, 208.
Odier, 439.
Œsophageal sound, 125.
Œsophageal tube, 127.
Œsophagoscope, 124.
Œsophagus, cancer of, 118, 120.
  symptoms, 123, 124.
Œsophagus, dilatation of, 111, 132.
  diverticula of, 119.
  neoplasms of, 118, 120.
  permanent canula of, 143.
  sounding of, 125.
  stenosis of, 109.
  stricture, cicatricial, 111; feeding in, 149; gastrostomy in, 146; rectal feeding in, 150.
  spasmodic, 116.

Œsophagus, ulcer of, corrosion, 115; syphilitic, 111; tubercular, 113.
Oettinger, 292.
Oil test, 81.
Openchowski, Von, 394, 463.
Oppenheim, 491.
Oppenheimer, 337, 407, 433.
Oppler, 67, 75, 284, 333, 334, 352.
l'orange Poirier, 34.
Orexin, 232.
Organic acids. See Acids.
Ord, 441.
Orth, 185, 186, 195.
Oser, 5, 86, 87, 229, 266, 275, 299, 367, 412, 436, 461, 473, 474, 478, 488, 492, 498, 551.
Osgood, 366.
Osler, 86, 220, 257, 258, 262, 291, 356, 425, 564.
Ost, 265.
Ostersprey, 337, 407.
Osswald, 570.
Ott, 342, 356, 358, 364, 540, 544.
Overloading of stomach, 168.

Pacanowski, 88.
Pain, epigastralgic, 537.
epigastric, 478.
in cancer, 331, 359, 364.
in catarrh of stomach, febrile, 172; chronic, 210.
in hyperæsthesia of stomach, 478.
in hypersecretion of gastric juice, 505.
in hysterical gastralgia, 497.
in nervous dyspepsia, 536.
in neurasthenic gastralgia, 493.
in stricture of the cardia, 116.
in ulcer of stomach, 404.
Palpation of stomach, 83.
of pancreas, 84, 90.
of stomach tube, 261.
Parasecretion, 24, 502.
Pariser, 98, 352, 416.
Parsons, 446.
Pauli, 263, 281.
Pavy, 386, 482, 576.
Peiper, 567.
Pemberton, 225, 435, 478, 501.
Penzoldt, 43, 45, 75, 87, 232, 240, 263, 290, 302.
Pepper, 106.
Pepsin and hydrochloric acid, digestion by, 65.
Pepsin and hydrochloric acid, in chronic catarrhal gastritis, 226.
quantitative estimation of, 67.
Pepsinogen, 67, 223.
Peptone, 60.
action of liver on, 158.
artificial, 371.
chocolate, 371.
enema, 150.
pastilles, Maggi's, 299.
reactions of, 60, 61.
Peptonuria in gastric dilatation, 294.
Perforation in gastric cancer, 330; in gastric ulcer, 412.
Perforation peritonitis, 414.
Peristalsis of stomach, 77, 459.
Pertik, 269.
Peyer, 482, 548.
Pfeiffer, 229, 250.
Pfungen, Von, 212, 437, 528, 529.
Phenolphthallein, 32, 33.
Phlegmon, gastric. See Gastritis phlegmonosa.
Phloroglucin-vanillin test, 38.
Phonendoscope, 263, 358.
Phthisis ventriculi. See Anadenia.
Pick, 412, 570.
Pidoux, 576.
Pinel, 479.
Piorry, 87.
Pitt, 323, 390.
Playfair, 556.
Pneumatosis, 510.
Points, painful, Burkart's, 494, 536.
Poirier, l'orange, 34.
Poensgen, 213, 526.
Poisoning, 188.
with alcohol, 188; caustic alkalies, 188, 189; hydrochloric acid, 188; nitrobenzol, 188; oxalic acid, 310; phosphorus, 188; sulphuric acid, 188.
Poisson, 411.
Poltowicz, 541.
Polyphagia, 517.
Polypi of stomach, 205.
Polypoid cancer of stomach, 321, 322.
Pomper, 187.
Popoff, 287.
Portal, 283.
Position, vertical, of stomach, 90.
Potton, 482.
Powell, 411.
Power, 117.

Pradazzi, 88, 89.
Prazmowski, 161.
Pribram, 95, 216.
Probefrühstück. See Test Breakfast.
Probemahlzeit. See Test Meal.
Probemittagbrod. See Test Dinner.
Proenzyme, rennet, 68.
Propeptone, 60.
  reactions of, 61.
  relations of to digestion, 62.
Proteolysis, 65,
Ptyalin, 69.
  quantitative examination of, 72.
Ptyalism, reflex, 547.
Pump, stomach, 4, 5, 12.
Puncta dolorosa. See Points, Painful.
Purgative, Oydtmann's, 248.
Purgatives, 245.
Pylorus, cancer of. See Carcinoma of Stomach.
  appearance of, in neoplasms, 95.
  closure of, 460.
  functions of, 460.
  hypertrophy of muscularis at, 357, 362.
  incontinence of, 526.
  palpation of, 262.
  relaxation of, 520.
  spasm of, 515.
  spastic contraction of, 273.
  stenosis of, cicatricial, 268; congenital, 269; hypertrophic, 269; mechanical, 269; causes of stenosis, external to stomach, 274.
Pyrosis, 209, 510.

Quenu, 565.
Quincke, 93, 115, 130, 220, 294, 382, 406.

Ramm, 230.
Rampold, 343.
Rankin, 442.
Raoult, 540.
Raudnitz, 68.
Rawzier, 338.
Ray, 446.
Reaction, ethyldiacetic acid (in urine), 293. (For other reactions see under individual headings.)
Reagent, Boas's, 38, 39.
  Günzburg's, 38.
  Lieben's, 44.
  Nessler's, 44.
  Töpfer's, 40, 48.
Reagent, Uffelmann's, 41.
  source of errors, 42.
Reale, 79.
Recklinghausen, Von, 180.
Reckmann, 433.
Reed, 17.
Reflex dyspepsia, 530, 546.
Reflexes from other organs on the stomach, 544.
Regnard, 105.
Regurgitation, 520.
  in diverticula of œsophagus, 521.
  in stricture of œsophagus and cardia, 111.
Reichmann, 24, 96, 229, 236, 501, 502, 504, 505, 506, 507.
Reinert, 407.
Relations, mutual, of stomach, liver, and intestines, 155; and nervous system, 574; other organs, 563.
Renal colic, 430.
Rennet ferment, 67; quantitative test for, 69; proenzyme, 68; zymogen, 68.
Reimer, 426.
Reinhard, 356.
Renvers, 143.
Reoch, 37, 38.
Resorcin, 234; test, 39.
Rest cure, Leube-Ziemssen, in ulcer, 434.
  Weir Mitchell, 556.
Retzius, 367.
Rheumatism, condition of stomach in, 576.
Richet, 152, 453, 458.
Richter, 284, 333, 494, 535.
Riegel, 22, 24, 26, 32, 74, 82, 86, 98, 107, 153, 161, 208, 255, 258, 286, 333, 345, 352, 387, 388, 389, 406, 421, 501, 503, 504, 505, 506.
Rieger, 102.
Riess, 366, 367, 552.
Ritter, 29, 389, 406.
Roberts, 232, 235, 239.
Rockwitz, 375.
Rolleston, 120.
Rokitanski, 114, 121, 181, 274, 383, 389, 390, 396.
Rosch, 375.
Rose, 262.
Rommelaere, 338, 339.
Rosenbach, 85, 212, 215, 254, 255, 264, 282, 345, 528, 548, 549.

Rosenheim, 7, 8, 19, 29, 45, 59, 95, 96, 99, 120, 124, 142, 185, 195, 220, 267, 309, 319, 321, 333, 345, 347, 349, 352, 374, 387, 391, 406, 422, 440, 551, 580.
Rosenstein, 516, 576.
Rosenthal, 150, 473, 474, 483, 490, 492, 494, 509, 514, 550, 552, 566, 568, 577.
Rosenthal, C., 68.
Rosin, 18.
Ross, 192.
Rossbach, 507.
Rossier, 523, 525.
Roth, 316, 382.
Rothschild, 406.
Rowing in chronic catarrhal gastritis, 243.
Ructus. See Eructation.
Rühle, 567.
Rumination, 521.
Rumpel, 189.
Rumsæus, 4.
Runeberg, 86.
Runge, 525.
Rupture of stomach, 189.
Ruppstein, 286, 287.
Rutherford, 247.
Rydygier, 308.

Sabel, 115.
Saccharification, 69.
by saliva, 70.
Sachs, 169, 171, 199, 425, 429.
Sadler, 337.
Sahli, 17, 76.
Salkowski, 65, 235, 580.
Salol test, 78.
Saly, 501.
Samuelson, 386.
Sanarelli, 320.
Sanctuary, 273.
Sansoni, 50.
Sarcinæ ventriculi, 284, 334.
Sarcoma ventriculi, 323, 375.
Sasaki, 218, 530, 531.
Sassezky, 178.
Satiation, feeling of, 469.
lack of, 484.
Saundby, 554.
Sauvage, 526.
Savelieff, 45, 440, 441.
Sawyer, 553.
Scheperlen, 220.
Scherf, 417.
Schetty, 179, 566.
Scheuerlen, 320.
Schönborn, 376.
Schiff, 225, 381, 452, 467, 528.
Schill, 320.
Schillbach, 105.
Schirrous cancer of stomach, 321, 324.
Schlesinger, 72, 333.
Schliep, 8.
Schlösing, 54.
Schluckgeräusch. See Murmur, Deglutition.
Schmauss, 408.
Size of stomach, 88.
Situation of stomach, 88.
Schmidt, F., 49, 53, 173, 200.
Schmidt-Mühlheim, 290, 457.
Schmidtmann, 478, 521.
Schmilinsky, 261, 262.
Schneider, 337, 521, 522.
Schnetter, 85.
Schneyer, 337.
Schrader, 466.
Schreiber, 18, 19, 142, 506.
Schroth's dry diet, 299.
Schuchardt, 318.
Schüle, 20, 352.
Schultze, 161, 287.
Schütz, 6, 87, 275, 516, 528.
Schwalbe, 169.
Scirrhus of stomach, 321, 324.
Secretion of stomach, 453.
Sedgwick, 393.
Sédillot, 147.
Sée, Germain, 22, 193, 237, 239, 244, 262, 278, 294, 422, 443.
Seemann, 37, 49.
Séglas, 521, 522.
Sehrwald, 386.
Senator, 45, 142, 159, 187, 288.
Senn, 265, 308.
Sensibility of the stomach, 463; morbid, 478.
Séré, De, 526.
Shape of stomach, changes in, 91.
Sialorrhœa, 547.
Sieber, 160.
Siebert, 244.
Sievers, 78, 79, 80, 106, 525.
Siewecke, 362.
Silbermann, 382.
Silberstein, 80.
Silberti, 233.

Silver nitrate, 271.
Simon, 163.
Simple gastritis, 165.
Singer, 38, 524.
Siphon, stomach, 4.
Siphonage in washing out stomach, 98.
Siredey, 335.
Sjöqvist, 49. 57.
Skin, anæsthesia of, in gastric ulcer, 405.
hyperæsthesia of, in gastric ulcer, 405.
condition of stomach in diseases of, 576.
Skjelderup, 301.
Skoda, 173.
Smirnow, 166, 180.
Smith, A., 274.
Snow, 316.
Soda solution, normal, 33.
Sodium chloride, reaction of, 36.
Sohlern, Von, 392, 393.
Sollier, 464.
Sommerville, 4.
Sonnenberg, 143.
Sounding of stomach, 10.
Sounds, œsophageal, 5.
siphon, 5.
stomach, 5.
Spallanzani, 16, 18, 160.
Späth, 16.
Spitzer, 34, 64.
Splanchnoptosis, 542.
Spray, gastric, 102.
Springs, mineral, treatment at, in gastric cancer, 373; catarrh, 249; neuroses, 561; ulcer, 446.
Stäbchen plessimeter percussion, 264.
Starch, digestion of, 60, 69.
test for, 71.
Starck, 392.
Status gastricus, 192.
Stein, 79.
Stekhoven, 229.
Stepp, 443.
Stern, 313, 572.
Stewart, D. D., 31, 223, 352.
Stewart, Grainger, 183.
Steyerthal, 479.
Sticker, 73, 406.
Stintzing, 29.
Stiénon, 319, 349.
Stiller, 473, 476, 509, 529.
Stintzig, 169.
Stöhr, 199.
Stoll, 403.
Stockton, 104, 106.
Störck, 366.
Stomach, anadenia of. See Anadenia.
atony of. See Atony.
atrophy of. See Atrophy.
capacity of, 91; to determine, 92.
carcinoma of. See Carcinoma.
catarrh of. See Gastritis catarrhalis.
contents of. See Contents of Stomach.
dilatation of. See Dilatation of Stomach.
distention with air or carbonic acid, 85.
hæmorrhage in. See Hæmatemesis.
inflammation of, purulent. See Gastritis phlegmonosa. Inflammation of, toxic. See Gastritis, Toxic.
innervation of, 448.
large, 255.
measurements of, 89.
models of, 91.
motility of. See Movements of Stomach.
mucous membrane. See Mucous Membrane.
neuroses of. See Neuroses of Stomach.
physical examination of, 82.
phthisis of. See Anadenia.
relation to liver and intestines, 155.
secretion in, 19.
shape of, 91.
size of, 90; test, 82, 85.
topography of, 88.
ulcer of. See Ulcer of Stomach.
Stools, in gastric cancer, 343; catarrh, 213; dilatation, 291; dyspepsia nervosa, 537; phlegmon, 184; ulcer, 408.
in stricture of cardia, 113.
lienteric, 343, 413.
tarry, 408.
Storer, 362.
Strauss, 40, 43, 45, 46, 161, 187, 287, 288, 333, 352.
Stroh, 162.
Strümpell, 264.
Struve, 414.
Subacidity, 24.
Sugar, digestion of, 69.
Suggestion in neuroses, 561.
Superacidity, 24.

Surgery of stomach, 157, 373, 446. See individual diseases.
Swieton, Van, 318.
Switzer, 143.
Symonds, 143.
Sympathetic nerve, course of, 452.
Syntonin, demonstration and reactions of, 60.

Tabes, gastric crises in, 490, 535, 501.
Talamon-Balzer, 401.
Talma, 210, 381, 385, 388, 504, 552.
Tantini, 462.
Taste in gastric cancer, 331; ulcer, 403; gastritis catarrhalis chronica, 209; in rumination, 522.
Tawizki, 230.
Teeth, care of, in diseases of stomach, 238.
Telangiectatic carcinoma of stomach, 321, 322.
Terray, 230.
Test breakfast, 21.
of Ewald and Boas, 21.
of Klemperer, 22.
dinner, of Leube, 22.
meal, 21.
of Riegel, 26.
supper, 82, 298.
Tetany after washing out stomach, 304.
in gastric dilatation, 292.
ptomaines in, 46.
Thayer, 352.
Thiersch, 319, 345.
Thoman, 182.
Thomas, 239, 560.
Thompson, 242.
Thrombosis in gastric cancer, 328.
Tiedemann, 18.
Tilger, 375.
Titration, method of, 30, 32.
Todd, 192, 276, 478, 501.
Töpfer, 40, 48, 57.
Tongue in diseases of stomach, 174.
in nervous anorexia, 485.
in gastric cancer, 331, 364; catarrh, acute, 175; chronic, 209; dilatation, 282; hypersecretion of gastric juice, 505; neurasthenia, 531; ulcer, 364, 403, 418; phlegmonous gastritis, 183; stricture of cardia, 113.
Torminæ ventriculi, 515.
Transformation of gastric ulcer into cancer, 422.
of starch, 60, 69.
Trastour, 540.
Traube, 277, 405.
Tréheux, 163.
Trendelenburg, 152.
Treves, 556.
Trier, 433.
Trinkler, 504.
Troisier, 329.
Tropæolin, 34.
Trousseau, 216, 248, 232, 373, 473, 501.
Tschelzoff, 344.
Tschelzow, 229.
Tschlenoff, 67.
Tube, Faucher's, 5.
œsophageal, 5.
stomach, 3; dangers of, 8, 127, 422; care of, 7; introduction of, 9, 10, 11, 12; recurrent, 7; sterilization of, 7; obstruction to passage of, 10; length of, 11; use of, in children, 14; in chronic gastritis, 200, 227; neuroses, 550; ulcer, 422; tympanites, 510.
Tuberculosis, condition of stomach in, 564.
Tuckwell, 513.
Tüngel, 324.
Tumor in gastric cancer, 334.
hypertrophy of muscularis at pylorus, 357, 362.
mediastinal, 118.
retroperitoneal, 118.
Tumors, non-carcinomatous, of stomach, 375.
Turck, 4, 46, 75, 101, 104, 207, 236, 238.
Tympanites, 510.
Typhoid fever, condition of stomach in, 564.

Uffelmann, 29, 30, 40.
Ulcer of duodenum, 390, 430, 432.
Ulcer of stomach, follicular, 383; round, 377.
adhesions in, 400.
age in, 393.
anatomical characters of, 394.
base, 396.
bloody stools in, 408.
bowels, 403.
cicatrization of, 399, 416.
composition of blood in, 385, 407.

Ulcer of stomach, corrosion of vessels in, 400.
diagnosis of, 418.
differential diagnosis, 418, 430.
diet in, 437.
emaciation, 404.
etiology, 380.
excision of, 446.
fever in, 404.
fistulæ after, 416.
form, 396.
hæmorrhage in, 407.
treatment of, 443.
hyperacidity of gastric juice in, 387, 406.
in cutaneous burns, 390.
micro-organisms in, 390.
microscopic appearance, 398.
necrosis, 400.
occurrence, 391.
operative procedures in, 446.
pain in, 403, 404.
treatment of, 443.
pathological anatomy, 394.
perforation of, 412.
perforation peritonitis, 414; treatment, 415.
prognosis, 433.
relapsing, 388.
rest cure in, 434.
results of, 399.
sex, 393.
site, 397, 431.
size, 396.
skin in, 405.
symptoms of, 403.
syphilitic, 402, 417.
tongue in, 403, 418.
treatment of, 434; at mineral springs, 446; rectal feeding in, 434, 436; use of Carlsbader water in, 434, 435; use of iron in, 437; use of nitrate of silver in, 442.
tube in, 422.
tubercular, 401, 418.
urine in, 406.
Unrest of stomach, antiperistaltic, 516.
peristaltic, 291, 515.

Vagus, course of, 451.
Value of chemical tests, 577.
Vanillin, phloroglucin, 38.
Vanni, 385.
Vaso-motor nerves of stomach, 457; relations of, in gastric secretion, 457.
Vassale, 381, 399.
Velden, Von den, 70, 208, 343, 345, 347, 387, 501, 504.
Verneuil, 152.
Vertigo gyrosa, 216.
stomachalis, 216.
e stomacho laeso, 216.
Villous carcinoma of stomach, 322.
Violet, methyl, 35.
Virchow, R., 114, 121, 169, 188, 328, 329, 358, 396, 417, 543.
Vizioli, 550.
Voelkel, 425.
Vogel, 366, 406.
Voigt, 120.
Volhard, 51, 53.
Vormagen, 111.
Vomit, coffee-grounds, 332.
taste of, 172, 537.
Vomiting, 462.
fæcal, 516.
hysterical, 513.
in abscess of liver, 545.
in diseases of brain, 545; spinal cord, 545.
in gastric cancer, 331, 334; catarrh, acute, 172; chronic, 210; in gastric crises, 490; dilatation, 282; ulcer, 407.
in hyperæsthesia of stomach, 479.
in hypersecretion, 505.
in injuries to uterus, 546.
in neurasthenia, 513, 537.
in operations on bladder, 546; urethra, 546.
in stricture of cardia, 72.
in phlegmonous gastritis, 183.
in phthisis, 564.
in poisoning, 189.
in pregnancy, 545.
in renal abscess, 545; colic, 545; diseases, 573.
in seasickness, 545.
nervous, 511.
of blood. See Hæmatemesis.
periodical, 514.
reflex, 544.

Waetzhold, 347.
Wagner, 51.
Waldeyer, 125, 319, 320, 321.

Walshe, 313, 317, 418.
Walton, 250.
Washing of stomach, 98.
  in poisoning, 190.
Water, filling stomach with, 82, 87.
Watson, 426.
Wegele, 104.
Weighing, systematic, 559.
Weill, 208.
Weinert, 517.
Weir, 307, 394, 413, 414, 446.
Weiss, 4, 426.
Weissgerber, 508, 509.
Welch, 313, 314, 322, 325, 329, 336, 375, 392, 397, 412, 413, 429.
Werner, 285, 575.
Wesener, 160.
West, 412.
Westphal, 216, 491.
Westphalen, 169, 203, 204, 255, 508.
Widal, 391.
Wiederhofer, 213, 281.
Wiesner, 8.
Wild, 236.
Wilkens, 503.
Wikinson, 313.
Wilks, 390.
Williams, 402.
Willigk, 433.
Wilson, 425.
Windthier, 523.
Winkhaus, 295.
Winter, 27, 49.
Winternitz, 305.
Wirbelweh, 494.
Witosowski, 398.
Witte, 409.
Wolff, J., 575.
Wolff, L., 77, 162, 301.
Wolfram, 346.
Wölffler, 374.
Wotitzky, 80.
Wright, 73.

Yeast cells in stomach contents, 187.
Yellowly, 424.
Yeo, Burney, 242, 576.

Zabludowski, 305.
Zawadski, 45.
Zeckendorf, 527.
Zenker, 93, 94, 111
Zesas, 147.
Ziegler, 181, 376.
Ziemssen, Von, 8, 85, 105, 106, 111, 434.
Zipkin, 573.
Zweifel, 75.
Zymogen. See Pepsin and Rennet.

THE END.

PRACTICAL DIETETICS,

WITH SPECIAL REFERENCE TO DIET IN DISEASE.

By W. GILMAN THOMPSON, M. D.,

Professor of Materia Medica, Therapeutics, and Clinical Medicine in the University of the City of New York; Visiting Physician to the Presbyterian and Bellevue Hospitals, New York.

LARGE OCTAVO, EIGHT HUNDRED PAGES, ILLUSTRATED.

Cloth, $5.00; sheep, $6.00.

SOLD ONLY BY SUBSCRIPTION.

"We commend to the critical attention of the medical profession this new and valuable work. We hesitate not to express the conviction that within the pages of this volume will be found more of explicit, reliable, and practical instruction with reference to the selection, preparation, and administration of foods appropriate to every age and condition, both in sickness and in health, than has hitherto been presented in any form to the medical profession."—*North American Practitioner.*

"The arrangement of this treatise is such that a busy practitioner can turn in a moment to a dietary which is adapted to any disease he may have under treatment and there find specific directions. We commend the book to every physician, believing that its frequent use will relieve him from a part of his professional work which has in the past been most unsatisfactory both to himself and to his patient."—*Brooklyn Medical Journal.*

"This book strikes us as a very important contribution to medical literature. We are greatly mistaken if it does not meet with a very large sale. All classes of practitioners will find it of the greatest practical value to them in their daily work."—*Pacific Medical Journal.*

"This is at once the best and most exhaustive book upon this subject with which we are familiar. The best, because, in the first place, it is written by a teacher of therapeutics who knows the needs of the practicing physician, and yet who has taught in previous years as a professor of physiology all that one needs to know in regard to the principles of digestion and assimilation. For this reason the author is unusually well qualified to prepare a useful manual, but it is not until one has perused the volume that he thoroughly grasps the scope and depth of the manner in which Dr. Thompson has treated his subject."—*Therapeutic Gazette.*

"Without any exception we believe this work to be one of the best, if not the best, for practical usefulness that has issued from any press by any author in the last ten years. It is particularly useful because it supplies a vacancy in the library which every physician finds whenever he has a case to treat, and where diet occupies a part in the treatment and the recuperation of the patient. . . . It is complete in every department, each chapter being a model of conciseness and perfectness. With a book like this at hand, many a day's sickness will be prevented by the attending physician being able to prescribe a proper diet."—*Medical Current.*

D. APPLETON AND COMPANY, NEW YORK.

REFERENCE-BOOK OF PRACTICAL THERAPEUTICS.

BY VARIOUS AUTHORS.

Edited by FRANK P. FOSTER, M. D.,

Editor of "The New York Medical Journal" and of Foster's "Encyclopædic Medical Dictionary."

In two large 8vo volumes. Sold only by subscription.

THIS work is intended as a ready-reference book, in which the physician can find the most recent information concerning the uses and application of remedies; their indications and counter-indications; the various conditions in which they are indicated; the forms in which drugs are best used, their doses, and the methods of administration.

"It is essentially a book for the practitioner, and is an up-to-date work of reference. Only so much of the physiological properties of drugs, their chemical, mineralogical, botanical, and zoölogical relations as are of direct bearing on their use in practice have been considered in the compilation of this work. . . . The ambitious physician will be pleased with this work."—*Canadian Medical Record.*

"With the second volume this excellent work is completed, and is rendered immediately available, by means of the general index and index of diseases and remedies, as a book of therapeutic reference. A supplement of nearly fifty pages bears witness to the rapid strides in medical science, since it is filled chiefly with matter relating to knowledge acquired since the appearance of the first volume. The work is well printed and well bound, and the brief articles on every subject relating to the treatment of disease are excellently written, and in the main satisfactory as to the information they impart."—*Medical Record.*

"A careful review of the second volume of this valuable work shows that there is nothing to criticise, and that the same care has been exercised by the various authors in their contributions that characterized those in the first volume. The editor has executed his difficult task well, and has added all the information that has been published in the journals on the different subjects since the original articles were written. So great has been the advance in therapeutics that it has been necessary to add an appendix, thus making the book thoroughly up to date in every particular."—*Medical Sentinel.*

D. APPLETON AND COMPANY, NEW YORK.

A TREATISE ON DISEASES OF THE RECTUM, ANUS, AND SIGMOID FLEXURE.

By JOSEPH M. MATHEWS, M.D.,
OF LOUISVILLE, KY.,
PROFESSOR OF THE PRINCIPLES AND PRACTICE OF SURGERY, AND CLINICAL LECTURER ON DISEASES OF THE RECTUM, IN THE KENTUCKY SCHOOL OF MEDICINE, ETC.

With Six Chromolithographs and numerous Illustrations in the Text.

SECOND EDITION, REVISED.

8vo, 537 pages. Cloth binding, $5.00.

SOLD ONLY BY SUBSCRIPTION.

"The author has placed before the profession the fruits of fifteen years' experience as a rectal specialist. . . . A careful perusal of Mathews's work can not fail to give the practitioner all the knowledge that is desirable to successfully diagnosticate and treat any case of rectal disease that may come before him, if he possesses a modicum of the dexterity that an ordinary surgeon should have. . . . The book is rich in clinical material, and, in the writer's opinion, is the best work on this specialty yet published. The publishers have done their work well, the six chromolithographs being artistic."—*Chicago Medical Recorder.*

". . . The work is a most practical and classical presentation of the vast and varied experience of a painstaking observer and worker. The specialist will buy it and read it, otherwise he would not be progressive. The general practitioners, above all, should procure and read this book, for the reason that it will at least assist them in making a correct diagnosis; and, if they care to treat these diseases, it gives them all that is newest and best."—*Medical Mirror.*

"This book we think is decidedly original in many of its features. The author has not taken other men's opinions as his guide, for the reason that in his fifteen years' experience as a rectal specialist he has learned 'that many things that are taught are not true, and that many true things have not been taught.' He has therefore accepted as truths only those things which could be substantiated by facts, and has here recorded them. Several chapters new to books on this subject have been introduced by him, among which will be found the following: Disease in the Sigmoid Flexure, the Hysterical or Nervous Rectum, Anatomy of the Rectum in Relation to Reflexes, Antiseptics in Rectal Surgery, and a New Operation for Fistula in Ano. . . . Illustrated with six excellent colored plates and numerous cuts; clearly printed with large type, and nicely bound, it presents a most attractive appearance. We do not know of any work on the subject which more thoroughly meets our approval."—*Memphis Medical Monthly.*

D. APPLETON AND COMPANY, NEW YORK.

A TEXT-BOOK OF ANIMAL PHYSIOLOGY,

With Introductory Chapters on General Biology, and a Full Treatment of Reproduction,

For Students of Human and Comparative Medicine.

By WESLEY MILLS, M. A., M. D.,

PROFESSOR OF PHYSIOLOGY IN MCGILL UNIVERSITY AND THE VETERINARY COLLEGE, MONTREAL.

8vo. With 505 Illustrations. Cloth, $5.00; sheep, $6.00.

". . . The author has set himself a task, as announced in the preface, of trying to make the student an observer and reasoner, rather than merely to tax his memory; to acquaint him with the general truths in the broad domain of biology, rather than to overwhelm him with useless detail and burdensome statistics. None who carefully peruse his work can fail to recognize that the subject has been successfully presented in accordance with this plan. . . . The general merit of the work easily places it on a par with any text-book yet written for beginners in this branch; and the clear deductions of the difference in function and general structure between man and lower animals can not fail to give broader ideas of the whole science."—Joseph Eichberg, M. D., *Professor of Physiology in Miami Medical College, Cincinnati, Ohio.*

". . . I am pleased to accord this work my hearty indorsement, simply from the fact that it presents the subject in a new way, and, strange to say, in a manner that we wonder had not been thought of before, viz., the comparative animal physiology together with biology and embryology, together with evolution, all in a work quite suitable for a medical student. Hitherto we have been compelled to go to natural history for these matters. . . . It surely deserves a place in our literature."—J. O. Stillson, M. D., *Professor of Physiology in the Central College of Physicians and Surgeons of Indianapolis, Ind.*

"I am delighted with Dr. Mills's book, the plan of which is excellent, and the details well worked out. It will give students in human physiology a new insight into the *relations* of the subject."—William Osler, M. D., *Professor of Physiology in Johns Hopkins University.*

". . . It fills a gap in the works on physiology hitherto vacant, and I commend it cordially as an excellent work."—Robert Reyburn, M. D., *Professor of Physiology in the Medical Department of Howard University, Washington, D. C.*

"As a text-book for students this work will undoubtedly take a high place, not altogether because it is a succinct and clear record of the latest knowledge in animal physiology, but also on account of its being founded on the true principles of teaching. Especial care is taken to point out what is really known; to separate the known from the unknown; to show what directions our investigations must take in order that our knowledge may increase. The work is well printed and profusely illustrated, and reflects great credit on the publishers."—*Montreal Medical Journal.*

D. APPLETON AND COMPANY, NEW YORK.

June, 1900.

MEDICAL

AND

HYGIENIC WORKS

PUBLISHED BY

D. APPLETON AND COMPANY, 72 Fifth Avenue, New York.

AULDE (JOHN). The Pocket Pharmacy, with Therapeutic Index. A *résumé* of the Clinical Applications of Remedies adapted to the Pocket-case, for the Treatment of Emergencies and Acute Diseases. 12mo. Cloth, $2.00.

BAILEY (PEARCE). Accident and Injury: Their Relations to Diseases of the Nervous System. 8vo, 430 pages. With 55 Illustrations. Cloth, $5.00; sheep, $6.00. (*Sold only by subscription.*)

BARKER (LEWELLYS F.). The Nervous System and its Constituent Neurones. Designed for the Use of Practitioners of Medicine and of Students of Medicine and Psychology. 8vo, 1122 pages. With Two Colored Plates and 676 Illustrations in the Text. Cloth, $6.00.

BARTHOLOW (ROBERTS). A Treatise on Materia Medica and Therapeutics **Tenth edition.** Revised, enlarged, and adapted to "The New Pharmacopœia." 8vo. Cloth, $5.00; sheep, $6.00.

BARTHOLOW (ROBERTS). A Treatise on the Practice of Medicine, for the Use of Students and Practitioners. **Seventh edition,** revised and enlarged. 8vo. Cloth, $5.00; sheep, $6.00.

BARTHOLOW (ROBERTS). On the Antagonism between Medicines and between Remedies and Diseases. Being the Cartwright Lectures for the Year 1880. 8vo. Cloth, $1.25.

BASTIAN (H. CHARLTON). Aphasia, and Other Speech Defects. 8vo, 366 pages. With Illustrations. Cloth, $4.00.

BASTIAN (H. CHARLTON). Paralyses: Cerebral, Bulbar, and Spinal. A Manual of Diagnosis for Students and Practitioners. With 136 Illustrations. Small 8vo, 671 pages. Cloth, $4.50.

BASTIAN (H. CHARLTON). Paralysis from Brain Disease in its Common Forms. With Illustrations. 12mo, 340 pages. Cloth, $1.75.

BERKLEY (HENRY J.). A Treatise on Mental Diseases. 8vo. Illustrated. (*In press.*)

BILLROTH (THEODOR). General Surgical Pathology and Therapeutics. A Text-Book for Students and Physicians. Translated from the tenth German edition, by special permission of the author, by Charles E. Hackley, M. D. **Fifth American edition, revised and enlarged.** 8vo. Cloth, $5.00; sheep, $6.00.

BOYCE (RUBERT). A Text-Book of Morbid Histology. For Students and Practitioners. With 130 Colored Illustrations. Cloth, $7.50.

BRAMWELL (BYROM). Diseases of the Heart and Thoracic Aorta. Illustrated with 226 Wood-Engravings and 68 Lithograph Plates, showing 91 Figures; in all, 317 Illustrations. 8vo. Cloth, $8.00; sheep, $9.00.

BRYANT (JOSEPH D.). A Manual of Operative Surgery. **Third edition, revised and enlarged.** 793 Illustrations. 2 vols., 8vo. Cloth, $5.00; sheep, $6.00.

BURT (STEPHEN S.). Exploration of the Chest in Health and Disease. 8vo, 210 pages. With Illustrations. Cloth, $1.50.

CAMPBELL (F. R.). The Language of Medicine. A Manual giving the Origin, Etymology, Pronunciation, and Meaning of the Technical Terms found in Medical Literature. 8vo. Cloth, $3.00.

CARMICHAEL (JAMES). Disease in Children. A Manual for Students and Practitioners. Illustrated with Thirty-one Charts. 12mo, 591 pages. (STUDENTS' SERIES.) Cloth, $3.00.

CHAUVEAU (A.). The Comparative Anatomy of Domesticated Animals. Revised and enlarged, with the co-operation of S. Arloing, Director of the Lyons Veterinary School. Second English edition. Translated and edited by George Fleming, C. B., LL. D., F. R. C. V. S. 8vo, 1084 pages, with 585 Illustrations. Cloth, $7.00.

CORNING (J. L.). Brain Exhaustion, with some Preliminary Considerations on Cerebral Dynamics. Crown 8vo. Cloth, $2.00.

CORNING (J. L.). Local Anæsthesia in General Medicine and Surgery. Being the Practical Application of the Author's Recent Discoveries. With Illustrations. Small 8vo. Cloth, $1.25.

CURRIER (ANDREW F.). The Menopause. A Consideration of the Phenomena which occur to Women at the Close of the Child-bearing Period, with Incidental Allusions to their Relationship to Menstruation. Also a Particular Consideration of the Premature (especially the Artificial) Menopause. 12mo, 284 pages. Cloth, $2.00.

DAVIDSON (ANDREW). Geographical Pathology: An Inquiry into the Geographical Distribution of Infective and Climatic Diseases. 2 vols. 8vo. Cloth, $7.00.

DENCH (E. B.). Diseases of the Ear. A Text-Book for Practitioners and Students of Medicine. With 8 Colored Plates and 152 Illustrations in the text. **Second edition, revised.** 8vo. Cloth, $5.00; sheep, $6.00.

DEXTER (FRANKLIN). The Anatomy of the Peritonæum. 12mo. With 39 colored Illustrations. Cloth, $1.50.

DOTY (ALVAH H.). A Manual of Instruction in the Principles of Prompt Aid to the Injured. Including a Chapter on Hygiene and the Drill Regulations for the Hospital Corps, U. S. A. Designed for Military and Civil Use. **Third edition, revised and enlarged.** 121 Illustrations. 12mo. Cloth, $1.50.

EVANS (GEORGE A.). Hand-Book of Historical and Geographical Phthisiology. With Special Reference to the Distribution of Consumption in the United States. 8vo. Cloth, $2.00.

EWALD (C. A.). The Diseases of the Stomach. Second American edition, translated from the third German edition, by Morris Manges, A. M., M. D., Attending Physician to the Outdoor Department, Mount Sinai Hospital, New York City. 8vo. With Illustrations. 612 pages. Cloth, $5.00; sheep, $6.00. (*Sold only by subscription.*)

FLINT (AUSTIN). Medical Ethics and Etiquette. Commentaries on the National Code of Ethics. 12mo. Cloth, 60 cents.

FLINT (AUSTIN). Medicine of the Future. An Address prepared for the Annual Meeting of the British Medical Association in 1886. With Portrait of Dr. Flint. 12mo. Cloth, $1.00.

FLINT (AUSTIN, JR.). Text-Book of Human Physiology; designed for the Use of Practitioners and Students of Medicine. Illustrated with three hundred and sixteen Woodcuts and Two Plates. **Fourth edition, revised.** Imperial 8vo. Cloth, $6.00; sheep, $7.00.

FLINT (AUSTIN, JR.). The Physiological Effects of Severe and Protracted Muscular Exercise; with Special Reference to its Influence upon the Excretion of Nitrogen. 12mo. Cloth, $1.00.

FLINT (AUSTIN, JR.). The Source of Muscular Power. Arguments and Conclusions drawn from Observation upon the Human Subject under Conditions of Rest and of Muscular Exercise. 12mo. Cloth, $1.00.

FLINT (AUSTIN, JR.). Physiology of Man. Designed to represent the Existing State of Physiological Science as applied to the Functions of the Human Body. Complete in 5 vols., 8vo. Per vol., cloth, $4.50; sheep, $5.50.

*** Vols. I and II can be had in cloth and sheep binding; Vol. III in sheep only. Vol. IV is at present out of print.

FLINT (AUSTIN, JR.). Manual of Chemical Examinations of the Urine in Disease; with Brief Directions for the Examination of the Most Common Varieties of Urinary Calculi. Revised edition. 12mo. Cloth, $1.00.

FOSTER (FRANK P.). Illustrated Encyclopædic Medical Dictionary: Being a Dictionary of the Technical Terms used by Writers on Medicine and the Collateral Sciences in the Latin, English, French, and German Languages. The work consists of Four Volumes, and is sold in Parts; Three Parts to a Volume. (*Sold only by subscription.*)

FOSTER (FRANK P.). A Reference-Book of Practical Therapeutics, by various writers. In Two Volumes. Edited by Frank P. Foster, M. D., Editor of The New York Medical Journal. Cloth, $5.00; sheep, $6.00; half morocco, $6.50, each volume. (*Sold only by subscription.*)

FOURNIER (ALFRED). Syphilis and Marriage. Translated by P. Albert Morrow, M. D. 8vo. Cloth, $2.00; sheep, $3.00.

FRIEDLANDER (CARL). The Use of the Microscope in Clinical and Pathological Examinations. **Second edition,** enlarged and improved, with a Chromolithograph Plate. Translated, with the permission of the author, by Henry C. Coe, M. D. 8vo. Cloth, $1.00.

FUCHS (ERNEST). Text-Book of Ophthalmology. With 178 Woodcuts. **Second American edition,** revised from the seventh enlarged German edition. By A. Duane, M. D. 8vo. With numerous Illustrations. Cloth, $5.00; sheep, $6.00. (*Sold only by subscription.*)

GARMANY (JASPER J.). Operative Surgery on the Cadaver. With Two Colored Diagrams showing the Collateral Circulation after Ligatures of Arteries of Arm, Abdomen, and Lower Extremity. Small 8vo. Cloth, $2.00.

GIBSON–RUSSELL. Physical Diagnosis: A Guide to Methods of Clinical Investigation. By G. A. Gibson, M. D., and William Russell, M. D. With 101 Illustrations. 12mo. (STUDENTS' SERIES.) Cloth, $2.50.

GOULEY (JOHN W. S.). Diseases of the Urinary Apparatus. Part I. Phlegmasic Affections. Being a Series of Twelve Lectures delivered during the autumn of 1891. With an Addendum on Retention of Urine from Prostatic Obstruction in Elderly Men. Cloth, $1.50.

GROSS (SAMUEL W.). A Practical Treatise on Tumors of the Mammary Gland. Illustrated. 8vo. Cloth, $2.50.

GRUBER (JOSEF). A Text-Book of the Diseases of the Ear. Translated from the second German edition by special permission of the author, and edited by Edward Law, M. D., and Coleman Jewell, M. D. With 165 Illustrations and 70 Colored Figures on Two Lithographic Plates. 8vo. Cloth, $6.50; sheep, $7.50.

HAMMOND (W. A.). A Treatise on Diseases of the Nervous System. With the Collaboration of Graeme M. Hammond, M. D. With one hundred and eighteen Illustrations. **Ninth edition,** with corrections and additions. 8vo. Cloth, $5.00; sheep, $6.00.

HAMMOND (W. A.). A Treatise on Insanity, in its Medical Relations. 8vo. Cloth, $5.00; sheep, $6.00.

HAMMOND (W. A.). Clinical Lectures on Diseases of the Nervous System. Delivered at Bellevue Hospital Medical College. Edited by T. M. B. Cross. M. D. 8vo. Cloth, $3.50.

HIRT (LUDWIG). The Diseases of the Nervous System. A Text-Book for Physicians and Students. With an Introduction by William Osler, M. D., F. R. C. P. **Second American edition,** revised from the latest enlarged German edition. 8vo, 671 pages. With 178 Illustrations. Cloth, $5.00; sheep, $6.00. (*Sold only by subscription.*)

HOFFMANN-ULTZMANN. Analysis of the Urine, with Special Reference to Diseases of the Urinary Apparatus. By M. B. Hoffmann, Professor in the University of Grätz, and R. Ultzmann, Tutor in the University of Vienna. **Third edition, revised and enlarged.** 8vo. Cloth, $2.00.

HOLT (L. EMMETT). The Diseases of Infancy and Childhood. 8vo. Cloth, $6.00; sheep, $7.00; half morocco, $7.50. (*Sold only by subscription.*)

HOLT (L. EMMETT). The Care and Feeding of Children. A Catechism for the Use of Mothers and Children's Nurses. **Second edition.** 16mo. 108 pages. Cloth, 50 cents.

HOWE (JOSEPH W.). Emergencies, and how to treat them. **Fourth edition,** revised. 8vo. Cloth, $2.50.

HOWE (JOSEPH W.). The Breath, and the Diseases which give it a Fetid Odor. With Directions for Treatment. **Second edition,** revised and corrected. 12mo. Cloth, $1.00.

HUEPPE (FERDINAND). The Methods of Bacteriological Investigation. Written at the request of Dr. Robert Koch. Translated by Hermann M. Biggs, M. D. Illustrated. 8vo. Cloth, $2.50.

JACCOUD (S.). The Curability and Treatment of Pulmonary Phthisis. Translated and edited by Montagu Lubbock, M. D. 8vo. Cloth, $4.00.

KELLY (HOWARD A.). Operative Gynæcology. In two large 8vo volumes. With 24 Plates and over 550 original Illustrations. Cloth, $15.00; half morocco, $17.00. (*Sold only by subscription.*)

KEYES (E. L.). A Practical Treatise on Genito-Urinary Diseases, including Syphilis. Being a new edition of a work with the same title by Van Buren and Keyes. **Second edition.** Almost entirely rewritten. With Illustrations. 8vo. Cloth, $5.00; sheep, $6.00.

KEYES (E. L.). The Tonic Treatment of Syphilis, including Local Treatment of Lesions. **Second edition.** 8vo. Cloth, $1.00.

LORING (EDWARD G.). A Text-Book of Ophthalmoscopy.

Part I. The Normal Eye, Determination of Refraction, and Diseases of the Media. With 131 Illustrations and 4 Chromolithographs. 8vo. Buckram, $5.00.

LORING (EDWARD G.). A Text-Book of Ophthalmoscopy.

Part II. Diseases of the Retina, Optic Nerve, and Choroid: their Varieties and Complications. The manuscript of this volume, which the author finished just prior to his death, has been thoroughly edited and revised by F. B. Loring, M. D., of Washington, D. C., and is now issued in the same style as the first volume. Profusely illustrated. Part II, buckram, $5.00. Two Parts, buckram, $10.00.

LUSK (WILLIAM T.). The Science and Art of Midwifery. With 246 Illustrations. **Fourth edition, revised and enlarged.** 8vo. Cloth, $5.00; sheep, $6.00.

MARCY (HENRY O.). The Anatomy and Surgical Treatment of Hernia. 4to, with about sixty full-page Heliotype and Lithographic Reproductions from the Old Masters, and numerous Illustrations in the Text. *(Sold only by subscription.)*

MATHEWS (JOSEPH M.). A Treatise on Diseases of the Rectum, Anus, and Sigmoid Flexure. 8vo. With six Chromolithographs, and Illustrations in the text. **Second edition.** *(Sold only by subscription.)*

MILLS (WESLEY). A Text-Book of Animal Physiology, with Introductory Chapters on General Biology and a full Treatment of Reproduction for Students of Human and Comparative Medicine. 8vo. With 505 Illustrations. Cloth, $5.00; sheep, $6.00.

MILLS (WESLEY). A Text-Book of Comparative Physiology. For Students and Practitioners of Veterinary Medicine. Small 8vo. Cloth, $3.00.

MORROW (PRINCE A.). A System of Genito-Urinary Diseases, Syphilology, and Dermatology. By Various Authors. In Three Volumes, beautifully illustrated. Vol. I. Genito-urinary Diseases. Vol. II. Syphilography. Vol. III. Dermatology. *(Sold only by subscription.)*

THE NEW YORK MEDICAL JOURNAL (Weekly). Edited by Frank P. Foster, M. D. Terms, $5.00 per annum.

Binding Cases, cloth, 50 cents each.

"Self-Binder" (this is used for temporary binding only), 90 cents.

General Index, from April, 1865, to June, 1876 (23 vols.). 8vo. Cloth, 75 cts.

NIGHTINGALE (FLORENCE). Notes on Nursing. 12mo. Cloth, 75 cents.

OSLER (WILLIAM). Lectures on Angina Pectoris and Allied States. Small 8vo. Illustrated. Cloth, $1.50.

OSLER (WILLIAM). Lectures on the Diagnosis of Abdominal Tumors. Small 8vo. Illustrated. Cloth, $1.50.

OSLER (WILLIAM). The Principles and Practice of Medicine. Designed for the Use of Practitioners and Students of Medicine. **Third edition, revised and enlarged.** Cloth, $5.50; sheep, $6.50; half morocco, $7.00. *(Sold only by subscription.)*

PELLEW (C. E.). A Manual of Practical Medical Chemistry. 12mo. With Illustrations. Cloth, $2.50.

PHELPS (CHARLES). Traumatic Injuries of the Brain and its Membranes. With a Special Study of Pistol-Shot Wounds of the Head in their Medico-Legal and Surgical Relations. 8vo, 582 pages. With forty-nine Illustrations. **Second edition.** Cloth, $5.00. *(Sold only by subscription.)*

PIFFARD (HENRY G.). A Practical Treatise on Diseases of the Skin. By Henry G. Piffard, A. M., M. D., assisted by Robert M. Fuller, M. D. With fifty full-page Original Plates and thirty-three Illustrations in the Text. 4to. (*Sold only by subscription.*)

POMEROY (OREN D.). The Diagnosis and Treatment of Diseases of the Ear. With One Hundred Illustrations. **Second edition,** revised and enlarged. 8vo. Cloth, $3.00.

POORE (C. T.). Osteotomy and Osteoclasis, for the Correction of Deformities of the Lower Limbs. 50 Illustrations. 8vo. Cloth, $2.50.

QUAIN (RICHARD). A Dictionary of Medicine, including General Pathology, General Therapeutics, Hygiene, and the Diseases peculiar to Women and Children. By Various Writers. Edited by Sir Richard Quain, Bart., M. D., LL. D., etc.; assisted by Frederick Thomas Roberts, M. D., B. Sc., and J. Mitchell Bruce, M. A., M. D. With an American Appendix by Samuel Treat Armstrong, Ph. D., M. D. In two volumes. (*Sold only by subscription.*)

RANNEY (AMBROSE L.). Applied Anatomy of the Nervous System, being a Study of this Portion of the Human Body from a Standpoint of its General Interest and Practical Utility, designed for Use as a Text-Book and as a Work of Reference. **Second edition, revised and enlarged.** Profusely illustrated. 8vo. Cloth, $5.00; sheep, $6.00.

ROBERTS (JOHN B.). Notes on the Modern Treatment of Fractures. 162 pages. With 39 Illustrations. Cloth, $1.50.

ROSCOE-SCHORLEMMER. Treatise on Chemistry.

Vol. 1. Non-Metallic Elements. 8vo. Cloth, $5.00.

Vol. 2. Part I. Metals. 8vo. Cloth, $3.00.

Vol. 2. Part II. Metals. 8vo. Cloth, $3.00.

Vol. 3. Part I. The Chemistry of the Hydrocarbons and their Derivatives. 8vo. Cloth, $5.00.

Vol. 3. Part II. The Chemistry of the Hydrocarbons and their Derivatives. 8vo. Cloth, $5.00.

Vol. 3. Part III. The Chemistry of the Hydrocarbons and their Derivatives. 8vo. Cloth, $3.00.

Vol. 3. Part IV. The Chemistry of the Hydrocarbons and their Derivatives. 8vo. Cloth, $3.00.

Vol. 3. Part V. The Chemistry of the Hydrocarbons and their Derivatives. 8vo. Cloth, $3.00.

SAYRE (LEWIS A.). Practical Manual of the Treatment of Club-Foot. **Fourth edition, enlarged and corrected.** 12mo. Cloth, $1.25.

SAYRE (LEWIS A.). Lectures on Orthopedic Surgery and Diseases of the Joints, delivered at Bellevue Hospital Medical College. **New edition,** illustrated with 324 Engravings on Wood. 8vo. Cloth, $5.00; sheep, $6.00.

SCHULTZE (B. S.). The Pathology and Treatment of Displacements of the Uterus. Translated from the German by Jameson J. Macan, M. A., etc.; and edited by Arthur V. Macan, M. B., etc. With one hundred and twenty Illustrations. 8vo. Cloth, $3.50.

SHIELD (A. MARMADUKE). Surgical Anatomy for Students. 12mo. (STUDENTS' SERIES.) Cloth, $1.75.

SHOEMAKER (JOHN V.). A Text-Book of Diseases of the Skin. Six Chromolithographs and numerous Engravings. **Third edition,** revised and enlarged. 8vo. Cloth, $5.00; sheep, $6.00.

SHURLY (ERNEST L.). A Treatise on the Diseases of the Nose and Throat. 8vo. Illustrated. (*In press.*)

SIMS (J. MARION). The Story of my Life. Edited by his Son, H. Marion-Sims, M. D. With Portrait. 12mo. Cloth, $1.50.

SKENE (ALEXANDER J. C.). A Text-Book on the Diseases of Women. Illustrated with two hundred and fifty-four Illustrations, of which one hundred and sixty-five are original, and nine chromolithographs. Third edition. 8vo. (*Sold only by subscription.*)

SKENE (ALEXANDER J. C.). Medical Gynecology. A Treatise on the Diseases of Women from the Standpoint of the Physician. 8vo. With Illustrations. Cloth, $5.00.

SKENE (ALEXANDER J. C.). Electro-Hæmostasis in Operative Surgery. Being a work supplementary to his Treatise on the Diseases of Women. 8vo. Illustrated. Cloth, $2.50.

STEINER (JOHANN). Compendium of Children's Diseases. A Hand-Book for Practitioners and Students. Translated from the second German edition, by Lawson Tait. 8vo. Cloth, $3.50; sheep, $4.50.

STEVENS (GEORGE T.) Functional Nervous Diseases: Their Causes and their Treatment. Memoir for the Concourse of 1881–1883, Académie Royal de Médecine de Belgique. With a Supplement, on the Anomalies of Refraction and Accommodation of the Eye, and of the Ocular Muscles. Small 8vo. With six Photographic Plates and twelve Illustrations. Cloth, $2.50.

STONE (R. FRENCH). Elements of Modern Medicine, including Principles of Pathology and of Therapeutics, with many Useful Memoranda and Valuable Tables of Reference. Accompanied by Pocket Fever Charts. Designed for the Use of Students and Practitioners of Medicine. In wallet-book form, with pockets on each cover for Memoranda, Temperature Charts, etc. Roan, tuck, $2.50.

STRECKER (ADOLPH). Short Text-Book of Organic Chemistry. By Dr. Johannes Wislicenus. Translated and edited, with Extensive Additions, by W. H. Hodgkinson and A. J. Greenaway. 8vo. Cloth, $5.00.

STRÜMPELL (ADOLPH). A Text-Book of Medicine, for Students and Practitioners. Translated, by permission, from the sixth German edition, by Herman F. Vickery, A. B., M. D., Instructor in Clinical Medicine, Harvard Medical School, etc., and Philip Coombs Knapp, Physician to Outpatients with Diseases of the Nervous System, Boston City Hospital, etc. With Editorial Notes by Frederick C. Shattuck, A. M., M. D., Jackson Professor of Clinical Medicine, Harvard Medical School, etc. Second American edition. With 111 Illustrations. 8vo, 981 pages. Cloth, $6.00; sheep, $7.00.

THAYER (WILLIAM SYDNEY). Lectures on the Malarial Fevers. With nineteen Charts and three Lithographic Plates showing the Parasite of Tertian, Quotidian, and Æstivo-Autumnal Fevers. Small 8vo, 326 pages. Cloth, $3.00.

THOMAS (T. GAILLARD). Abortion and its Treatment, from the Standpoint of Practical Experience. A Special Course of Lectures delivered before the College of Physicians and Surgeons, New York, Session of 1889–'90. From Notes by P. Brynberg Porter, M. D. Revised by the Author. 12mo. Cloth, $1.00.

THOMPSON (W. GILMAN). Practical Dietetics, with Special Reference to Diet in Disease. 8vo. Cloth, $5.00. (*Sold only by subscription.*)

THOMSON (J. ARTHUR). Outlines of Zoölogy. With thirty-two full-page Illustrations. 12mo. (STUDENTS' SERIES.) Cloth, $3.00.

TILLMANNS (HERMANN). A Text-Book of Surgery. In three volumes. Vol. I. GENERAL SURGERY AND SURGICAL PATHOLOGY. General Rules governing Operations and the Application of Dressings. Translated from the third German edition by John Rogers, M. D., assisted by Benjamin T. Tilton, M. D., New York. Edited by Lewis A. Stimson, M. D., Professor of Surgery in the University of the City of New York, Medical Department. 8vo. With 441 Illustrations. Vol. II. REGIONAL SURGERY. With 417 Illustrations. Vol. III. REGIONAL SURGERY. Translated from the fourth German edition by Benjamin T. Tilton, M. D. Edited by Lewis A. Stimson, M. D. 8vo. With 417 Illustrations. Each volume, cloth, $5.00; sheep, $6.00. (*Sold only by subscription.*)

ULTZMANN (ROBERT). Pyuria, or Pus in the Urine, and its Treatment. Translated by permission, by Dr. Walter B. Platt. 12mo. Cloth, $1.00.

VAN BUREN (W. H.). Lectures upon Diseases of the Rectum, and the Surgery of the Lower Bowel, delivered at Bellevue Hospital Medical College. **Second edition, revised and enlarged.** 8vo. Cloth, $3.00; sheep, $4.00.

VAN BUREN (W. H.). Lectures on the Principles and Practice of Surgery. Delivered at Bellevue Hospital Medical College. Edited by Lewis A. Stimson, M. D. 8vo. Cloth, $4.00; sheep, $5.00.

VON ZEISSL (HERMANN). Outlines of the Pathology and Treatment of Syphilis and Allied Venereal Diseases. **Second edition,** revised by Maximilian von Zeissl. Authorized edition. Translated, with Notes, by H. Raphael, M. D. 8vo. Cloth, $4.00; sheep, $5.00.

WEBBER (S. G.). A Treatise on Nervous Diseases: Their Symptoms and Treatment. A Text-Book for Students and Practitioners. 8vo. Cloth, $3.00.

WEEKS-SHAW (CLARA S.). A Text-Book of Nursing. For the Use of Training-Schools, Families, and Private Students. Second edition, revised and enlarged. 12mo. With Illustrations, Questions for Review and Examination, and Vocabulary of Medical Terms. 12mo. Cloth, $1.75.

WORCESTER (A.). Monthly Nursing. **Second edition, revised.** Cloth, $1.25.

WYETH (JOHN A.). A Text-Book on Surgery: General, Operative, and Mechanical. Profusely illustrated. **Third edition, revised and enlarged.** 8vo. (*Sold only by subscription.*)

RC816
Ewald
Diseases of the Stomach
10/29/28
Ewi
1900
Annex
Annex