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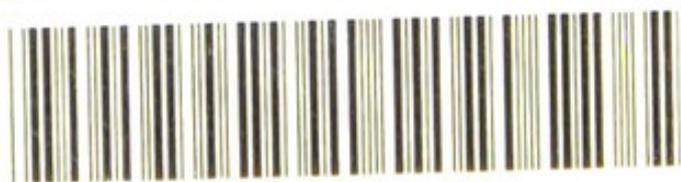
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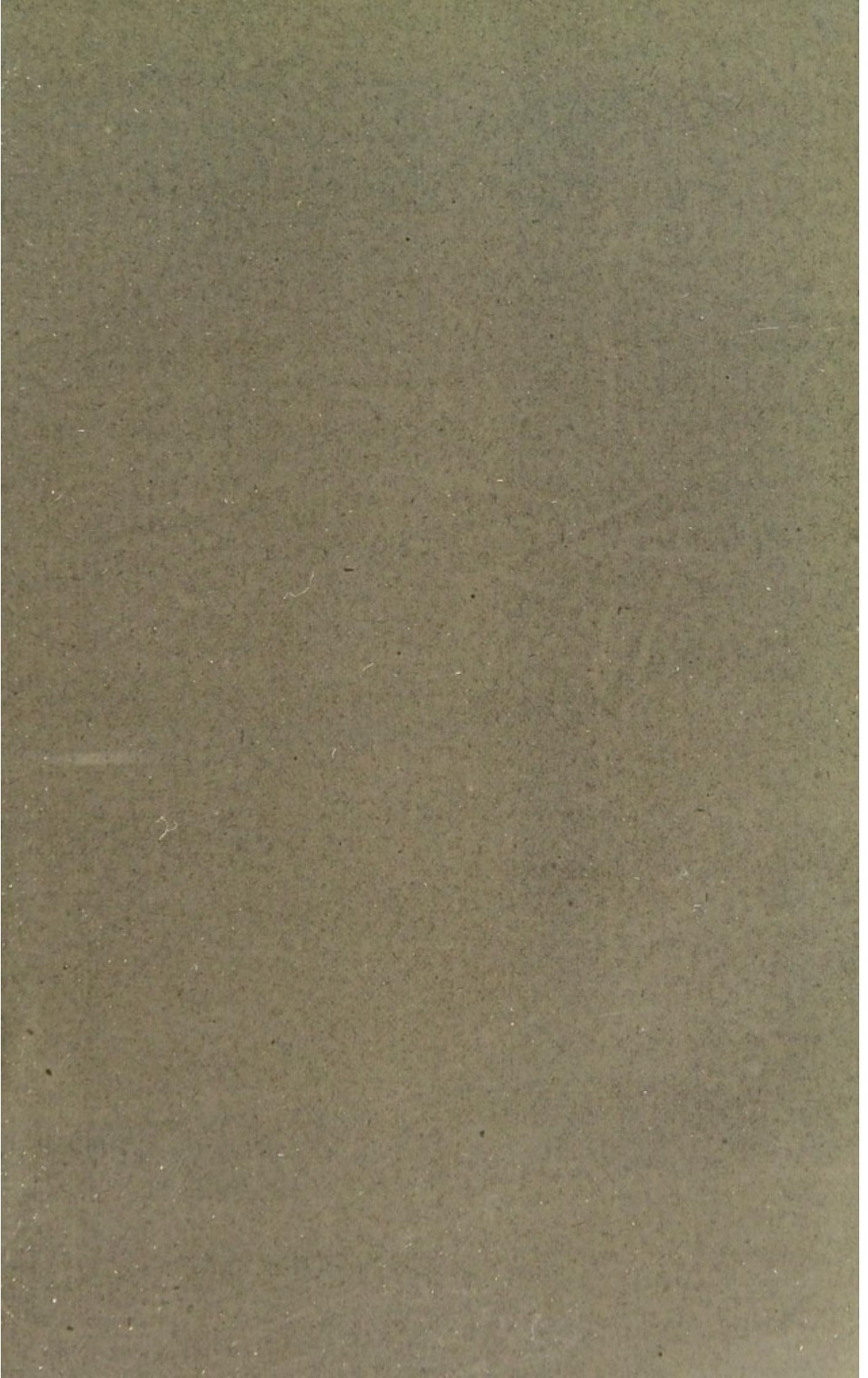


INDIGESTION

GEORGE HERSCHELL



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INDIGESTION:

*A MANUAL OF THE DIAGNOSIS AND MODERN
TREATMENT OF THE DIFFERENT VARIETIES
OF DYSPEPSIA.*

BY

GEORGE HERSCHELL, M.D. LOND.



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PREFACE.

THE object which I have in view in writing this book is to present, in a form sufficiently concise and methodical to meet the requirements of students and practitioners of medicine, a résumé of the more important points in the diagnosis and treatment of indigestion.

Unfortunately, a large proportion of the most recent information on this subject is scattered through journals, or exists in the form of isolated monographs, and is thus not immediately available when wanted in practice.

I therefore venture to hope that the present work will supply a distinct want.

In its preparation I have not confined myself to my own experience, but have freely availed myself of the most recent English and Continental writings. I have attempted invariably to acknowledge the source from which any fact has been obtained, and if I have failed in any instance to do so, the omission has been purely accidental and unin-

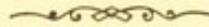
tentional. And in order to increase as far as may be the practical utility of this volume, I have appended a list of all the authorities referred to in the text, and have endeavoured to make the index as full and complete as possible.

I have purposely avoided the introduction of reports of cases, as in my opinion they would detract from the value of this book as a concise clinical manual.

GEORGE HERSCHELL.

5, West Street,
Finsbury Circus, E.C.
Oct. 1st, 1891.

INDIGESTION.



CHAPTER I.

THE PROCESS OF NORMAL DIGESTION.

Food stuffs—Saliva—The diastatic ferment—Gastric juice—Action of HCl—The ferments in the stomach—Stomach digestion—Digestion in the intestine—Bile—Pancreatic juice—Intestinal juice—Fæces.

IN order to understand the phenomena attending indigestion, it is absolutely essential to have a distinct idea of the process of normal digestion in the healthy human body. We shall commence, therefore, with a brief consideration of the successive changes that the food undergoes from the moment that it enters the mouth until it is either absorbed into the system or excreted from the body.

The food we eat has the twofold office of replacing tissue material that has been used up in the daily wear of the organism, and of supplying energy to the body. Some articles of diet have the one function, some the second, and some have both.

To fully comprehend the process of digestion we must consider these different substances separately, as their preparation for absorption into the system is effected respectively by different digestive fluids, and in different parts of the digestive apparatus.

For this purpose the food we eat may be conveniently divided into six classes.

1. ALBUMINOIDS.—These may be again divided into :

(a) *Albuminoids Proper*, which may be either animal or vegetable, such as egg-albumin, blood-fibrin, muscle-albumin or fibrin,* myosin, globulin, animal and vegetable casein, and legumin. To this list must be added keratin† and elastin.‡

(b) *Gelatin and Gelatin-Producing Substances*, such as connective tissue, chondrin, and bone.

(c) *Extractives*, as kreatin, kreatinin, etc.

2. FATS.

3. CARBOHYDRATES.—Starches, sugars, and their derivatives, such as the organic acids and cellulose.

4. SALTS.

5. WATER.

6. ACCESSORY FOODS, such as tea, coffee, cocoa, and alcohol.

All ordinary diets contain the first five groups variously distributed among the different common articles of food.

For example, in *meat* we shall find albumin, muscle-fibrin, fat, connective tissue, myosin; and in cooked meat gelatin, with extractives, which give the flavour or aroma.

* Although chemically identical, egg-albumin and the albumin of muscle must be distinguished from each other, as they differ physiologically. If egg-albumin be introduced into the circulation, it is very soon eliminated by the kidneys unchanged; but if serum-albumin (as found in muscles) be similarly injected, it does not reappear in the urine as such. The proteids of muscle are chiefly the globulins—myosin, myoglobulin, and a body termed myoalbumin, which is more soluble and which nearly resembles serum-albumin.

† *Keratin*, the chief constituent of the skin, nails, hair and feathers was, until recently, classed among the gelatin-yielding substances. But it is distinguished from these both by the large quantity of sulphur that it contains, and by the fact that when decomposed, tyrosin appears in the product.

‡ *Elastin*, likewise, once placed in the same category, must now be removed, as on decomposition it yields a small amount of tyrosin.

In *bread* we shall have starch, gluten, sugar, and salts.

In *vegetables* we find either starch and cellulose alone, as in the potato, together with valuable salts, or vegetable-albumin, as in beans.

It may be added that the myosin, of which the bulk of the lean of meat is composed, does not exist as such during life. In the living muscle it is represented by a semi-fluid substance, which coagulates at its death into a clot, which we know chemically as myosin (Martin).

These, then, being the various food stuffs on which we live, we shall consider the changes that they undergo in passing through the alimentary canal.

IN THE MOUTH.

The first thing that happens to the food is, that it is broken up by the act of mastication, and intimately mixed with the saliva.

The saliva is the mixed secretion of the salivary and mucous glands of the mouth, and is a viscid, ropy, alkaline, opalescent fluid. The quantity secreted in the twenty-four hours has been estimated by Bidder and Schmidt at 1,000 to 2,000 grammes, and the specific gravity varies from 1.002 to 1.009, but is usually 1.004. It contains about 50 per cent. of solids, viz., epithelium, mucin, ptyalin, albumin, and salts. Its ash shows the presence of potassium, chlorine, and phosphoric acid. There is also present in mixed saliva a small quantity of *sulphocyanide of potash*, the presence of which may be ascertained either by the claret colour which it strikes with perchloride of iron, or by the property that it possesses of liberating free iodine from iodic acid, and thus turning starch-paper blue which has been moistened with this reagent.

Saliva appears to possess two functions, both of great importance.

It facilitates the act of swallowing, at the same time keeping the mouth clean from particles of food, which, if allowed to decompose, would injure the teeth. Its other action, and without doubt its most important one, is that of changing starch into maltose and grape-sugar.

This action is due to a strong and most energetic ferment called ptyalin, or, better still, salivary diastase, which is able to act upon all starchy materials, not even excepting glycogen.

By the action of ptyalin, starch is changed into maltose and a little grape-sugar. This change goes on very much quicker if the starch has been sufficiently cooked to rupture the envelopes of cellulose which enclose the starch granules, and in such case is very little slower than the action of the pancreatic juice in the same direction. The rapidity of the action, indeed, is such that after a very few seconds the mixture will begin to have the property of reducing iodine from a solution of iodine in iodide of potassium. However, before the end-product maltose is reached various intermediate substances are formed from the starch, called respectively amyloextrin, erythroextrin, and achroodextrin, which differ in their reducing power.

The first effect of the salivary or pancreatic ferment upon starch-paste is to liquefy it. If you test as soon as liquefaction has taken place you will get a pure blue with a weak iodine solution, and a very slight reaction of sugar with Fehling's solution. In a few more minutes you will get, by adding more iodine to the diluted blue solution, a deep violet colour, showing the presence of erythroextrin mixed with starch. After a few more minutes you will be unable to get the blue reaction with iodine, showing that the starch has been completely converted, but the reddish erythroextrin reaction will be very marked. After a further interval you will cease to obtain any reaction with iodine. All this time the sugar reaction goes on increasing,

and continues to increase for some time after the iodine reaction has stopped.

It is extremely probable that one of the chief uses of the salivary ferment is to liquefy the starch jelly into which we have converted our farinaceous food by cooking processes.

From the rapidity with which the diastatic ferment acts, one would on first thoughts naturally suppose that all the starch would be quickly converted into sugar. But this is evidently not the case, as on examining the stomach contents of healthy people several hours after a meal you will still get the violet iodine reaction showing the presence of unaltered starch. The arrest of the diastatic action of the salivary ferment is due to the presence of free HCl in the stomach. It has been experimentally shown that free acids in small quantity will check, and in large quantity absolutely stop this action, and the following table, taken from Boaz*, gives the quantity of the different acids which will respectively check or totally arrest the process.

	Will check the action.	Will arrest it.
Hydrochloric - - -	.07 %	.12 %
Lactic - - -	.1 %	.15 %
Butyric } - - -	.2 %	.4 to .5 %
Acetic }		

And since under normal conditions the percentage of HCl in the stomach during digestion is at least .2 per cent., the cause of the cessation of the amylolytic action is very clear.

It was formerly supposed that under the most favourable circumstances the actual change in the mouth was very slight, as it required the faintly alkaline reaction of the normal saliva for its production, and that it was immediately arrested when the food comes in contact with

* Diagnostik und Therapie der Magenkrankheiten, p. 19.

the acid gastric juice in the stomach.* But this view is now very generally abandoned, as Ewald has ascertained that the sugar-forming function of the salivary ferment continues for ten minutes after the food has reached the stomach, and V. den Velden maintains that this process continues there from half to one hour. The saliva also probably acts by materially facilitating the precisely similar action of the pancreatic juice, when the food has left the stomach and passed into the small intestine. For one may readily imagine that it will be far easier for the alkaline pancreatic juice to continue an action which has been once started in the mouth, than to originate the same *de novo* in starch that has been thoroughly acidified by contact with the gastric juice. In support of which theory Boaz states as the result of experiments made by himself that after the diastatic action of the ptyalin has been completely arrested by contact with a .15 per cent. solution of HCl for one hour, he has succeeded in reviving it by alkalizing with a solution of sodium carbonate.

In the mouth the saliva will also feebly emulsify a little of the fat contained in the food, and will probably dissolve certain soluble ingredients of the food such as salts and sugar. On the remaining constituents of the food it has no action.

IN THE STOMACH.

Here the food will come into relation with the gastric juice.

In a pure state the gastric juice is a clear colourless acid fluid of a specific gravity varying from 1.002 to 1.003, and containing about 5 per cent. of solids. The quantity secreted in twenty-four hours has been variously estimated,

* Hammarsten, Jahresbericht über die Leistungen der ges. Medicin. Jahrg., VI., vol. i., 1871.

but is probably about 1,580 grammes. It contains free hydrochloric acid, which in conjunction with the gastric ferments produces the characteristic action upon the food. The acidity of the gastric juice varies from .1 to .22 per cent. and in dogs may reach .3 or more. It is highest at the middle period of gastric digestion, and less at the beginning and end of the process.

The hydrochloric acid is of use in five different ways.

1. It has an antiseptic action, stopping abnormal fermentation, and destroying organisms which have obtained access to the stomach by having been swallowed with the food or in other ways. This antibacillary action goes on not only in the stomach, but also in the duodenum, and perhaps in the large intestine.

The antiseptic action of the gastric juice was first pointed out by Spallanzani a hundred years ago, and the later investigations of Sieber, Schmidt, and others, have shown that it is due to the free hydrochloric acid that it contains. But it is a notable fact that this action only applies to the micro-organisms normally found in the stomach, and that it has very little influence upon pathogenic bacteria when it is only allowed to act upon them for the length of time corresponding to the duration of gastric digestion, at the temperature which obtains in the stomach, and when protected by the animal and vegetable tissues which are introduced with them into the stomach. The experiments of Strauss and Wurtz, it must be remembered, which apparently demonstrated the fact that the bacilli of tubercle, charbon, typhoid, and cholera, were destroyed by the gastric juice, were conducted at a temperature of 100° Fahr. with pure, undiluted gastric juice.

An argument in favour of the hypothesis that the hydrochloric acid in the stomach is chiefly useful as an antiseptic to prevent the occurrence of abnormal fermentations, and that digestion can go on independently of it is

found in the recent experiments of C. von Noorden.* This observer found as the result of the exact determination of the effects of stomach digestion upon food stuffs in diseased conditions, that both in cases where the hydrochloric acid was very deficient, and equally so when it was in excess, a diet of milk, eggs, white bread, raw meat, and butter, was almost completely digested. In the former case all but 7 per cent. of albumin and $4\frac{1}{2}$ per cent. of fat; in the latter case all but $8\frac{1}{2}$ per cent. of albumin and 5 per cent. of fat.

He does not, however, state whether the subjects experienced flatulent dyspepsia or not.

2. It has the power of forming active ferments out of the inactive proenzymes.

3. It regulates reflexly the peristaltic action of the walls of the stomach, and appears to act vicariously when there is a deficiency of motor impulses sent from the regulating centre.

4. It converts albumin into syntonin or acid albumin.

5. It has the power of converting cane sugar into invert sugar (dextrose and lævulose).

THE FERMENTS IN THE STOMACH.—The peptic ferments exist in the first instance as inactive bodies called proenzymes (pepsinogen), which are converted into active ferments by the agency of the HCl.

The ferments in the stomach are two in number, pepsin and the milk-curdling ferment.

Pepsin.—This has the property of changing by the help of the HCl, egg albumin or fibrin into peptone, and of taking from gelatin its power to gelatinize, changing it into what is technically termed glue peptone.

No other mineral or organic acid has the same power of converting pepsinogen into pepsin.

* Zeitschr. f. klin. Med., XVII., p. 137.

According to several observers* the secretion of the glands of the fundus of the stomach is only an inactive proenzyme which requires the action of HCl to convert it into the active pepsin before it can be utilized in the digestion of food. This pepsinogen differs from pepsin, insomuch as that whilst the latter is destroyed in a few minutes by sodium carbonate, the former is only slowly attacked, and on the other hand that pepsin is quickly destroyed by the action of carbonic acid, whilst pepsinogen is only very slowly acted upon.

The action of pepsin and hydrochloric acid together upon the food is as follows :

Albuminoids are changed first into syntonin or acid albumin, then into albumoses, and finally into peptone. According to Ott and Popoff† some of the peptone is changed subsequently into serum albumin.

The Milk-Curdling Ferment.—In the normal stomach from earliest childhood there exists a ferment, which possesses the power of precipitating casein from milk. This was isolated by Hammarsten, and will act upon milk in neutral solution. Of course, as is well known, HCl will itself throw down the casein in milk, but this ferment is quite distinct from it, and acts independently of it. It is secreted by special rennet glands in the stomach, and it is this substance which coagulates casein in the making of cheese. The neutral infusion of the rennet glands has also the power either in neutral or alkaline solutions of changing milk sugar into lactic acid. According to the investigations of Boaz and Rosenthal, the secretion of the rennet ferment

* Langley and Edkins, Pepsinogen and Pepsin. *Journ. de Phys.*, vol. VII., pp. 371-415.

Podwyssotzki, Zur Methodik der Darstellung des Pepsinextractes. *Pflüger's Archiv.*, Bd. XXXIX., s. 562-574.

Hertzen, Ueber die Entwirkung der Alkalien auf Pepsin. *Annali di Chim. e di farmac.*, Bd. VIII., 302.

† *Archiv. f. Physiol.*, 1889, 83.

commencing at the same time, increasing when the latter increases, and diminishing when it diminishes.

As regards the part played by the milk-curdling ferment in gastric digestion, we know nothing for certain. It is extremely improbable that it is the agent which actually curdles milk in the human stomach, as the acid of the gastric juice, which has the same action, would have been beforehand with it.

In addition to the peptone formation and the precipitation of casein, other actions go on to a slight extent in the stomach.

Cane sugar is changed into grape sugar (invert sugar) by the action of the HCl, and a small proportion of the fats are split up into glycerin and fatty acids. Starch and gums are not acted on.

These are really all the changes in the food which take place during its sojourn in the stomach.

The precise action upon a meal of meat and bread may be described somewhat in the following manner :

The gelatin-yielding parts of the meat, viz., the connective tissue, the white fibrous tissue, the cartilage, the matrix of bone and gristle, the structureless membranes, such as the sheathes of nerves, muscles of glands, are dissolved and peptonized. The fat globules are set free, and the muscle fibres split up into discs by the removal of the material which covers them.

The change continuing, these albuminoid materials become converted into peptone. The gluten of the bread and the protoplasmic contents of vegetable cells are also changed into peptone, while their envelopes of cellulose remain unchanged.

It is probable that while in the stomach a certain proportion of the watery solution of salts and grape-sugar are absorbed directly into the veins of the stomach, likewise in the stomach progresses *pari passu* with that of the HCl,

alcohol, and the serum albumin that it is supposed a certain proportion of the albuminoids are changed into.

Our knowledge of the power of the stomach in this direction is limited to the fact that water, salt, sugar, and peptone are absorbed by the stomach. This has been proved by the experiments of Tappeiner* and Anrep.† How much is absorbed we do not know. There have been also many controversies as to the precise method. Some suppose that crystalloids, such as salt and sugar, are absorbed by diffusion; but since we know that other substances, such as albumin, mucin, gelatin, and gums, which, being colloids, do not diffuse, are yet certainly absorbed, we are driven to the conclusion that active cellular action most probably has a great deal to do with the process.

In the digestion of meat the exact process appears to be that the hydrochloric acid converts the outer layer into acid albumin; this is dissolved off by the pepsin in the form of peptone, leaving a fresh surface ready to be again acted upon by hydrochloric acid.

From the experiments of Ewald and Boaz‡ it appears that there are three stages in digestion in the stomach.

The first continues for about fifty minutes after a meal of lean meat, and in this lactic acid alone is present. This lactic acid they believe to be simply set free from the meat, and not secreted by the stomach. If some of the contents of the stomach are examined, digestion is not found to have proceeded very far as yet, as the transverse striæ of the muscular fibres can be plainly seen. After a meal of bread and potatoes this stage lasts only about thirty minutes. Pure starch or pure albumin, when introduced

* Ueber Resorbtion im Magen. *Zeit. f. Biol.*, Bd. XVI., s. 497.

† Die Aufsaugung im Magen des Hundes. Reichert und Dubois. *Archiv.*, 1881, s. 508.

‡ Virchow's *Arch.*, CI., 1885, p. 346.

into a stomach that had been washed out, was found to produce a secretion of hydrochloric acid alone.

In the second stage, which continues up to sixty or ninety minutes after the food has been swallowed, we find that hydrochloric acid is present as well as the lactic. Digestion has now commenced in earnest, and the remains of the meat have a paler tint.

In the third stage, which is at its height two hours after the meal, hydrochloric acid alone is found in the stomach. In the case of carbohydrates, the lactic acid is apparently formed by fermentation.

Whilst these processes are going on the contents of the stomach are being subjected to a series of movements, which have for their object to further break up the masses of food, and to eject through the pylorus so much of it as has undergone solution. The movements of the stomach are of two kinds :

(1) *Rotatory* or *churning* movements, which occur periodically, and persist for several minutes at a time ; and (2) a *peristalsis*, which occurs also periodically, and which forces the food as fast as it is dissolved through the pylorus into the duodenum. These latter movements commence about a quarter of an hour after the meal has been taken, and continue for about five hours. These movements are most active at the pyloric end of the stomach, and according to Rudinger, mechanically open the pylorus by the contraction of the longitudinal muscular fibres of the stomach. As to agency by which the muscular movements of the stomach walls are induced, Brucke* believes that they are caused by the local irritation of the HCl. There is something to be said in favour of this theory, from the well-known fact that when the HCl is deficient the muscular movements are generally below the normal. Another theory is that the peristaltic movements are caused by the local con-

* Lehrbuch der Physiol., 4^o Aufl., Bd. I., s. 322.

gestion which accompanies the digestive act, and which stimulates local ganglia which act automatically on the application of such stimuli.

As regards the mechanism of the secretion of gastric juice in the stomach, Professor Sticker, by his experiments, has demonstrated the fact that the presence of the saliva in the stomach has a distinct effect in promoting the flow of gastric juice. And this is only what we should expect, as we know that an alkali in the empty stomach always causes a flow of the acid gastric juice. In a case where there was marked diminution of gastric juice, the experiment was made of introducing the whites of three eggs into the stomach, and withdrawing them after two hours. This was done twice; the first time saliva was forbidden to be swallowed, and in the second it was allowed to be swallowed freely. In the first case the albumen was very slightly digested, and the gastric juice showed very little peptonizing power; in the second case it was perfectly digested.

FERMENTATIVE PROCESSES IN THE NORMAL STOMACH.—It is a well-known fact that during normal digestion certain fermentative processes go on in the stomach without producing symptoms of any kind whatever. It is only when in excess that they become pathological.

The physiological fermentations in the stomach, each the work of a specific organism, are the following :

1. The acetic acid.
2. Butyric acid.
3. Lactic acid, and the
4. Yeast.

IN THE SMALL INTESTINES.—The chyme here comes into contact with the pancreatic juice, the bile, and the intestinal juice, all of which are alkaline, and can only act in the presence of an alkali. The acid contents of the

stomach are gradually neutralized by the alkali present, so that the food by the time it arrives at the lower part of the intestine presents an alkaline reaction.

The Pancreatic Juice is transparent, colourless, odourless, saltish to the taste, and has a strong alkaline reaction owing to the presence of sodium carbonate. It contains four ferments or enzymes, and as it will act upon the constituents of all classes of food, it is the most important digestive fluid that we possess.

1. *It converts starch into sugar*, continuing the action begun by the *ptyalin* of the saliva in the mouth. Its action, however, is much more energetic, acting upon raw, as well as upon boiled starch, the change being effected almost at once at the temperature of the body. This is called its 'diastatic action.'

Until quite recently it was thought that this action consisted of the complete change of the starch into grape-sugar (dextrose), with the formation of dextrin only as an intermediate product; but the researches of Musculus and Mering among others, have pointed out that the amount of sugar formed is but one half the weight of the starch, and that this sugar is not grape sugar, but maltose, or the sugar which exists in malted grain. All the rest is dextrin, which cannot be converted into sugar by any further action of the ferments. It is also quite certain that this dextrin and maltose are converted somehow into grape sugar before they are absorbed into the system, but the precise mechanism by which this is effected we do not know. We know it is so, because in the case of diabetic patients who cannot destroy the carbohydrates, grape sugar alone appears in the urine after starch has been eaten, and neither maltose nor dextrin can be found in the blood or in the tissues.*

2. *It forms the fats into a fine permanent emulsion.* The mechanism by which this is effected is as follows:

* Bunge, Textbook of Physiological and Pathological Chemistry.

If an ordinary neutral fat, in a perfectly fresh state, be shaken up with a solution of an alkali, no change takes place; but if the fat contains a small quantity of a fatty acid, in other words, if it is slightly rancid, it is immediately emulsified when agitated with an alkaline solution. Now, the first action of the pancreatic juice upon the fat molecule is to cause it to take up three molecules of water and split up into glycerin and fatty acids, the quantity of fat thus acted upon being a very small percentage of the whole amount present in the intestine. This action is due to the presence of a special fat-spitting ferment discovered by Bernard,* and the reason why the whole of the fat does not undergo this change is due to the fact that this ferment exists only in very small quantity in the pancreatic secretion. In most cases this decomposition of the fats begins in the stomach, but here it is effected by fermentation as the result of the agency of micro-organisms, and some observers have imagined that the change in the intestine was caused in the same manner. This, however, is disproved by Nencki's experiments,† as he found that the presence of an antiseptic will stop this change in the stomach, but not in the intestine.

When the fat thus mixed with fatty acid comes into contact with the alkaline salts contained in the pancreatic juice, the bile, and the intestinal secretion, it is immediately emulsified, and being thus finely divided, is ready to be taken up by the intestinal epithelium, and passed on into the chyle-vessels. This emulsification is very materially aided by the constant motion communicated to the chyme by the peristaltic movements of the intestine.

3. *Proteids and gelatin-yielding substances are converted into peptone*, and some of this peptone again into leucin and tyrosin. The agent in effecting this transformation is a

* Ann. de Chim. et de Physique, ser. 3, t. XXV., p. 474.

† Arch. f. exper. Path. u. Pharm., vol. XX., p. 373.

ferment named pancreatin, or trypsin, which only acts in the presence of an alkali. 'In fact, a 1 per cent. solution of sodium carbonate seems to play the same part in assisting trypsin as a .2 per cent. solution of HCl does for pepsin in gastric digestion' (Landois and Stirling).

The Bile.—The principal action of the bile is to assist in emulsifying the fat in the manner above described. If the bile is prevented from reaching the intestine by an obstruction in the duct, or by an artificial biliary fistula, more than half the fat which is eaten reappears in the excreta, which, moreover, are clay-coloured. According to Bunge, this is not entirely due, as has been supposed, to the absence of the colouring matter of the bile, but partly to the masking of the natural colour of the fæces by the fat; for if the light-gray excretion of a jaundiced person be extracted with ether, which dissolves the fat, the dark colour is again evident.

Bile increases the active functions of the epithelial cells, whose function it is to absorb the fat.* It moistens the coats of the intestine, and gives to the fæces their normal amount of water, so that they can be readily evacuated. Thus bile acts as a natural purgative, especially as it increases the peristaltic movements of the intestine.

The diastatic action of bile, if it exists, is so slight that it may be disregarded for practical purposes, and the anti-septic property which has been ascribed to it admits of another explanation; namely, that when withheld, the excess of fat above described encloses the particles of food, and, preventing them from being acted upon by pancreatic juice, allows them to become decomposed through the agency of the putrefactive organisms of the intestine.

The Intestinal Juice.—The importance of this secretion—which appears to have no action of any importance upon any form of food—its slight diastatic action on boiled starch

* Thanhoffer, Pflüger's Arch., vol. VIII., p. 406.

not manifesting itself until five hours have elapsed—lies without doubt in the very large quantity of sodium carbonate that it contains. It has, first of all, to neutralize the acids of the intestinal contents; not merely the hydrochloric acid of the gastric juice, but also the butyric and lactic acid produced by fermentation, and then, when this is accomplished, to emulsify the fats with its surplus carbonate of soda. For no emulsification of fat can possibly take place until all the acid has been thus neutralized. And Nature provides for the automatic adjustment of the amount of carbonate of soda secreted, by the law that in the human body acid secretions are increased by alkalies, and *vice versâ*. *Nature always strives to neutralize.* And just as in the stomach the presence of sodium carbonate will reflexly increase the quantity of the acid gastric juice, so the presence of acid in the intestine stimulates the reflex mechanism to pour out a copious alkaline secretion until the intestinal contents become distinctly alkaline. The alkalinity of the intestinal contents appears to also subserve another purpose. When the food leaves the stomach, the hydrochloric acid of the gastric juice is intimately mixed up with the minutest particles of food. When the sodium carbonate comes into contact with the acid, carbonic acid gas is formed, which, having its origin between the particles of food, will mechanically separate them, and thus allow the digestive juices to gain easier and more immediate access to them.

IN THE LARGE INTESTINE.—Here there is very little intestinal juice, and consequently the digestive processes proper are very slight.

All the food which is capable of absorption, and which has not been already assimilated in the small intestine, is absorbed, and the intestinal contents gradually assume a fæcal character. The powers of absorption of the large intestine are very considerable, as not only water and the

products of digestion can be thus dealt with, but also substances such as milk, unchanged fluid egg-albumin, flesh juice, and gelatin in solution, when introduced in the form of nutrient enemata. Fermentative and putrefactive processes also go on to a considerable extent in the large intestine, accompanied with the formation of gases, which will be more particularly described when we consider the subject of flatulence.

The amount of fæces is about 170 grms. in the 24 hours, and, besides 75 per cent. of water, is made up of the following substances :

1. *Materials Derived from Food.*—The residue of animal and vegetable tissues used as food, and which are either incapable of digestion, have been imperfectly masticated, or have been taken in too large quantity. Among these we find vegetable cells, muscle fibres, elastic fibres, areolar tissue, starch granules, cellulose, hairs, mucin and nuclein and crystalline needles of lime, fatty acids and casein.

2. *Formed Elements Derived from the Intestinal Canal,* such as red blood cells, leucocytes, and epithelium.

3. *Colouring Matter,* which recent investigations have shown not to consist entirely of biliary derivatives, but also of hæmatin and sulphide of iron.

4. *Products of Fermentative and Putrefactive Processes,* such as indol and skatol.

5. *Micrococci and Bacteria,* which form a considerable portion of normal fæcal matter. These are the moulds, yeasts, and fission fungi.

We may here mention the important part played by cellulose in the formation of the normal fæces. Cellulose was until recently supposed to be entirely incapable of digestion, but from the experiments of Weiske* and Knierem† it was proved that sheep digested 40 per cent.

* Zeitschr. f. Biolog., vol. VI., p. 456, 1870.

† *Ibid.*, vol. XXI., p. 67, 1885.

of the cellulose of sawdust and paper, when eaten mixed with hay, and that human beings digest from 47·3 to 62·7 per cent. of the woody fibres in carrots, cabbage and celery. Knierem, in another set of experiments upon himself, found that he digested 25·3 per cent. of the woody fibres of lettuce.

But this apparent digestion of the cellulose is not a true act of digestion, but is effected by a fermentative action, probably inaugurated by parasitic bacteria, which simply split up the cellulose into marsh gas and carbonic acid.* Cellulose, however, while being hardly of any use to the organism as food, is yet of the greatest importance, as by its mechanical stimulus it promotes the peristaltic movements of the intestine. If a herbivorous animal, such as a rabbit, be fed upon a diet from which cellulose is completely absent, motions of the bowels absolutely cease, and it dies after a short time from inflammation of the intestine.

To sum up, then, the whole subject :

Saliva contains salivary diastase or ptyalin, and converts starch into dextrin and sugar.

Gastric juice contains

Pepsin, which changes proteids into peptones in the presence of an acid ; and the

Rennet ferment which precipitates the casein of the milk.

Pancreatic juice contains

Trypsin, which changes proteids into peptones in neutral and alkaline solutions ;

Curdling ferment, which precipitates the casein of milk ;

Pancreatic diastase, changing starch into dextrin and sugar ; and an

* Hoppe-Seyler, Ber. der deutsch. chem. Ges., vol. XVI., p. 122, 1883, and Zeitschr. f. physiol. Chem., vol. X., p. 404, 1886.

Emulsive ferment, which emulsifies and saponifies the fats.

Bile assists in emulsifying the fats.

Intestinal juice, besides neutralizing the acid contents of the stomach, contains invertin, which changes cane-sugar into invert-sugar ; and perhaps a curdling ferment.

And the food, in its passage through the alimentary canal, is acted on in the following manner :

1. *The proteids* are acted on by

(a) The gastric juice.

(b) The pancreatic juice.

Peptones are formed with some leucin and tyrosin.

2. *Fats* are acted on by

(a) The pancreatic juice.

(b) The bile.

Partly split up into glycerin and fatty acids, are emulsified and saponified.

3. *The carbo-hydrates* are acted on by

(a) Saliva.

(b) Pancreatic juice.

(c) Succus entericus (very slightly).

4. *All three—proteids, fats, and carbo-hydrates—*are acted on to some extent by the putrefactive processes in the intestines.

5. *Water and salts* are unchanged.

CHAPTER II.

THE CAUSES OF INDIGESTION.

The physical basis of indigestion—Heredity—Age—Anæmia—Disturbances of the nervous system—Neurasthenia—Reflex irritations—Eye-strain—Gout—Imperfect mastication of food—Exposure to cold and wet—Excessive exercise—Excess of food—Insufficient supply of food—Improper arrangement of meals—Injudicious admixture of foods—Indigestible foods—Alcoholic excess—Jam and sweets—Tea drinking—Excessive smoking—Catarrh of stomach—Ulcer of stomach—Cancer—Bronchitis—Heart disease—Kidney disease—Disease of liver—Phthisis.

WHEN the human body is in perfect health, the process of digestion goes on unconsciously—we do not know that we have a stomach. But when the digestion of food is accompanied by pain, or other disagreeable sensations either in the region of the stomach, or reflexly in some other organ of the body, or when any of the functions of the body are perverted or disturbed, and we can trace a connection between such disturbance and the digestive act, we are said to suffer from indigestion.

The causes of indigestion may be divided into two classes :

1. The actual abnormality in the mechanism of digestion which prevents the food being properly digested, or the physical basis of indigestion.
2. The bodily cause which produces this abnormality.

For example, in the first group we place the alterations in quantity and quality of the digestive juices, and in the second, the reasons why these alterations are present.

CLASS I.—THE PHYSICAL BASIS OF INDIGESTION.

A. We may find food in the stomach in such a condition as not to be readily acted on by the gastric juice.

B. Alterations in the saliva.

1. It may be diminished in amount.
2. It may be increased in amount.
3. Its reaction may be acid.
4. Its active ingredients may be deficient.

C. Abnormalities in the muscular movements of the stomach.

1. These may be deficient.

The food will then remain longer in the stomach than it should do, and an opportunity will be afforded for abnormal fermentations to take place.

2. The muscular movements may be in excess.

In these cases the food will not remain long enough exposed to the action of the gastric juice for digestion to be properly performed.

3. The pylorus may not close properly.

This will also favour the premature passage of imperfectly-digested food into the duodenum.

4. Spasm of the pylorus may be present.

This will produce a temporary dilatation of the stomach, attended by the distressing train of symptoms described on pages 65-68. It is probably conservative, and designed to prevent the alkaline digestion in the duodenum from being stopped by an excess of acid from the stomach.

D. Abnormal dilatation of stomach.

This may be :

- (a) Primary.
- (b) Depending upon pyloric obstruction.

E. Diminution in size of stomach.

This may be caused by :

- (a) Gradual contraction of infiltrating growths.
- (b) Long-continued abstinence.
- (c) Spasmodic action of the muscular walls of the viscus.

F. Degenerative changes of the mucous membrane.

These are usually the sequelæ of long-continued chronic catarrhs, and often produce serious consequences in the form of grave disturbances in the nutrition of the patient. Pathological conditions not to be distinguished from pernicious anæmia are not unfrequently met with in practice, and which depend upon atrophy of the glandular structures of the stomach-walls. There is often thinning of all the coats of the stomach, with more or less complete atrophy of the secreting organs. Consequently the secretion of gastric juice and the absorptive power of the stomach are either diminished or else entirely absent.

It is in these cases that peptonized and pancreatized foods find their legitimate sphere in practice.

G. Alterations in the quality or quantity of the gastric juice.

- (a) The pepsin may be deficient.
- (b) The free hydrochloric acid may vary in quantity, and upon these variations a great many of the dyspepsias met with in practice depend.
- (c) The rennet ferment may be deficient.

The commonest abnormality met with in the composition of the gastric juice is a departure from the three normal stages of acidity met with during the digestion of a meal. See page 11.

1. We may find the first stage unduly prolonged.

The lactic acid, in these cases, is accompanied by volatile acids, such as butyric and acetic, and the quantity of hydro-

chloric acid is relatively small. In this form of dyspepsia there has been no error of diet, the fault is a diminished secretion of hydrochloric acid. The conversion of carbohydrates, such as sugar, into lactic acid, can only take place under certain favourable circumstances, which are only normally present in the first half hour or so of digestion. In order that the lactic acid change may take place, the amount of free hydrochloric acid in the stomach must be less than .07 per cent. As soon as it reaches this amount the formation of lactic acid ceases; and as the average quantity of free hydrochloric acid present during active digestion is as much as .25 per cent., it can be easily seen that the formation of lactic acid must soon cease. Thus we see that in the normal state of things the quantity of lactic acid formed must be very small, and any increase in it is always an evidence of disease, and shows us that free hydrochloric acid is not being secreted in normal amount.

2. The hydrochloric acid may be present in too great quantity. It is secreted in so large an amount that it immediately neutralizes the alkaline saliva, and thus stops the action of the ptyalin, which we have seen (p. 5) continues in the normal state for some time after the food has reached the stomach.

3. In the two former cases the hydrochloric acid is only secreted when food has been introduced into the stomach; but there is another class of cases in which a highly acid gastric juice is poured out when the stomach is entirely empty. This condition has been termed 'gastroxynsis,' and 'gastroxia' by Rossbach and Rosenthal respectively. It was first described by Reichmann* in 1882, and afterwards by V. den Velden,† some cases occurring in men in which the acid secretion could be drawn off between

* Berl. klin. Wochenschr., XXIV., p. 199.

† Volkmanns Samml. klin. Vorträge inn. Med., No. 96, 1886, p. 2611.

meals by a stomach-tube, and in which vomiting was a constant symptom.

It is a noteworthy fact that the quantity of free hydrochloric acid in the gastric juice exactly corresponds to the quantity necessary to prevent the development of putrefactive organisms (Bunge).

4. In certain inflammatory and catarrhal affections of the stomach the secretion of gastric juice takes place continuously, and the secretion itself contains little pepsin, is turbid, sticky, and feebly acid, sometimes even alkaline, and the walls of the stomach are coated with a thick tenacious mucus. In this case all kinds of bacteria are able to grow luxuriantly.

5. The gastric juice may be unduly diluted by an excess of liquid ingested.

H. The stomach may contain various substances taken with the food, which may mechanically interfere with digestion.

(*a*) Substances which precipitate gelatin and albumin in an insoluble form, such as tea and coffee, which form an insoluble tanno-albumin or tanno-gelatin.

(*b*) Alkalies which neutralize the acidity of the gastric juice.

(*c*) The salts of the heavy metals and concentrated solutions of common salt, magnesium, and sodium sulphates, which throw down precipitates with pepsin and peptones.

(*d*) Alcohol, which also when present above a certain percentage in the stomach, precipitates pepsin and retards digestion.

I. Alteration in the secretion of bile.

(*a*) It may be diminished.

In this case there will be imperfect digestion of fat, and constipation.

(b) It may be increased.

This will cause increased peristalsis of the intestine and consequent diarrhœa.

J. Diminution in the quantity of the pancreatic juice.

K. Abnormal fermentation in the intestine.

This may occur either as a sequel of acute gastric indigestion, where the highly acid undigested stomach contents are ejected into the duodenum, and neutralizing the alkaline juices there, ferment, as digestion is impossible in an acid medium.

Or as the result of chronic disturbance of the natural relation existing between the chyme and the duodenal juices.

L. Excess or deficiency in the peristaltic movements of the intestines.

The former will hurry the food along without allowing time for it to be properly digested.

The latter will allow it to remain until fermentative changes have taken place.

CLASS II.—THE CAUSES OF INDIGESTION AS MET WITH IN ACTUAL PRACTICE.

Having now considered the theoretical conditions which may interfere with the digestion of food, we shall proceed to the consideration of the actual causes of disturbance of the digestive functions as encountered in daily life, bearing in mind that as a rule in any given case more than one abnormality of function is the result of the exciting cause.

Causes should theoretically be divided into predisposing and exciting ones. It is impossible, however, to classify the causes of dyspepsia in this way by any hard and fast rule, as a predisposing cause may at another time be an exciting one, and *vice versâ*.

Heredity.—Certain faulty conditions of the nervous system are liable to be transmitted from parent to son. In many cases, from reasons growing out of our modern civilization, the inheritance of a faulty nervous organization is apt to show itself in defects of the digestive functions. The inordinate mental activity, the active competition and struggle for existence which characterizes the age in which we live, the haste to get rich, the disappointment of failure, all contribute to this end.

Advanced Age.—The stomach becomes weak as age advances, in common with all the other functions of the body. As a consequence of this, there is diminished excitability of the gastric nerves, with impaired muscular action of the walls of the stomach, and deficient secretion of gastric juice. Chronic structural changes are also apt to occur in advanced life; the gastric glands become atrophied, and the arteries atheromatous. There is an exception to this rule, however, in the case of many neurasthenics who, as they advance in years, lose the dyspepsia that had tormented them in their younger days.

Anæmia.—Anything which lowers the general tone of the system will act as a powerful predisposing cause of dyspepsia.

General anæmia, by producing weak action of the heart, disturbs the normal adjustment between the arterial and venous sides of the circulation; hence, in all conditions of general anæmia, there is a tendency to dyspnoea, pulmonary œdema, bronchorrhœa, special forms of liver disease, gastric catarrh, and even temporary albuminuria.

Anæmia also affects the great nutritive processes, and these in turn disturb the functional activity of all the organs of the body.

The gastric and intestinal glands are diminished in their functional activity by poor blood, and the muscular move-

ments of the stomach are retarded by weakened muscular action.

Disturbances of the Nervous System.—The alterations of function of the stomach caused by defective innervation may be either due to :

1. A general lowering of nerve-tone throughout the body.
2. A local idiopathic neurosis of the stomach.
3. Reflex irritations from other organs.

Exhaustion of the nerves of organic life, or neurasthenia, is one of the most fertile and ever-present causes of indigestion at the present day. Without a certain amount of nerve-energy, derived from the sympathetic nerves, there must necessarily be failure of the two most important conditions of digestion—muscular movements of the stomach and healthy gastric juice. This form of indigestion is often met with in the ill-fed and badly nourished. In the dyspepsia of exhaustion, the solvent power of the stomach is so diminished, that if food is forced upon the patient, it is almost certain to be followed by flatulence, headache, uneasy and painful sensations in the stomach, and sometimes diarrhœa.

The various symptoms of neurasthenia are now well known to the profession through the writings of Beard and others, and include abnormal sensations in mind and body, exhaustion, palpitation of the heart—in short, symptoms referred to nearly every organ of the body with alteration of function, and, above all, dyspepsia, often in an aggravated form. Other causes of nervous dyspepsia almost, if not quite, as important as neurasthenia, we may mention : hysteria, anæmia and chlorosis, functional disorders of the sexual organs, sexual exhaustion (Beard), diseases peculiar to women, pregnancy, floating kidney (Senator), malaria, Leube's and Basedow's diseases.

One also meets with disturbances of gastric function,

unattended by local disease in the different reflex irritations.

The stomach may be disturbed reflexly by lesions in many organs. This fact has been known for many years. Spallanzani excited vomiting in himself by tickling his fauces in the morning before breakfast, when the stomach was empty. After several acts of vomiting had taken place, he obtained a considerable amount of fluid which dissolved meat, and prevented its putrefaction, thus proving that irritation of the fauces produced not only vomiting, but also a secretion of gastric juice. It is well known that sympathetic vomiting is constantly produced by the reflex irritation of irritative lesions in the brain, liver, or uterus, and also by the passage of gall-stones, and that the vomited matter is generally extremely acid. This acid is evidently a hyper-secretion of gastric juice produced by the reflex irritation.

The lesions of the uterus which produce gastric disturbance reflexly are :

1. Cancer of the uterus, the vomiting being frequently attended with thirst and pain.
2. The condition which is present when a miscarriage is about to take place.
3. Chronic ulcer of the cervix.

The vomiting of pregnancy is also undoubtedly reflex, and is supposed to be due to stretching of nerves by the enlarging organ.

Eye-strain.—G. M. Gould, in a paper, 'Clinical Illustrations of Reflex Ocular Neuroses,'* states that he has found that, in the young of either sex (especially in girls), and in adult females, where eye-strain of any considerable degree exists, the normal action of the digestive system is often interfered with to a considerable extent. He alludes to the fact that in a previous paper (*Medical and Surgical Reporter*,

* Internat. Journ. of Med. Sciences, 1890.

1889) he had given the details of a case of flatulent dyspepsia of twenty years' standing which was almost instantly cured by proper spectacles. He has positive and unqualified assurances from twenty-eight cases that their loss of appetite, dyspepsia, nausea, more or less soon disappeared after getting their glasses.

Gout.—Gout is without doubt a very frequent cause of dyspepsia, and acts in two different ways, producing two distinct forms of stomach disturbance.

1. It may produce a chronic inflammatory condition of the coats of the stomach, precisely in the same manner as it does in other tissues of the body. The resulting symptoms will resemble those due to ordinary chronic catarrh.

2. It may produce flatulent distension of the stomach, coming on two hours or so after a meal (see page 66). This appears to be directly caused by deficient secretion of bile. The antiseptic action of the biliary secretion being absent, and also its stimulating effect upon the peristaltic movements of the duodenum, the food will remain there and ferment. In consequence, the food in the stomach being unable to escape into the already overloaded bowel, will also undergo fermentation, attended with the evolution of gas.

Imperfect Mastication of Food.—This may be due to :

(a) Undue haste in eating.

(b) Defective teeth.

(c) Conditions of the mouth which prevent the act of mastication from being efficiently performed, such as soreness of the gums, and paralysis of the muscles used in chewing.

When this act has been imperfectly performed, the food is not broken up fine enough, and consequently the saliva and later on the gastric juice are not mixed so thoroughly with it. Moreover, the food being hastily swallowed, the

ptyalin of the saliva has not time to act upon the starch before it is neutralized by the acid in the stomach. But a still more important point is this. As we have stated on page 13, it has been proved by experiment that the presence of the alkaline saliva in the stomach acts as a very powerful stimulus to the secretion of the gastric juice. Now, the normal stimulus to the flow of gastric juice is the act of mastication. So it follows that if the food is not sufficiently masticated, the saliva will not be secreted in sufficient quantity, and consequently one of the usual stimuli to the flow of gastric juice will be absent.

Moreover, imperfectly-masticated food, offering a large surface to be acted on by the gastric juice, will be slower digested, and, besides acting as a mechanical irritant, will, by remaining longer in the stomach, afford increased opportunities for fermentation to take place. It must be borne in mind that the comparative digestibility of different dishes, particularly vegetable ones, is in direct ratio to the facility with which they can be reduced into a homogeneous mass by mechanical means. And it is a distinct advantage that this reduction should take place in the mouth, and be effected rather by the act of mastication than by mashing in the kitchen, since in the former case they become in the process thoroughly mingled with saliva, which is such an important factor in their digestion. It is an important point to bear in mind, therefore, that when from any cause, such as defective teeth, food has to be used which has been artificially broken down, or when soft farinaceous dishes such as porridge are taken, they should be kept in the mouth a moment longer than required for the mere preparation for swallowing, in order that they may be well mixed with saliva. It would be a good thing if parents would train their children when quite young to eat in this manner.

Exposure to Cold and Wet.—Nothing will arrest normal

digestion so soon as anything that lowers the body temperature. Severe dyspepsia is often produced by a drive in the cold air without sufficient wraps, or a cold sea-bath soon after a meal.

Active Bodily Exercise just before or just after a Meal.—Exercise just before a meal, by exhausting the mere energy, diminishes the available force which can be utilized to carry on the process of digestion.

As regards the effect of exercise after a meal, the subject has been definitely settled by the experiments of Dr. Cohn.* The experiments were made on dogs, which were given a meal of scraped meat and water. They were then divided into two batches, one of which was allowed to rest, and the other was given two hours' active exercise. The result was very striking and conclusive. In the batch that had rested, digestion was at its highest point one hour after the meal; the contents of the stomach were rich in hydrochloric acid and pepsin, and poor in lactic acid. At the end of two hours only traces of lactic acid were to be found; at the end of six hours digestion was completed. In the other batch, which were examined after two hours' active exercise, only traces of hydrochloric acid and peptones were found, and large quantities of lactic acid. It was only after a lapse of five hours, the animals having rested three hours, that digestion began again, and at the end of six hours digestion was not yet finished.

Excess of Food.—An adult may consider that he is taking sufficient to keep himself in health if he eats in 24 hours the equivalent of 1 lb. of meat, and 2 lbs. of bread. All beyond this is not required for the needs of the organism, and in its digestion puts just so much needless work upon the digestive organs. The nearer a man can keep to this amount the better, provided that he has no personal peculiarities of size, occupation, climate or

* L'Abeille Médicale, Nov. 19, 1888.

state of health to provide against. Of course an occasional excess in the matter of diet can do no serious harm, as the digestive organs have a large reserve of energy, and are, or should be, seldom worked up to their limit. But, as a rule, to consume more food than Nature demands, throws a large strain upon the tissues whose function it is to eliminate the waste from the system, besides overtaxing the digestive organs. And a man who has always constantly circulating in his blood-current a quantity of nitrogenous substances which are undergoing retrograde metamorphosis is certainly on the high road to gout and its attendant evils.

Insufficient Supply of Food.—If the supply of food is insufficient the body is imperfectly nourished, and the stomach participating in the general tissue-starvation is unable to do its work properly. The diet of bare subsistence, estimated from the mean of prison diets, has been calculated to be 1 oz. of fat, 12 ozs. of starch, and $\frac{1}{4}$ oz. of mineral matters a day, the amount of carbon contained being 7.44 ozs. This will just serve to keep a man without activity in a condition of low health.

Improper Arrangement of Meals.—The meals may be either crowded too closely together, or there may be too great an interval between them. To take the extremes, we occasionally meet with cases where breakfast is taken at 9, a biscuit or sandwich at 11, lunch at 1, afternoon tea and cake at 4, with perhaps fruit and ices, and a heavy dinner at 6, followed possibly by supper at 12. Or on the other hand, a breakfast at 8, perhaps no lunch, and dinner as late as half-past seven or eight. Both of these are bad. In the first case the stomach is never allowed the opportunity of emptying itself before the next meal is put into it, and in the second case the whole system is allowed to become exhausted, and when the food is at last taken there is no bodily energy left to

digest it, and the appetite has quite vanished. A man in health should be satisfied with three meals a day, and sufficient time—five or six hours—should be allowed to elapse between each, to enable the stomach to completely digest the last meal and get rid of the bulk of it into the duodenum.

Injudicious Admixture of Foods.—Certain articles of diet, which so react upon each other as to produce an insoluble substance, often cause dyspepsia when taken together. A familiar example of this is a raw egg taken in a cup of strong tea. The albumin of the egg combines with the tannin of the tea, and a dense insoluble precipitate of tanno-albumin, absolutely indigestible and chemically allied to leather (tanno-gelatin), is thrown down. This, although it spoils the egg, vastly improves a common rough tea, and there would be no objection to taking it thus if the egg were strained out and thrown away before the tea was consumed.

Certain articles of diet when introduced into the stomach with the food also appear to have the property of delaying digestion. Wolff* has lately investigated the subject and has arrived at certain results. After administering a Leube's test meal, and ascertaining the length of time occupied by normal digestion, and the degree of acidity at its different stages in the subjects to be experimented upon, he gave them the same breakfast, and at the same time introduced certain articles of diet and medicinal agents into the stomach. Among his results were the following:

1. *Alcohol*, in quantities not exceeding 20 per cent., slightly increased the secretion of hydrochloric acid and hastened the process of digestion, but in quantities of 30 per cent. or more, distinctly retarded peptonization, and

* Zeit. f. klin. Med., XVI., Hft. 3 and 4. Med. Chron., vol. XII., p. 371.

diminished the quantity of hydrochloric acid secreted. After a time the stomach began to lose its power of being excited to secrete gastric juice by the presence of food in it, and continually larger doses of alcohol were required to stimulate its flow.

2. *Coffee*, administered in the form of caffein, and in the dose that was estimated as present in an ordinary cup of coffee, lessened the secretion of hydrochloric acid, and delayed digestion.

3. *Bitters* increased the amount of gastric juice when taken with food, but had less effect than plain water when given upon an empty stomach.

4. *Common Salt*, given in quantities of 75 grains, lessened the secretion of hydrochloric acid, especially when hyperacidity was present.

It must not be imagined, however, that because tea and coffee delay digestion that their action upon the system is necessarily injurious, for, as Sir William Roberts* has pointed out, this retardation may prove a real benefit to the individual, as the danger of throwing the whole meal in a peptonized form upon the circulation will be avoided.

In investigating the action of drugs, etc., upon digestion by producing the latter artificially in the laboratory, one must remember that the processes carried on in the stomach differ from the same processes carried on in a test tube. The stomach can do what a test tube can not. It can secure constant movement of its contents; it can remove them as fast as they are dissolved; and it can continually secrete fresh quantities of gastric juice. This accounts for the fact that, whilst in the artificial process a pint of claret added to the food will delay digestion for a couple of hours, yet in a healthy person everything takes place as usual, from the simple fact that an excess of

* Collected Contributions on Digestion and Diet, 1891.

gastric juice is immediately secreted which neutralizes the claret.

Use of Indigestible or Unwholesome Aliments.—The digestibility of any given article of diet consists in the readiness with which it can be acted on and rendered soluble by the digestive juices.

The relative digestibility of different articles of diet apparently depends mainly upon the following points :

1. Their degree of cohesion.

Articles so tough that they cannot be ground up by the teeth pass through the system unchanged, whilst, at the opposite extreme, fluids and semi-fluids are absorbed at once. This is the reason why the flesh of young animals is more digestible than that of old ones.

2. Meat that contains fat interposed between its fibres, is less digestible than the kinds that have not. Beef is an example of the former, mutton of the latter.

3. Within certain limits dilution favours digestibility.

4. Too high temperature of starchy food diminishes its digestibility.

5. Food that has begun to decay is unwholesome, as it contains the poisonous alkaloids termed ptomaines.

6. Some foods, such as certain shell-fish, fungi, etc., contain poisonous alkaloids.

Excess in Alcohol.—We have already (page 25) alluded to the fact that more than a certain quantity of alcohol taken with food will retard digestion, but independently of its immediate mechanical effect upon any particular meal, alcohol forms one of the principal causes of indigestion as it is met with at the present day. It is unfortunately the fact that the reprehensible practice of taking stimulants between meals is an extremely common one in the age in which we live. As I have pointed out elsewhere,* it is not usually for pure self-gratification and indulgence, but rather as a

* Health Troubles of City Life, 1890.

stimulus to mental exertion, that spirits are taken in this manner. In a healthy organism, when a certain quantity of work either of mind or body has been performed, a sense of fatigue or weariness is perceived which compels the individual to cease for a time his labour and allow time for nature to recuperate the organism. Alcohol simply deadens this sense of weariness and enables the man to go on working without feeling how tired he really is. To quote my exact words: 'Stimulants never increase the natural capacity of the brain. They can only abstract for the purposes of work in hand some of the energies which are sorely needed to repair and to restore a brain which has already been taxed to the furthest limit which is consistent with health. To remove the sense of fatigue caused by overwork by the consumption of alcohol is to close one's ears to the voice of nature. The weariness of the brain is a protest against further exertion until recuperation has been obtained by rest, and if the weary feeling is deadened or destroyed by adventitious means nature will exact her penalty. Exhaustion of the brain is most dangerous when it cannot be perceived, and the man who deliberately rouses his jaded faculties to excessive exertion by alcoholic excitement makes a call upon his reserve energies which he often finds it difficult to repay.' And the nervous exhaustion which is thus produced is accompanied in many cases by severe forms of functional dyspepsia.

Another manner in which alcoholic excess tends to set up dyspeptic disturbance is by its local action upon the coats of the stomach. Alcohol, particularly when only slightly diluted, as for example in the form of gin and bitters, acts as a direct local irritant, and tends to set up gastric catarrh when taken upon an empty stomach.

The dyspepsia of beer-drinkers is caused in a little different manner. Here it is not so much the alcohol which does the harm, as the introduction into the stomach of large

quantities of cold (perhaps iced) liquid, often containing acetic acid. Thus the gastric contents are too much diluted, the nerves of the stomach are inhibited by the cold, and acetic acid fermentation is possibly set up.

Use of Jams and Sweets either in Excess or at Improper Times.—This is a very fertile cause of indigestion, especially among young patients. A quantity of jam is often taken at the close of a mixed meal such as breakfast, and thus an abundant opportunity is afforded for abnormal fermentations to be started during the first stage of digestion in the stomach. It is not at all unusual for a breakfast to consist of two cups of well-sweetened coffee, poached eggs, toast well buttered, grilled bacon, jam, with perhaps new bread and plenty of butter. The stomach is thus filled with a diluted, highly saccharine fluid, containing already, if the jam is not very well made, or the teeth are carious, plenty of germs ready to set up fermentation on the slightest opportunity.

Can it be wondered at then that patients who are thus imprudent suffer habitually from flatulent indigestion?

Another very common practice, especially among children and young ladies, is to fill up the intervals between their meals with eating sweets. That is to say that they are in fact continuously introducing into the stomach during the process of digestion substances which are admirably designed to afford a pabulum for the abnormal ferments present there.

I can call a case to mind as an illustration. A young married lady consulted me some few months ago for dyspepsia accompanied with a great deal of flatulence. She had tried a number of drugs, but without any effect. It came out on questioning her that she habitually ended her breakfast with jam, and in addition often took a slice of bread and jam at eleven o'clock. On discontinuing the use

of jam altogether her dyspepsia promptly ceased, without the use of any drug whatever.

Excessive Smoking.—Excess in smoking is a relative term. Whilst some people are exceedingly tolerant of tobacco, others can only use it in the extremest moderation without experiencing its ill effects. There can be no reasonable doubt but that dyspepsia is very often produced by its use when taken in a quantity which is excess to the particular individual. It acts in two ways: firstly, by its general depressing effect upon the nervous system; and, secondly, by its local action upon the nerve-terminals in the stomach.

We often meet with clinical proof of this in practice. A patient comes to us with marked dyspeptic symptoms, slightly furred tongue, and perhaps tremulous hands. On inquiry we find that he smokes several cigars between each meal. We restrict his allowance to one cigar after dinner, and he is soon quite well without any other treatment.

Excessive Tea-Drinking.—As a cause of indigestion this is most frequently met with among females in the lower classes. These are often in the habit of drinking large quantities of tea at all times. In addition to the action of the tannin therein contained on the albuminous constituents of food, mentioned on page 34, excessive tea-drinking produces indigestion—

1. By its action upon the nervous system. Here it acts very similarly to tobacco.

2. By diluting the contents of the stomach below the point of concentration required for the efficient action of the gastric juice.

3. Moreover, large quantities of hot fluid frequently introduced into the empty stomach tend to keep up a condition of dilatation, not at all conducive to the performance of its functions.

Catarrhal Inflammation, and Congestion of the Mucous

Membrane of the Stomach.—This condition interferes with digestion in several ways.

(a) The presence of a considerable quantity of mucus in the stomach sheathes the food, and prevents it from being acted on by the gastric juice.

(b) In children, especially, the mucus which coats the walls of the stomach interferes with absorption.

(c) The congestion of the mucous membrane interferes with the secretion, and alters the composition of the gastric juice.

(d) In cases which have existed any length of time the gastric glands undergo changes, the secreting tubes become shrunken and wasted, are irregular in form and calibre, and frequently undergo fatty degeneration. The epithelium disappears, and is replaced by granules and fat globules. Cysts are occasionally found, which appear to be the result of distension of parts of the tubes which are constricted off from the rest. According to some observers these changes affect groups of the glands one or two lines in diameter, which are then visible to the naked eye as dull white spots.

Gastric Ulcer.—Although not coming, strictly speaking, within the scope of this book, it is as well to mention gastric ulcer as a cause of dyspepsia. We must not lose sight of the fact that in practice we are called upon to exclude the existence of the lesion in many of the cases that come under our notice.

The same is true of cancer of the stomach.

Cancer of Stomach and other Growths.—The researches of Voinovitch* have established the following facts :

* P. Voinovitch, St. Petersburg Inaugural Dissertation, 1890, No. 16, p. 76. This paper was based on a series of observations on 21 cases of cancer of the stomach in Professor Koshlakoff's clinic; 16 cases were men, aged 34 to 63, and 5 were women, aged 40 to 60. Of these cases, in 12 the disease affected the pylorus, 4 the cardia and œsophagus, 2 the œsophagus alone, and 3 the posterior wall of the

1. In cases of cancer of the stomach the gastric juice is profoundly altered in composition.

2. In 19 out of 21 cases (287 analyses having been made), no free hydrochloric acid can be detected in it.

3. Pepsin is also absent in the majority of cases.

4. The milk-curdling ferment (see p. 9) is always absent.

5. The motor power of the stomach is greatly diminished in disease affecting the pylorus, but not in cancer of the cardiac end or of the œsophagus.

6. The absorptive power of the stomach is always diminished.

Lesions of other Organs which impede the Circulation through the Stomach.—Anything which offers impediment to the return of blood from the stomach to the heart will produce congestion of the stomach. Congestion of the same kind, but more gradual in its approach and less in degree, comes from all conditions affecting the circulation of blood through the liver. All passive congestions of this kind are accompanied by a secretion into the stomach of a large quantity of mucus, which is often vomited.

(a) *Bronchitis*.—According to Chelmonski,* in emphysema of the lungs, the contents of the stomach are often without free hydrochloric acid, and contain only a small quantity of pepsin. He believes that the condition is not constantly present in the same case, but that it is intermittent, and depends upon temporary stasis in the gastric circulation.

stomach. In 19 cases the diagnosis was confirmed by a post-mortem. The total acidity of the gastric juice was estimated by the phenolphthalein test with a decinormal solution of sodium hydrate. The hydrochloric acid was by various colour tests, such as tropœolin-oo, methyl-violet, congo red paper, phloro-glucine-vanilline, and also by Sjöqvist's method (see p. 90 *et seq.*). The motor power of the stomach was estimated by salol, and the absorptive power by iodide of potassium (see p. 85).

* Rev. de Méd., No. 7, 1889.

(b) *Heart Disease*.—The experiments of Hufner* appear to show that in valvular disease of the heart the passive congestion present in the stomach weakens or abolishes its power to produce acid ; but later experiments of Adler and Stern† go far to prove that his results are erroneous, and that the gastric contents of patients with heart disease do not differ materially from those obtained from individuals with healthy stomachs. They believe that the dyspepsia of these patients has a central origin ; but this apparent discrepancy may be accounted for by the fact, observed by many workers in the same field, that the disturbances of function in this affection vary considerably, depending upon diverse conditions, the most important being the stage of the disease.

Kidney Disease.—In chronic Bright's disease there are several conditions that tend to disturb the stomach. When the kidneys cannot do their work the blood becomes contaminated by retained morbid products, which should have undergone elimination.

1. The gastric juice may become vitiated from actually containing urea. This is not a mere speculation, as it has been found that urea is present in the vomited matters in malignant cholera and other diseases associated with temporary diminution of the renal function. In these cases there is very often diarrhoea alternating with the vomiting, and produced, like the latter, by the irritation set up by the vicarious elimination of urinary products.

2. The constant drain of albumin from the system produces an asthenic condition, and the stomach, participating in the general debility, is unable to perform its functions efficiently.

In renal calculus we frequently find disorder of the stomach, which is evidently reflex and caused by the constant irritation in the kidney.

* Münch. med. Wochenschr., 1889, XXXVI., No. 33, 561.

† Berliner klin. Wochenschr., 1889, No. 49, 1060.

Disease of the Liver.—The stomach is more in relation with the liver than with any other organ of the body, and we have good reason to think that an intimate connection exists between their functions.

If the secretion of the liver is defective, the functions of the stomach are invariably disordered.

The most usual cause of liver derangement is a want of the proper correspondence which should obtain between the amount of food we eat and the fresh air that we inhale. An excess of rich and highly alcoholic food requires the blood to be very perfectly oxygenated to dispose of the *luxus* consumption. This will not be the case, as we can readily see, if the circulation and respiration are deficient owing to sedentary habits—too little exercise, or confinement in hot, badly-ventilated rooms. Want of exercise also will diminish the metabolism of the body by inducing renal and intestinal torpidity, with consequent retention of urea, uric acid, bile, and other morbid products. These waste materials, entering the blood by the hepatic veins, probably produce all that train of uneasy nerve sensations in the dyspeptic not immediately due to the toxic effects of the *leucomaines* formed by the digestive process.

Phthisis.—Often dyspepsia is one of the first signs of phthisis, and many patients lose their appetite and become constipated long before any other symptoms occur.

From the researches of Chelmonski,* it appears that in the course of chronic phthisis, there is often found an absence of free hydrochloric acid and a very small amount of pepsin. He believes that this depends sometimes on anæmia of the stomach, due to general debility and chronic fibrous endarteritis, sometimes on passive hyperæmia of the stomach, and occasionally on amyloid degeneration of the mucous membrane and of the arteries. The results arrived at by Schetty† appear to establish the fact that

* *Rev. de Méd.*, No. 7, 1889.

† *Deutsch. Archiv.*, Bd. XLIV., 219.

the dyspepsias of phthisical patients do not always depend upon gastric catarrh and a diminution of the secretion, and corroborate those of Immermann,* who comes to the conclusion that in most cases of phthisis which are attended with dyspeptic symptoms, there is nothing wrong with the quantity or quality of the gastric juice, and consequently that the perversion of function must be attributed to disorder of the nervous system.

On the other hand, Grusdew † found that in thirty-six out of sixty-four patients examined, there was no free hydrochloric acid at all, and in addition made out the fact that the quantity of hydrochloric acid was lowered in direct proportion to the severity of the disease. Brieger ‡ also, as the result of a number of examinations, states that in cases of severe phthisis he only found normal gastric juice in 16 per cent., and that in all the others it was profoundly altered. In 10 per cent. the normal constituents of the juice were almost entirely absent. In cases not so advanced the gastric juice was not so frequently altered, but in most was by no means normal. In commencing phthisis about half the number of patients exhibited abnormalities in the gastric juice. He also found that both the motor power, and the absorption from the stomach, appeared to be diminished in direct ratio to the abnormality of the gastric juice. In contradiction to Immermann he believes that these changes depend upon gastric catarrh, and later on, atrophy of the gland structure.

However, summing up these observations by different experimenters, I think the weight of evidence, without doubt, points to the fact that the stomach disturbances in phthisis,

* 'On the Functions of the Stomach in Tubercular Phthisis.' *Verhandl. des Congresses für innere Medicin*, 1889. - *Fortschritte der Medicin*, 1889, p. 743.

† *Wratsch*, 1889, 15 and 16. *Centralblt. f. klin. Med.*, 1890, p. 92.

‡ *Deut. med. Wochenschr.*, 1889, No. 14. *Centralblt. f. klin. Med.*, 1889, p. 663.

at least, after the first stage, are in most cases due to profound alterations in the gastric juice, in the direction of insufficient quantity of its active ingredients; and that these alterations depend, at least in some cases, upon catarrhal inflammation of the mucous membrane of the stomach. And moreover in advanced cases we may have associated both dilatation and thinning of the organ with consecutive atrophy of its glandular secreting tissue.

The diarrhœa, which is frequently so distressing a complication of the later stages of phthisis, may result from mere catarrh or from coincident ulceration, generally tubercular, of the intestine itself.

Among the earliest and most important of the disturbances of the digestive organs associated with phthisis we must place *vomiting*. This is often the first thing which brings the patient to consult the physician; and many cases are known where medical men have committed the serious mistake of overlooking the constitutional disease and ascribing the ailment to simple dyspepsia.

In phthisis we meet with three kinds of vomiting:

1. We meet with it in the early stages of the disease, coming on at the end of a paroxysm of coughing. Here it is manifestly the direct result of the act of coughing irritating the vagus nerve, and precisely resembles the vomiting constantly met with in whooping cough.

2. It is, however, much more common to meet with it at a later period of the disease, when it is attended with loss of appetite and uneasy sensations referred to the pit of the stomach. Here it is obviously of gastric origin.

3. In advanced phthisis, especially in women, we get compression of the pyloric end of the stomach by an enlarged fatty liver. We shall have as the result nearly the same train of symptoms as arise from pyloric stenosis, but not to the same extent.

CHAPTER III.

SYMPTOMS OF INDIGESTION.

Mental depression—Drowsiness—Sleeplessness—Headache—Vertigo—Vaso-motor disturbances—Alterations in the appetite—Nausea—Vomiting—Waterbrash—Regurgitation—Acidity and heartburn—Epigastric pressure, fulness, pain—Spasms—Flatulence—Dyspnœa—Palpitation—Constipation—Diarrhœa—Pharyngeal catarrh—Skin affections.

The Symptoms of Indigestion are protean in their form, and may manifest themselves as disturbances in almost any organ or function of the body.

And, moreover, in their investigation, one must bear continually in mind that several of these symptoms, such as gastralgia, although usually associated with others and forming by their clinical grouping the disease we term indigestion, may yet occur by themselves, and in such a degree of severity as to necessitate their being looked upon and treated rather as independent affections.

We shall consider the various symptoms and concomitant phenomena in order, at the same time attempting to show how they may be differentiated from similar ones produced by other causes, especially the structural diseases of the stomach.

A very considerable number of the symptoms met with in indigestion may be referred to the nervous system. It is extremely probable that the abnormal sensations and functional nervous disturbances experienced by the dys-

peptic during the process of digestion are due to the absorption into the system of alkaloids which are actually generated in the stomach and intestines. Some of the best work in the elucidation of the mode of action and formation of these substances has been done by Brieger.* He pointed out that alkaloids are formed in putrifying meat analogous to those occurring in plants during growth. From decomposed meat he isolated two poisonous ones, choline and neurine, and from putrid fish an alkaloid which he named muscarine, as it appeared to be identical in action with the muscarine found in certain fungi, and, like it, was antagonized by belladonna. He also discovered that, under certain conditions, a poisonous alkaloid was actually formed during the digestion of fibrin by pepsin. This he termed pepto-toxin, and showed that it had an action like curare.

MENTAL DEPRESSION.—It is a well-known fact that the process of digestion, when delayed or imperfectly performed, is often accompanied by a feeling of depression, which may vary from an extremely slight uneasy sensation in the head to a most intense melancholy. There is very little doubt that these sensations are caused by the absorption into the system of those poisonous products of imperfect digestion, which have been already alluded to under the name of leucomaines. This explains the marvellous effect of a dose of blue pill in such cases. It is a matter of common observation that a smart mercurial purge will often entirely alter the aspect of things in general. After a good evacuation from the bowels, life, which before looked full of gloom, again appears worth living, and troubles which seemed unbearable now become things to be laughed at. The purge has washed away the decomposing material from the large bowel, and the morbid substances which have

* Untersuchungen über Ptomaine und weitere Untersuchungen über Ptomaine.

been already absorbed are quickly eliminated through the urine.

DROWSINESS.—This symptom is not unfrequently present during imperfect digestion, and usually comes on an hour or two after meals, when the digestion in the intestine is commencing, and, like the mental depression, is due in all probability to the absorption into the system of the poisonous products of digestion.

SLEEPLESSNESS.—This is most commonly caused by the presence of lumps of undigested food in the stomach, which, by keeping up a reflex irritation of the brain, render continuous sleep impossible. Another way in which dyspepsia produces sleeplessness is through the mechanism of a dilated stomach—as a rule, not a permanently dilated viscus, but a temporary condition due to a spasm of the pylorus, which prevents the stomach from emptying itself. This spasm, as has been pointed out (page 22), is usually due to reflex irritation of the pylorus by stomach contents rendered highly acid by the abnormal production of organic acids. The patient has most likely dined out; has taken a considerable quantity of champagne or claret with a dinner of larger dimensions than usual. He has finished up with a cup of coffee and a liqueur, and after that a glass or two of whisky and soda-water. He has thus afforded every opportunity for this condition to develop, as he has filled his stomach with a mixture of acid wine, saccharine matters, and so much alcohol per cent. as to be incompatible with the normal performance of its digestive functions.

Moreover, the bulk of the liquid that he has taken has been of an effervescing nature, and has evolved plenty of gas, and thus well dilated his stomach to start with. He does not feel much inconvenience until he goes to bed, but then his troubles commence. The stomach, becoming more distended by this continued evolution of gas from its

fermenting contents, and being prevented from emptying itself by the spasm of the pylorus, presses up against his diaphragm and displaces his heart slightly upward. Thus the heart's action is impeded and palpitation is produced. The descent of the diaphragm being also materially interfered with, breathing becomes shallow and difficult. There is a sense of sinking at the epigastrium, and in extreme cases a feeling of impending dissolution. Often the heart is inhibited, and beats slower than it should do, the gastric fibres of the vagus nerve being irritated by the acid contents of the stomach. This state of things usually lasts until about three o'clock in the morning, when the stomach empties itself and the patient goes off to sleep.

SENSATIONS IN THE HEAD.—Dyspeptics often suffer from :

Headache, which may exist in various forms, and may vary from merely a slight uneasiness to acute pain. It is generally frontal, but very often occipital. I have seen many cases in which the chief sign of indigestion was an uneasy feeling, hardly amounting to actual pain, which affected the back of the head and extended a little way down the nape of the neck. This invariably came on about an hour after meals, and lasted for two or three altogether.

Sometimes an attack of dyspepsia has evidently acted as the exciting cause for an attack of migraine in patients liable to it.

Another not uncommon phenomenon that we observe in dyspeptic cases is :

Vertigo.—The first medical writer to trace a connection between giddiness and dyspepsia was undoubtedly the French physician, Trousseau, who in his classical work ('Lectures Clinicales') described it under the name of 'vertigo à stomacho læso.' Whilst it is no doubt a fact that vertigo does frequently occur in dyspepsia, yet I think

it extremely probable that many of the cases narrated by Trousseau were really labyrinthine, as Menière's disease had not been properly made out at the period when he wrote. And it is for this disease that we must be on our guard when we meet with a patient suffering, we presume, from vertigo due to stomach disturbance. For this and for *petit mal*. I can call to mind more than one case where a patient has treated himself for years on account of periodical attacks of, as he supposed, 'indigestion and biliousness,' and where, on examination, almost complete deafness of one ear has been found. And this mistake is more readily made from the fact that stomach disorder very often acts as the exciting cause of the attack.

The vertigo arising from stomach disorder comes on suddenly, and often only lasts a moment. The patient is usually walking in the street and suddenly feels giddy and as if he would fall, and catches hold of the railings or his companion. As a rule the sensation only lasts a few seconds. Sometimes he will feel as if the pavement were heaving under his feet. These attacks may be distinguished from slight seizures of epilepsy by the fact that the face is usually flushed and that they occur shortly after a meal.

They may be differentiated from Menière's disease by the fact that in the latter there is usually

1. Deafness. Although the patient may be unconscious of this, it may be ascertained by testing the relative hearing distance for a watch with the two ears.

2. The vertigo can be excited by movements, such as coughing and blowing the nose.

3. There is generally some amount of tinnitus.

4. There is imperfect conduction for a tuning-fork from the vertex to one side, and

5. The patient often sees objects distinctly moving in one direction.

Both vertigo due to gastric disease and to Menière's disease may be followed by vomiting.

VASO-MOTOR DISTURBANCES.—These are frequent accompaniments of dyspepsia, and may assume any of the following forms:

1. **Feeling of Constriction at the Root of the Nose.**—This very distressing sensation, although I believe never before alluded to in any published description of the disease, is of not unfrequent occurrence. I have notes of thirteen cases of indigestion in which it constantly occurred, and have observed it in many more. It is a sensation as if the nose were compressed, and causes frequent involuntary sniffing in the sufferer to try and remove the feeling of obstruction. From my observations I have come to the conclusion that there is absolutely some degree of swelling of the mucous membrane of the nose, and that this condition is almost invariably associated with temporary dilatation of the stomach. It is therefore, apparently, a local vaso-motor disturbance, produced reflexly by irritation of the pneumo-gastric nerve. It is a sensation extremely like the globus hystericus, only occurring in the nose. Some patients describe it as a sensation that the nose is of immense size, others that the nose is filled with cotton wool. Others as a feeling of constriction at the root of the nose. It is relieved at once by the insufflation of a little menthol or cocaine.

2. **Formication and Tingling.**—This may be localized to a finger or toe, or may extend over a whole limb, or even over the greater part of the body.

3. **Numbness.**—All of us are familiar with the numbness in a limb caused by continued pressure upon a nerve, such as occurs when we sit with our leg over the rail of a chair. Now, in certain dyspeptic conditions this phenomenon is produced with much greater facility and with much slighter pressure. It is therefore not uncommon to find the region

supplied by the ulnar nerves quite numb on waking in the morning, and this has been caused by the mere pressure of the arms on the bed.

4. There are two abnormal sensations in other parts of the body, which I believe are frequently met with in dyspepsia, without being generally ascribed to its influence, viz. :

(a) *A feeling of heaviness in one foot or a feeling of constriction round the calf of the leg.*

This is undoubtedly dependent upon indigestion, and in the cases where I have observed it, came on suddenly at a variable period after a meal of articles difficult to digest. And

(b) *A sensation as if one side of the mouth were stiff and drawn up.*

The patient usually is afraid that paralysis is commencing. This feeling very often comes on immediately after a meal at which a considerable quantity of acid liquid or pepper has been taken. I have seen cases where it could be induced immediately by swallowing a mouthful of highly-seasoned food. When once it has been started it may persist for hours, days, or even weeks, and causes the greatest distress and apprehension in the patient. In some instances the lips feel swollen, and in others articulation of mimetic words is interfered with. In these latter cases the patient, if a medical man, usually fancies that he is about to develop general paralysis of the insane.

It is a curious fact that almost invariably it is the left side which is affected.

ALTERATIONS IN THE APPETITE.—In indigestion the appetite may range from absolute anorexia, or complete loss of appetite, through various grades up to bulimia, in which the sense of hunger is experienced in its highest form. In many cases the appetite is perverted, and unnatural inclination exists to eat either articles of diet forbidden by the physician, or strange and abnormal substances which in a state of health would excite disgust.

Loss of Appetite.—This is a symptom in most diseases of the stomach, and varies much in degree. Its cause is probably complex, and depends partly upon the presence of dead epithelium upon the surface of the digestive tract, the common association of a furred tongue and loss of appetite being familiar to us all—and partly on the condition of the nervous system.

Anything which will make a profound impression upon the latter, such as bad news, anxiety or fear, especially just before food, will often cause the desire for it to entirely cease for a time. It is usually the expression of nerve trouble, and is especially frequent in young people and women. In the latter doubtless on account of their tendency to hysteria. In hysteria and neurasthenia the anorexia often forms the real disease. Loss of appetite may consist only in an absence of desire for food, or the consciousness of a dislike for food such as one often meets with under normal circumstances, and which can be overcome by an effort; or it may amount to an absolute disgust for food in any form, accompanied by a feeling of nausea at the idea of eating. In my experience absolute loss of appetite is more frequently found in functional disturbance than in real organic disease.

Excess of Appetite often occurs physiologically in young, rapidly-growing individuals if too long time elapses between meals, and must be distinguished from bulimia, or an abnormal sensation of hunger. The latter differs from the former in being often very intense and accompanied with the greatest suffering and other symptoms, such as dulness and drowsiness, headache, malaise, sweating, tremor, and a feeling of oppression or pain in the epigastrium.

Alterations in Taste are also very generally present in indigestion.

There may be a sour or bitter taste in the mouth, or it may be unpleasant, foul, or pasty. The immediate cause

for this is probably the varying conditions of the epithelium in the mouth.

Abnormal Sensation of Hunger (Bulimia) is a symptom of many diseases, and various serious affections are occasionally accompanied by it.

This symptom may be either acute or chronic, and may either be

1st. A pure neurosis of the stomach.

2nd. The result of hysteria.

3rd. The result of exhaustion of the whole body caused by either long and severe disease, general neurasthenia, or worry.

4th. As a sequel to an attack of acute gastric catarrh.

5th. Diabetes.

6th. Intestinal worms.

7th. Disease of the mesenteric glands.

8th. Basedow's disease.

9th. Menorrhagia.

10th. Phthisis.

11th. Neurotic increase in the stomach movements.

The most recent writer upon the subject is Peyer,* who states the different conditions in which he has found bulimia to appear. He gives the history of a case of acute bulimia which came under his own observation. A lady, æt. 32, after a prolonged period of worry and trouble, was suddenly attacked with a sensation of misery at the epigastrium, which rapidly developed into a feeling of hunger, so intense as to be absolutely painful. She at once drank three pints of milk, but without relief, and her symptoms increasing in intensity, she feared that she was about to die. Within an hour she had taken 3 pints of milk, 23 eggs, and 2 pints of wine. At last she became exhausted and fell asleep. In the morning following she was quite well, and did not have any repetition of the attack.

* Corresp. Blatt für Schweiz. Aerzte, Oct. 15th, 1888.

He states that chronic cases of bulimia are very common, and present a feeling of satisfaction directly after food, but the hunger soon returns, and if food is not again taken, causes great distress. And a curious fact is that notwithstanding the large quantity of food which these patients consume, yet they often emaciate.

Most of the patients affected with bulimia suffer from many other symptoms of abnormal irritability of the nervous system. In fact it may be taken to be an expression of excessive irritability of the centrepetal nerves which regulate the sensation of hunger.

Whilst on the one hand bulimia often is the local expression of a nerve disturbance, yet it may possibly be a complication of a true organic disease of the stomach.

One must be careful in practice to distinguish bulimia from polyphagia, which latter means simply eating and drinking to excess. This condition, which is observed in a mild degree in diabetes and in convalescence from acute diseases, is present under some circumstances to a very high degree in lunatics, and sometimes in epilepsy, hysteria, hydrocephalus, and tumours of the brain. Rosenthal mentions a case which occurred in a patient suffering from severe neurasthenia.

As regards the variations of the appetite, for practical diagnostic purposes we may note:

1. The appetite is generally deficient in severe organic disease of the stomach, in cancer and atrophy of the mucous membrane.

Also in the severest forms of chronic gastritis and amyloid degeneration of the coats of the stomach, the appetite is temporarily lost or directed towards forbidden articles of diet. According to Boaz* cancer patients (presumably Germans) often ask for herring salad, salt cucumber and beer!

* Diagnostik der Magenkrankheiten.

2. In dilatation (due to pyloric stenosis) the appetite is usually normal or even voracious ; but in temporary dilatation of the stomach due to chronic catarrh, where there is abnormal fermentation of the stomach contents, notably among drunkards, there is often entire temporary loss of appetite.

3. In ulcer of the stomach the appetite is generally normal. Indeed you may get increased desire for food, particularly in the intervals of pain. But as the sequelæ of ulcer develop (stenosis of pylorus, dilatation or cancer), the appetite will gradually diminish.

The loss of appetite observed in neurasthenics is of quite a different character. In a typical case of this description you will often find a very good appetite suddenly vanish after one or two mouthfuls of food have been taken. The stomach feels as if already filled, and there is often a sense of heavy weight at the epigastrium.

In these cases the appetite, like the mental attitude of the patient, is easily elevated or depressed.

NAUSEA.—This symptom usually accompanies the act of taking food, but has also been observed during the height of the digestive process, or even on an empty stomach in cases of disturbed innervation of that organ. In this latter connection it has not unfrequently been observed in bulimia, hysteria, and hyperacidity of the stomach of nerve origin. In these cases the distress is relieved directly by taking food.

But nausea occurring, as it does, in so many different conditions, is not of much practical value in diagnosis. It is not at all an uncommon symptom in the different forms of catarrh of the stomach, cancer of the stomach, tapeworm, in dilatation of the stomach and abnormal fermentative processes, also in anæmia and its associated dyspeptic symptoms. Nausea may either exist as a symptom by itself, or may accompany the act of vomiting.

VOMITING.—The consideration of this symptom is of the highest importance in making a diagnosis between functional disturbance and organic disease of the stomach.

It may be caused in any of the following ways :

1. Irritation of the terminations in the stomach of the afferent fibres of the pneumo-gastric nerve by

- (a) Acute or chronic inflammation of the stomach.
- (b) Ulcer of the stomach.
- (c) Cancer of the stomach.
- (d) Alcoholic drinks.
- (e) Irritating substances, such as undigested food, in the stomach or hyperacidity of its contents.

Dilatation of the stomach produced by

- (a) Paralysis of its muscular walls.
- (b) Narrowing of the pylorus, from
 - (1) Malignant disease.
 - (2) Spasm.
 - (3) Fibroid disease.
- (c) Narrowing of the œsophagus.

It is important to remember that vomiting may also be caused by central irritation produced by Bright's disease, or by disease of the brain, and from the reflex irritation of pregnancy, or stretching of a duct. We have in any given case to find out what is its cause, and the following facts will help to guide us to a conclusion :

1. If vomiting occurs in a person in good health, we must suspect either an attack of acute indigestion, or that something irritating has been swallowed. We should in these cases, however, not forget that a violent emotion is occasionally a cause.

2. If the food is expelled immediately it is swallowed, we must look for :

- (a) Constriction or spasm of the œsophagus.
- (b) Constriction of the cardiac orifice of the stomach.
- (c) Great irritability of the stomach.

(d) Some irritation in some other organ of the body leading to sympathetic vomiting.

(e) Hysteria.

3. If the vomiting never occurs, except after food has been taken ; and then gives immediate relief from pain which came on after the food had been swallowed, we should suspect cancer or ulcer.

4. If the vomiting takes place some hours after digestion has commenced, it is probably due to narrowing of the pylorus, with its accompanying dilatation of the stomach.

In ulcer of the stomach it usually occurs soon after a meal, and generally in the course of a typical attack of pain, and when this pain has reached a certain height. As soon as the stomach is emptied all pain is at an end for the time being, or a slight burning sensation may be experienced for a few minutes longer. It is a remarkable fact that, as a rule, vomiting does not make its appearance until the severe pain has been suffered from for some weeks.

In brain disease there is usually an absence of nausea and retching. The act of vomiting occurs quite independently of the taking of food, occurs often when the patient is in the erect position, and may be excited by sudden movements of the head.

In Bright's disease there is usually diarrhœa associated with the vomiting.

In dilatation of the stomach and pyloric stenosis vomiting generally occurs whilst digestion is at its height, and not unfrequently in the course of the following night.

In chronic catarrh of the stomach the vomiting very often commences two or three hours after the meal, and is preceded by a feeling of epigastric pressure and by nausea, which latter may even have commenced before the meal was terminated.

In hyperacidity of the stomach vomiting does not, as a

rule, come on until some hours have elapsed, and corresponds in time with the highest degree of acid formation in the stomach, and the consequent spasmodic closure of the pylorus. In this case also vomiting during the course of the night is of common occurrence.

In alcoholic dyspepsia the sickness occurs in the morning on first rising, and is often excited by brushing the teeth.

PYROSIS OR WATERBRASH.—This is a condition which usually comes on in the morning on an empty stomach. It often commences with pain in the epigastrium, which is increased by movement. After this has continued for some little time a thin colourless fluid is brought up, which is alkaline, and usually tasteless, and varies from one to several ounces. It strikes red with ferric chloride, and converts starch into sugar. There appears to be no doubt but that Dr. Chambers was correct in his explanation of the phenomenon, and that it really is saliva, which, secreted in abnormal quantity, and arrested by spasm of the cardiac orifice of the stomach, gushes back into the mouth. Sometimes an attack terminates in actual nausea and vomiting, when the ordinary contents of the stomach are brought up. According to Dr. Carter,* waterbrash occurs in three classes of cases.

1. Where there is no indication of gastric disease, the patients being usually neurotic women, suffering from pelvic irritation or pregnancy.

2. Where the attacks of waterbrash are traceable to offending food in the stomach.

3. Where there is evidently actual disease of the stomach, and the symptom occurs indiscriminately after every kind of food.

This writer believes that pyrosis is always a true reflex act, and caused by irritation in the stomach, or in other

* Practitioner, 1890, p. 321.

organs, such as the uterus and ovaries. It is to be noted that in many of his patients he found dilatation of the stomach and muscular insufficiency, as estimated by Ewald's salol test.

REGURGITATION.—This symptom consists in the regurgitation of gas or fluid, or even solid particles of partially-digested food into the mouth; and is only very seldom of much diagnostic importance. In its simplest form it is merely eructation of wind; but rare cases have been noted where undigested food was brought up into the mouth, masticated, and swallowed afresh. When the matters which are brought up into the mouth are intensely acid, setting the teeth on edge, we know that there is excess of acid in the stomach, and by the proper tests we can ascertain (see page 89) whether the acidity is due to hydrochloric or to organic acids.

In cases where there is excessive abnormal fermentation going on in the stomach, the eructations are often very foul smelling, and in certain cases have been found to consist of inflammable gases. MacNaught (*Brit. Med. Journal*, 1888) asserts that he has succeeded in cultivating a gas-producing organism which he says is present in these cases.

ACIDITY OF THE STOMACH AND HEARTBURN.—This is a sensation of heat and constriction either in the epigastrium or the throat, and is caused by the irritation of the mucous membrane of the cardiac end of the stomach, and the lower end of the œsophagus by the organic acids contained in the gastric contents.

Patients often complain of a sensation of 'clutching' at the throat, and describe it 'as if the throat were fixed in a vice.' This latter sensation is due, in all probability, to irritation of the terminal fibres of the vagus nerve. It is most often met with in cases where neurasthenia is the fundamental cause of the dyspepsia, and where we should

à priori expect to find a condition of abnormal irritability in the nervous system.

Heartburn is very frequently met with where abnormal fermentative processes are going on in the stomach, generally in cases of acute and chronic gastritis and dilatation of the stomach, but also not unfrequently in other forms of dyspepsia.

In most instances it undoubtedly points to increased formation of acid in the stomach contents which may be either due to excessive production of the organic acids as the result of fermentative changes, or may be a real increase in the amount of hydrochloric acid in the stomach. Occasionally, however, especially in neurotic patients, one finds heartburn without any increase in the acidity of the stomach contents, and, according to Leo,* in some of these cases there are abnormal fermentative processes present.

ABNORMAL SENSATIONS REFERRED TO THE REGION OF THE STOMACH: PRESSURE, FULNESS, PAIN.

FEELING OF PRESSURE IN THE EPIGASTRIC REGION.— This is a symptom that one meets with in nearly every disease of the stomach, and for this reason is not of much use for diagnostic purposes. It varies in intensity with the amount of disturbance of the digestive functions. In its mildest form it consists of merely a slight feeling of oppression, which is quite endurable, and gradually diminishes during the progress of gastric digestion; whilst in its severest it may continue for hours. In some cases it appears in the intervals between meals, when the stomach is empty, and here there is frequently no apparent disturbance in the digestive function. A symptom also very common, and generally associated with the preceding, is a FEELING OF FULNESS.

* Diagnostik der Krankheiten der Verdauungsorgane, p. 40.

This often comes on after a little food has been taken, and the patient experiences the sensation of having made a hearty meal when really he has hardly eaten anything.

ACTUAL PAIN.—The following are the chief diagnostic points which enable us to discover the meaning of the pain in the case under consideration :

In **Dyspepsia without Inflammatory Change** (Atonic dyspepsia), the pain is dull and heavy, localized at the epigastrium, comes on one or two hours after food. There is no tenderness, no vomiting, no hæmatemesis, tongue clean, no tumour, patient may be any age, and of either sex.

Dyspepsia with Chronic Inflammation (Chronic gastric catarrh).—Pain is a burning soreness, sometimes augmented by food, felt behind sternum, sometimes going through to the back and radiating round to the left, constant, but comparatively slight, comes on two or three hours after food, the amount of pain varying with the degree of inflammation. It is very slight in cases of mild catarrh, whilst in very acute catarrh the introduction of food into the stomach may set up severe pain at once. There is frequently some local tenderness. Often some retching, no hæmatemesis, tongue furred, no tumour, any age, either sex, usually constipation, free HCl, no dropsy, not much emaciation, no cachexia.

Ulcer.—Pain, referred to the epigastrium just below the ensiform cartilage, increased by pressure, and relieved by vomiting or the passage of food into the duodenum. It is boring, tearing, burning or stabbing, and usually very severe. Sometimes it is felt in the back, between the eighth dorsal and second lumbar vertebræ; comes on immediately after food, usually vomiting, usually abundant hæmatemesis, tongue clean, no tumour, age generally under thirty, usually female, usually constipation, HCl in excess, no dropsy, frequently extreme pallor and debility.

Cancer.—Cutting pain in the epigastrium, frequently radiating, rarely remits. Comes on one or two hours after food. There is usually tenderness and vomiting, but hæmatemesis not very abundant, tongue variable, there is generally a distinct tumour, age generally over forty, male sex, obstinate constipation, no HCl, often œdema of ankles. Gradual progressive loss of flesh and debility, sometimes cachectic hypertrophy of peripheral lymphatic glands, especially above the clavicle.

Periodical attacks of gastralgia, which are occasionally met with in practice, are of the greatest diagnostic and prognostic interest, as they may be either the precursors of locomotor ataxia, or the gastric crises of the same, or may be simply neuroses of the stomach. In the last case they sometimes occur when the stomach is empty, and are relieved by taking food.

For diagnostic purposes we should carefully bear in mind the following points connected with gastric pain :

1. Pain coming on soon after a meal is very often due to organic disease of the stomach. This probability is strengthened if it ceases when digestion is finished, or vomiting takes place.

2. On the other hand, in nervous or hysterical people with no serious disease we not unfrequently get severe pain directly after a meal.

We infer that the pain is a neurosis when we meet with it in cases of impoverished blood, or enfeebled health, especially if there are disorders of the uterus or ovaries, or neuralgic pains elsewhere. The best guide is the condition of the digestive apparatus in the intervals between the pains. Disordered digestion, epigastric tenderness, nausea and vomiting, are not seen in simple neuroses.

3. Pain coming on two or three hours after a meal, and lasting several hours is usually due to hyperacidity of the stomach contents.

4. One must be careful not to confuse pain in the abdominal muscles with gastric pain.

5. Aneurism of the aorta and incipient disease of the dorsal vertebræ may give rise to pain in the epigastrium; also pleuritis, intercostal neuralgia, abscess of liver, intestinal disorders, colic, disorganization of the tissues of the kidney or pancreas, and the passage of gall-stones, or renal calculi.

6. The nearer the pain is to the middle line, and the more fixed and confined to a small spot, the more likely is it to be gastric, and probably a serious malady.

7. If pain is persistent and severe, and there is tenderness of the epigastrium, there is nearly always a morbid state of the tissues of the stomach. A mere uneasy sensation is generally functional, although there may be slight tenderness of the epigastrium. The former may be distinguished from the latter by the time after a meal when it takes place. If more severe soon after meals, worse after a heavy meat meal than a light farinaceous one, it is almost always structural.

If it occurs only when the stomach is empty, and is relieved by food, it is almost certainly functional.

8. Spasmodic attacks of pain may be due to chronic organic disease, but are more generally neuralgic. And a great help to diagnosis is the fact that there is a predisposition to such attacks of a purely neuralgic character among gouty, rheumatic, debilitated subjects, among women who are anæmic, and men exposed to exhausting influences.

When such a predisposition exists, the actual attacks are brought on by exposure to cold and damp, violent emotions, and flatulence in the intestines. And these attacks often alternate with neuralgic or spasmodic affections, such as asthma or angina.

SPASMS.—A patient, particularly among the uneducated classes, probably in the out-patient room, complains of

'spasms,' perhaps 'round the heart.' What does she mean? For it is usually a woman.

She may be trying to describe either :

1. Increased cramp-like peristaltic movements of the stomach and intestines.
2. Gastrodynia, or
3. Simple flatulence, impeding the movements of the diaphragm and heart.

Besides these so-called spasms, there are two conditions met with in dyspeptic patients which are *really* clonic spasms.

1. Hiccough. This consists of clonic spasms of the diaphragm, caused in many cases by the presence of undigested food in the stomach.

2. Fibrillary twitching in the orbicularis muscle of the eye, or occasionally in other muscles. This latter never, in my experience, happens unless the dyspepsia is associated with lowered nerve-tone from excessive smoking, tea-drinking, or excesses of other kinds.

FLATULENCE.—This is a very common and distressing symptom, and occurs both in functional dyspepsia and in chronic gastric catarrh. It is usually caused by the fermentation of the contents of the stomach and intestines as the result of the multiplication of specific organisms with the attendant evolution of gases. These gases consist of carbonic acid, sulphuretted hydrogen, hydrogen, nitrogen and the hydrocarbons. The hydrogen and nitrogen are produced by the bacteria which set up the butyric acid and acetic acid fermentations, but the marsh gas is formed incidentally during the solution of the cellulose taken in the vegetable matters used as food, and which, as we have explained, is effected by a process of fermentation. Cases have been recorded by MacNaught* where the gases issuing

* Brit. Med. Journal, 1890, I., p. 470.

from the mouth have proved themselves to be inflammable, by accidentally catching fire.

In cases of extreme flatulence the stomach contains *torulæ*, *sarcinæ*, and multitudes of other vegetable parasites. The gas-forming organism, however, appears to be a bacillus. MacNaught isolated it, and cultivated it in Pasteur's fluid. Gas was freely evolved, which burnt with a blue flame and was probably marsh gas. The organism grows in an acid medium, and consequently can develop in the acid contents of the stomach. The reason why it does not grow in the healthy stomach is probably because its contents are removed before there has been sufficient time for this to take place. Hence we can see why, in cases of dilatation of the stomach, and where the muscular movements are insufficient, it should develop in abundance.

On the other hand, more frequently than has been supposed, in cases of functional dyspepsia, flatulence is of nerve origin, and may occur when the stomach is empty. In nervous people, who, as a rule, digest their food rapidly, we sometimes meet with cases where, after we may presume the stomach has emptied itself into the duodenum, attacks of epigastric pain come on, attended with sudden flatulent distension of the stomach and bowels. This condition is generally relieved by again taking food. But nevertheless, the fact that taking food gives relief rather favours the hypothesis, that even in these cases the evolution of gas may be due to an organism, and that the organism is destroyed by the antiseptic gastric juice which would be secreted as soon as food entered the stomach.

We must not forget, however, that attacks of pain, with vomiting and flatulence occurring when the stomach is empty, are occasionally pre-ataxic signs.

As the result of flatulence we mention an exceedingly distressing symptom from which many dyspeptics suffer, viz., *Dyspnœa*, or *difficulty in breathing*.

This is produced, in most cases, by the distended stomach pressing up and impeding the descent of the diaphragm, and tilting the heart up out of position. In young subjects whose arteries are elastic, the heart is often displaced upwards so much that the apex beat may be felt an inch or more above its normal position. In some cases I have even seen it beating in the axilla when the patient was lying upon the left side. In cases like this, especially if the heart is weak, *flatulence may be really dangerous*. It is a fact not appreciated to the extent that it should be, that to all those who have weak hearts, a stomach much distended with wind is a most dangerous complication. In cases of this description, mere gastric flatulence, superadded to the existing cardiac trouble, has been known even to cause sudden death. I believe that most of the instances where patients suffering from chronic heart-disease, having retired to bed in their usual health shortly after partaking of a hearty meal, and have been found dead in the morning, are due to this cause.

The pressure upon the heart, combined with a recumbent position upon the left side, has produced this result, a much more common one than is generally imagined.

In other cases the dyspnoea appears to be due to irritation of the fibres of the pneumogastric nerve which are distributed to the stomach. This is also the cause of the **Palpitation of the heart** which is occasionally observed in dyspeptic subjects. This palpitation in its mildest form consists of a simple tumble, or jump of the heart, occurring occasionally. In its severest form it is a source of great distress.

Syncope, or fainting, is not unfrequently the result of a distended stomach, and is due to irritation of the inhibitory fibres of the same nerve. In my experience I have observed it more often in cases where the stomach is overloaded with solid food, than where it is merely distended

with wind. The patient has suffered most probably from slight nausea and loss of appetite for several days, with perhaps slight sensations of faintness, which he has taken stimulants to relieve. After a rather hearty meal, with perhaps a little more tea or claret than usual, he faints, and, vomiting, brings up not only what he has eaten at the time, but articles of food taken at preceding meals, in a semi-digested condition. It is a curious fact, pointing to irritation of the pneumogastric nerve as the exciting cause of the fainting, that in many cases the patient is conscious, just before losing consciousness, of an aura or pain in the neck along the course of the nerve.

Minor degrees of irritation will produce intermittency of the pulse, and it is a peculiarity of this form of irregularity of the heart's action that a beat is completely left out, the pulse-trace descending below the level, and the next ascent being correspondingly higher.

CONSTIPATION.—This is an almost universal accompaniment of functional dyspepsia, and is one of the commonest complaints met with at the present day. There is a great difference in the frequency with which healthy people have an action of the bowels. Some people have a motion more than once a day, others only twice or so a week. And these variations need not be pathological. When, however, the usual number of evacuations is departed from, and at the same time discomfort is experienced, we must consider the condition as abnormal and calling for treatment.

In dyspepsia the causes of constipation are—

1. Deficiency in the peristaltic movements of the intestines, generally associated with deficiency of bile.
2. Excessive dryness of the fæces.
3. Restriction of diet. This is a very frequent result of the 'dieting' which patients often undergo for the cure of their indigestion. One can have a too digestible diet. By carefully leaving out of your diet list all articles which are

indigestible, the normal stimulus of the intestinal movements is absent, and it is no wonder that constipation ensues. This fact, as we have pointed out, has been experimentally verified, as rabbits from whose food cellulose was entirely withheld became constipated, and very soon died of inflammation of the bowels. So it is not difficult to understand why dyspeptic patients, who live on lean mutton chops and dry toast, should be habitually constipated. Very many derangements of health follow a torpid state of the large bowel. The poisonous alkaloids produced by the abnormal fermentations going on in the retained contents are absorbed into the system, and, poisoning the nervous system, perpetuate the dyspepsia. So a vicious circle is established which it is very hard to break. As symptoms produced by constipation, we have mental depression—sometimes reaching the most severe hypochondriacal conditions—furred tongue, offensive breath, and loss of appetite. Also persistent nerve-pains in the back, hip, groin, or thigh, and many other symptoms simulating the antecedent states of structural diseases of the nerve-centres.

DIARRHŒA also not unfrequently accompanies indigestion. In this case it is very often associated with a congested state of the liver, and may be regarded as a natural curative measure. Excessive irritability of the muscular walls of the stomach, associated with weak digestion, will hurry the food out of the stomach into the duodenum before it is properly digested. Here it will by its presence increase the peristaltic action of the intestine, and a form of diarrhœa will be the result, the undigested food being found in the evacuations.

The same effect is also produced by irritating articles of food, such as oatmeal. It is a common delusion that oatmeal porridge is the most wholesome thing that can be taken for breakfast. The real state of the case is the exact opposite. If you examine a grain of oats under the micro-

scope, you discover a rough and bristling structure. You find that the grain is covered with a fibrous shaggy coat, with dust and insects' eggs stored away in its meshes. This is composed very largely of siliceous material, useless for food and injurious to the mucous coats of the digestive tract.

This is quite incapable of being acted upon by any of the digestive juices ; in fact, nothing less than a caustic alkali or a mineral acid will dissolve it. It is therefore absolutely unchanged by any amount of cooking or boiling to which the oatmeal may be subjected. By its scrubbing and irritating action upon the lower bowels, it acts as a cathartic. And then, after a time, the mucous membranes becoming accustomed to this abnormal irritation, constipation ensues, as the physiological stimulus of ordinary food is no longer sufficient to excite the peristaltic movements of the intestines.

Diarrhœa may also occur as the result of acute duodenal dyspepsia. In acute gastric dyspepsia, the acid decomposing mass which passes the pylorus completely neutralizes the alkaline secretions of the duodenum, and thus the remaining fats, starches and undigested proteids decompose instead of being digested, absorption is arrested, and the offending mass quickly setting up increased peristaltic movements, diarrhœa is the result. This is familiar to us all as the diarrhœa which accompanies acute indigestion, and which is often curative.

CATARRH OF POSTERIOR NASAL CAVITY, PHARYNX, AND LARYNX.—Catarrh of the pharynx very often accompanies catarrh of the stomach. It frequently gives rise to an irritating cough, which is worse on rising in the morning, and which varies in severity from a slight hacking to such a severe paroxysm as to be followed by retching.

The 'stomach cough' of dyspepsia is familiar to every physician, and, whilst depending partly upon a catarrhal

condition of the fauces, is yet greatly due to reflex irritation proceeding from the stomach.

SKIN AFFECTIONS.—It is not at all uncommon to meet with various skin diseases as the result of the malassimilation of food consequent on dyspepsia. They mostly accompany cases where there is well-marked gastro-duodenal catarrh. The forms most frequently met with are urticaria, erythema, lichen, herpes, and eczema.

Urticaria very frequently follows a single meal of indigestible material. On the other hand, it is a curious fact that in some cases skin eruption other than urticaria appears to vary inversely as the digestive disturbance. When dyspeptic symptoms are severe, the skin disease diminishes, and *vice versa*. This phenomenon may, I think, be explained on the supposition that in these cases an irritating substance, the product of malassimilation, such as uric acid, is being vicariously eliminated by the skin and mucous membrane of the digestive tract, and when a good deal of it is got rid of by one channel, there remains less to be dealt with by the other one ; perhaps not enough to set up marked symptoms. It is my impression, however, that in all cases where affections of the skin accompany digestive disturbances, there is in addition some abnormal irritability of the nervous system.

CHAPTER IV.

OBJECTIVE EXAMINATION OF THE DIGESTIVE ORGANS.

Inspection—Palpation—Percussion—The succussion sound—Artificial aids to percussion—Auscultation—Estimation of the absorptive power of the stomach—Estimation of the motor power of the stomach—Examination of the stomach contents—Examination of the urine.

AT the present day we are, thanks to modern science, in a far better position than formerly to estimate with an approach to accuracy abnormalities in the digestive organs and secretions. In order to do so, we make use of inspection, palpation, percussion, and auscultation. We have, in addition, tests by which we may ascertain the normal condition or otherwise of the motor and absorptive functions of the stomach.

INSPECTION.—By the simple act of inspection we can learn many points which will help us very much in making a correct diagnosis of the condition of the digestive organs. With the advance of more modern methods, the physician of the present day is apt to neglect to a very great degree the older ones which stood his forefathers in such good stead, and to underrate the knowledge of the case which he may gain by the simple use of his eyes.

The first thing to do is to examine the mouth thoroughly and observe the condition of the parts. This should be done in the following order :

THE TEETH AND GUMS.—The points to be observed are —

(a) **Sponginess or Chronic Inflammation of the Gums.**—These conditions frequently accompany dyspepsia depending upon chronic catarrh of the stomach and chronic alcoholism.

(b) **Defective or Carious Teeth.**—Notice particularly whether if opposing teeth have been lost in such positions as to interfere with the act of mastication.

(c) **Whether the Teeth are habitually kept Clean or not.**—The decomposing food which collects around the roots and in the cavities of teeth which are not properly and regularly cleaned, affords a very excellent breeding-ground for micro-organisms, which, when swallowed with the food, will, if there happens to be any deficiency in the quantity of HCl in the gastric juice, set up lactic and butyric acid fermentations in the stomach.

THE TONGUE.—The condition of the tongue is, in my experience, not nearly so trustworthy a means of diagnosing gastric disturbance as is generally supposed.

Apart from the fact that it is very often merely a purely local matter, being a part of the general condition of the mouth, as it is constantly coated in such local troubles as gingivitis, stomatitis, peridontitis, caries of the teeth, and mercurial salivation—we often find the tongue habitually coated in people whose digestive organs are apparently in excellent order, and, on the other hand, we not unfrequently meet with clean tongues in patients who have gastric symptoms of considerable intensity.

Dickinson* says that it is a common belief that the tongue is directly indicative of many disturbances of the stomach, bowels, and organs associated with digestion. Some people appear to imagine that the tongue is but an exposed sample of the alimentary canal, and indicates by its

* The Tongue as an Indicator of Disease. Gulstonian Lectures, 1888.

changes the extent of similar changes in the hidden parts. With those who do not go thus far, the white tongue is taken as a sign of constipation, or that the stomach and liver are out of order, and that alteratives, especially of the mercurial sort, are needed. He further states that, as the result of many observations, he has not been able to discern any condition of the tongue especially connected with ulcer or dyspepsia. In many of his cases, where dyspepsia was accompanied by stomatitis, the tongue was thickly coated, probably as a local result. In cases of simple dyspepsia and ulcer, the lower degrees of coating were present, possibly in connection with loss of appetite and limitation of food.

He also established the fact that while some forms of constipation are undoubtedly accompanied with changes in the tongue, there is no evidence that they stand to one another as cause and effect, as he has seen the tongue perfectly clean and normal after three weeks total constipation in an hysterical woman. I think, however, that most observers are of opinion that the tongue *can* furnish in a great majority of cases some useful information, and the following conditions are, I venture to believe, established by experience :

A flabby, pale, moist, relaxed tongue, often indented at the edges, is very frequent in functional dyspepsia, associated with loss of nerve tone. It is not usually heavily furred. A tongue red at the tip, furred at the base, bare, scored, or fissured, is often present in chronic gastritis.

A white, or yellowish-white, tongue, especially when slightly tremulous, is very suggestive of chronic alcoholism.

A tongue which is pretty uniformly white over its surface is often met with in atonic or functional dyspepsia.

A yellow or brown fur, mainly up the middle of the tongue, with a bad taste in the mouth, sometimes bitter, sometimes hot, denotes that the liver is not acting properly.

THE PHARYNX.—This is often congested and inflamed, especially in smokers and drinkers. This condition may also depend upon a dyspepsia, of which it may be absolutely the only symptom; and for this reason the careful examination of the pharynx should never be neglected. So often have I seen in my own practice apparently incurable cases of chronic pharyngitis rapidly get well when attention has been directed to the normal performance of the digestive act, that I usually treat all cases of this kind as if due to dyspepsia, whether symptoms of the latter are present or not.

ABDOMEN.—The inspection of the abdomen is valuable, chiefly as affording useful hints with regard to the further investigation of the case.

Under favourable circumstances, that is, when the abdominal walls are not overloaded with adipose tissue, we may often make out—

1. **The Outline of the Anterior Lower Surface of a Distended Stomach.**—For instance, if in a thin individual with relaxed abdominal walls, we can make out the outline of the greater curvature of the stomach, passing transversely below the umbilicus, we may assume almost for certain that we have to deal with a case of dilatation of the stomach. When the stomach is very much dilated, the appearances are extremely marked. The abdomen is asymmetrical, presenting a rounded swelling in its left half, which extends below the level of the umbilicus, and is bounded inferiorly by a curved margin, which extends from the lower edge of the left ribs to the right of the middle line, and corresponds with the greater curvature of the stomach. In some rare cases the left half of the epigastrium appears to be sunken in above another shorter curved line, which corresponds with the lesser curvature.

In extreme cases the stomach descends much lower in the abdomen than under normal conditions, and the greater

curvature may even reach nearly to the pubes. In this condition the epigastric and left hypochondriac regions can be plainly seen to be drawn in and sunken, whilst the lower part of the abdomen is abnormally protuberant.

2. **Distended Loops of Intestine.**—In cases of fæcal retention, the loaded viscera can often be seen at the first glance. In cases of dyspepsia, associated with fermentative changes in the large intestine, we can very frequently discover a fulness in the right iliac region, which points to enlargement of the cæcum. I have found this in thirty-eight out of fifty cases of so-called 'intestinal dyspepsia,' which I examined with the special object of ascertaining how often it was present.

3. **Abnormal Prominences of the Abdominal Wall,** pointing to the probable existence of tumours of the contained organs.

4. **Peristaltic Movements of Stomach and Intestines when in excess.**—While protuberance of the abdomen is not in itself proof positive of the existence of dilatation of the stomach (as it occurs also in persons whose small intestines are distended with flatus), yet it is conclusive when we can also see visible peristaltic movements through the abdominal walls.

'If the surface of the abdomen is attentively watched, a wave of contraction may often be seen to start from the left hypochondrium, descend below the umbilicus, and pass on to the right side, and then a little upwards towards the cartilages of the right ribs' (*Fagge*).* Or—

'A portion at the extreme left, about the size of the hand, quickly forms a convex prominence, with a decided amount of resistance to pressure; in a few seconds the swelling subsides, and another part, more to the right, swells up for a similar length of time. After each successive portion of the stomach wall has become hard and

* Principles and Practice of Medicine, II., p. 362.

prominent, the whole subsides. This phenomenon occurs spontaneously, or may be set up by manipulating the abdominal wall, or flicking it with the finger sharply, or sometimes by mere exposure of the abdomen' (*Taylor*).*

One must be careful in practice not to confound this phenomenon with hysterical contraction of portions of the abdominal wall, or the contraction of the rectus muscle often caused by manipulation.

The inspection of the abdomen is greatly facilitated by allowing a bright concentrated light to fall upon it, by which means the shadows are accentuated.

PALPATION OF THE ABDOMEN.—This is a mode of examination of the greatest importance, and should be carefully and deliberately performed, with the patient lying on his back, with the knees drawn up. There are three things for which we have to examine :

(a) **Sensibility to Pressure.**—In investigating this we have to ascertain the degree of pain produced, whether only tenderness or actual pain, and the precise position of the abnormal sensitiveness. This latter is very important, as it gives us a distinct idea which organ is affected. For instance, pain or pressure in the epigastrium is nearly always due to an affection of the stomach, whilst if it should be a little lower down and towards the left, it just as probably points to an affection of the transverse colon. If there is one painful spot over the region of the stomach, pressure on which causes a reflex point of pain on the vertebral column, generally about the twelfth dorsal vertebra, we have probably a case of ulcer of the stomach. If there are several acutely-tender spots, it is most likely dyspepsia, depending upon neurasthenia or hysteria. In this case the painful-pressure points correspond to the various sympathetic ganglia in the abdomen, viz., the cœliac, solar, aortic, and other abdominal plexuses, and

* *The Practice of Medicine*, p. 552.

indicate a condition of hyperæsthesia of the nervous system.

(b) **Abnormal Resistance in the Abdomen.**—The examination should be conducted by placing the flat of the hand upon the abdomen, and pressing very gently towards the vertebral column. Before commencing to exercise pressure, the hand must be allowed to remain in contact with the abdominal wall for a few seconds, in order to avoid inducing contraction in the recti muscles, which if it occurred would entirely vitiate one's results, and absolutely prevent the condition of the internal organs from being ascertained. The abdominal muscles are often naturally very rigid, especially over a deep-seated swelling, if one is present.

The patient should now draw up his knees, fix both heels well into the surface of the couch, and breathe deeply in and out. The examining hand gently laid upon the abdomen is then allowed to rise and fall with each respiratory movement, the fingers and palm being kept evenly applied to the skin, and all sudden movements carefully avoided.

Pressure should now be made alternately on both sides of the middle line and the resistances carefully compared. By this means we may ascertain the presence of tumours or thickenings connected with the abdominal viscera. It is not generally known that it is quite easy to ascertain the presence of fæcal impaction in the ascending and descending colon. To do so it is only necessary to allow the flat of one hand to rest gently upon the surface of the abdomen, whilst the other one passed under the patient presses up with the finger-tips the soft parts lying between the last ribs and the crest of the ilium. If the colon is loaded, it will be pressed up against the former and will be felt as a cylindrical body, between the two hands.

(c) **The Succussion Sound.**—This is a splashing sound which is elicited by making short, quick, pushing movements with the tips of the fingers over the region of the stomach.

It occurs to a greater or less extent in healthy people after the ingestion of large quantities of fluid, but in these cases it can never be perceived below the umbilicus. The important point to bear in mind is that if it can be produced below this point, particularly when the stomach is presumably empty, it is almost diagnostic of dilatation of the stomach. Boaz* states that by following the lower limit where the succussion sound can be produced, and marking it with an aniline pencil upon the skin, one is able to map out the size and position of the stomach far more accurately than by ordinary percussion. According to the same writer the diagnosis of atony of the muscular walls of the stomach can be made with absolute accuracy by eliciting the phenomenon under the following conditions:

If you give a healthy man 50-100 grammes of water to drink, even if his abdominal walls are very thin, you will be unable to produce the splashing sound, but if there is atony of the stomach walls, the phenomenon can be readily elicited with the aforesaid quantity of liquid, or even less. Splashing sometimes occurs in the transverse colon, but may be distinguished from that in the stomach by the fact that in the former the area where the phenomenon appears is bounded upwards by a straight line.

PERCUSSION OF THE STOMACH.—By means of this mode of examination we attempt to determine the size and position of the stomach, and the extent of any new formations which we may have discovered by palpation.

Normal Position of the Stomach.—The greater part of the stomach (about five-sixths) lies to the left of the middle line, and the remainder to the right of it. The lesser curvature and pylorus are covered by the left lobe of the liver, and the fundus lies under the left leaflet of the diaphragm. The pylorus is level with the tip of the ensiform cartilage in the right sternal line.

* Diagnostik der Magenkrankheiten, 1890, p. 71.

The greater curvature passes transversely across the abdomen about an inch above the umbilicus. The fundus thus lies partly behind the lower anterior portion of the left lung. Thus it will be seen that in the normal stomach only that portion of its anterior surface which is adjacent to the thoracic or abdominal wall is accessible to percussion. When, however, it is either dilated permanently, or simply abnormally inflated with wind, it is usually displaced downwards as a whole, and sometimes to such an extent as to enable us to define its upper margin.

In attempting to map out the size of the stomach we should proceed systematically.

The best course to pursue is undoubtedly to try and define first of all the lower limit of the viscus. To do this one should commence at the symphysis pubis, and percuss upwards until the characteristic tympanitic sound of the stomach is recognised. This point should then be marked upon the abdomen with an aniline blue pencil.

The note that the stomach gives on percussion may be distinguished from the tympanitic percussion note of the intestines by being deeper in character and not so high pitched. It is, however, very difficult to describe, and varies very much with the stomach contents.

As regards the method of percussion, mediate percussion is generally employed, and it will be found best to strike as lightly as possible whilst defining the lower margin. On the other hand we must use considerably more force in order to elicit the characteristic note over the portion of stomach lying beneath the lung.

Besides dilatation of the stomach and atony of its walls, the lower limit of the stomach is depressed in all conditions which press down the diaphragm, such as empyema, pleurisy with effusion and pneumothorax. The stomach may also be pushed downwards by enlargement of the liver or spleen.

The determination of the upper margin of the stomach is

not at all easy to effect, as unless it is partly filled with air there is often very little difference to be made out between its percussion sound and that of the margin of the lung.

From the experiments of Pacanowski* and Wagner,† it appears that the exact position of the upper margin of the stomach is as follows :

In the left parasternal line it lies opposite the lower margin of the fifth rib, or the fifth intercostal space. Rarely a little higher or lower.

In the left mammary line, opposite the fifth intercostal space.

In the anterior left axillary line, opposite the lower border of the seventh or eighth ribs. Rarely as high as the lower border of the sixth rib, never lower than the eighth.

In connection with the subject of dyspepsia, the exact fixing of the upper margin of the stomach is of little importance.

The same may be said of the right and left extremities. They are very difficult to make out, and give information of little diagnostic value. In fact it is only under extremely favourable circumstances that we can define them at all.

It will thus be seen that the apparent dimensions of the stomach, as ascertained by percussion, do not convey any true information, as this percussion area changes its form and magnitude, not only when the stomach itself is altered, but when any alteration in size of the adjacent organs exists.

For instance the percussion area of the stomach will be diminished in cases of enlargement of the left lobe of the liver, left pleurisy with effusion, pneumothorax, hypertrophy of the heart or enlargement of the spleen, while it will be increased in atrophy of the left lobe of the liver.

But the commonest causes of augmentation of the per-

* Pacanowski, *Deutsch. Arch. f. klin. Med.*, Bd. IV., 342.

† Wagner, *Ueber die Percussion des Magens nach Auftreibung mit Kohlensäure*. Inaug. Dissert., Warburg, 1869.

cussion area are dilatation and displacement downwards of the stomach.

It is a fact to be continually remembered, that as these conditions are apt to occur in conjunction, we may be very easily led to over-estimate the amount of dilatation. In such cases we should always try to make out the positions of both the upper and lower borders of the stomach, for if they are really cases of considerable dilatation we ought to find the distance between them to exceed 10-14 cm.

ARTIFICIAL AIDS TO PERCUSSION OF THE STOMACH.—In order to assist the process of mapping-out the stomach, the following means have been used :

1. **Distension with Carbonic Acid Gas.**—This is done by administering separately, each dissolved in water, half-teaspoonful doses of tartaric acid and bicarbonate of soda. V. Ziemssen, however, recommends the administration of much larger quantities, giving to males seven grammes of bicarbonate of soda and six of tartaric acid, and to females one gramme less.

This mode of diagnosis was first introduced by Frerichs and Mannkopf, and has been extensively used on the Continent.

When properly performed the stomach becomes sharply defined, and one is thus enabled to thoroughly explore its surface for tumours, etc.

2. **Filling the Stomach with Water.**—This may be conveniently done by simply drinking, although Penzoldt thinks it necessary to inject a quart by means of a stomach-tube !

These methods are chiefly useful when there is a difficulty in defining the lower margin of the stomach, from the fact that in the case under examination the stomach and transverse colon happen to contain the same substances, and therefore give acoustically the same, or very similar sounds. They may both contain air, or both contain solids, or a mixture of air and solids. If, then, we can artificially create

a distinguishable difference of sound, our examination will be much facilitated.

For instance, if they both contain air, and we fill the stomach with water, we shall find on percussion a dull sound, easily differentiated from the tympanitic note of the distended colon.

If they both contain solids, we can, by inflating the stomach, in most cases cause a marked difference in the percussion note to become apparent.

Penzoldt* has recently introduced a method of determining the presence of dilatation of the stomach, which is of great value. It depends upon the fact that if a healthy person drinks one litre of water, the dulness corresponding to the greater curvature is always above the umbilicus. If, however, the viscus is dilated, the dulness will reach to or below it.

Piorry,† as recorded by Dehio, has considerably improved upon this process. He first of all gives a quarter of a litre to drink, and then makes out the position of the greater curvature; he follows this up with successive portions of the same quantity, percussing afresh each time.

This method is extremely valuable, as it gives us a good idea of the tonicity of the muscular walls of the stomach. When there is considerable atony, the stomach will quickly sink down after one or two glasses of water have been taken.

The position of the patient's body during the percussion of the stomach may also render us valuable assistance. As Pacanowski has pointed out,‡ if we place the patient in an upright position when his colon contains fluid, this

* *Die Magenerweiterung*. Erlangen, 1877.

† *Zur physicalischen Diagnostik der mechanischen Insufficienz des Magens*. Verhandlungen des 7^{ten} Congresses für innere Medicin, 1888.

‡ *Percutorisch Bestimmung der Magengrenzen*. Deutsch. Arch. f. klin. Med., Bd. XL.

will gravitate downwards into the lower part of the intestine, and we shall be able to make out a zone of clear tympanitic sound between the lower margin of the stomach and the intestine.

Percussion, in an upright position, is also useful when the stomach is full, as the liquid contents, gravitating downwards, materially assist us in defining its lower margin. When examining in this position, however, we must bear in mind that the tense abdominal walls will always modify the percussion note, and render it duller than it would otherwise be.

In some obscure cases it is of advantage to percuss in the lateral position, as here the liquid contents of the stomach, falling to the side upon which the patient is lying, will cause parts which were dull in the dorsal position to become tympanitic.

AUSCULTATION OF THE STOMACH.—If we listen with a stethoscope over the stomach region we can hear—

1. A sound, or rather a succession of two distinct sounds, which accompany the act of swallowing. These are caused by the escape of food through the cardiac orifice into the stomach, and although of the highest diagnostic import in stricture of the œsophagus, are of no practical value in investigating a case of indigestion.

2. When the stomach is filled with liquid and air a succession, or splashing sound, may be heard upon some quick movement of the patient, or if the abdominal walls are alternately contracted and relaxed. If this is met with in people whose stomachs are not dilated, it signifies abnormal relaxation of the muscular walls of that organ.

3. Bubbling sounds. As these are entirely absent when the stomach is empty, their presence, five to seven hours after a principal meal, or three to four hours after a minor one, points to retention of chyme, associated with abnormal fermentative changes.

ESTIMATION OF THE ABSORPTIVE POWER OF THE STOMACH.

—The patient is given a capsule containing one gramme of iodide of potassium. The saliva is then tested for iodine every two or three minutes by placing a little of it upon starch paper, and adding a drop of fuming nitric acid. The presence of iodine is shown by a blue colour, which should appear in from eight to fifteen minutes after the capsule has been swallowed.

In certain conditions, where the absorptive power of the stomach is impaired, such as dilatation, ulcer, and cancer, this period is much prolonged.* This test was first introduced by Penzoldt and Faber.†

ESTIMATION OF THE MOTOR POWER OF THE STOMACH.—

To ascertain the motor power of the stomach, a capsule of salol is given (one gramme), and the urine examined at intervals. Salol is split up into phenol and salicylic acid, when it comes into contact with the alkaline contents of the duodenum. The rapidity with which salicyluric acid is found in the urine will give one an idea as to the time the stomach takes to empty itself. The acid may be tested for with liq. ferri perchlor., with which it strikes a dark-claret colour.

On the other hand, Brunner, and more recently Huber.‡ do not believe that the appearance of the salicyluric acid in the urine, after salol has been taken, is an absolute measure of the normality of the movements of the stomach. The latter has found that occasionally, in apparently healthy people, the appearance of the acid may be delayed without obvious cause, and that variations occur from time to time. He, however, is of opinion that we have an absolute test, not in the interval which elapses before it appears in the urine, but in the duration of time before it

* Zweifel, *Deutsch. Archiv. für klin. Med.*, XXXIX., 349, 1886.

† *Berlin. klin. Wochenschr.*, XIX., 363, 1882.

‡ Huber, *Münch. med. Wochenschr.*, 1889, No. 19; *Centrbt. für klin. Med.*, 1889, p. 803.

ceases to be discovered; and, moreover, he believes that the number of hours beyond the normal, during which the reaction can be obtained, varies directly with the degree of insufficiency of the motor power of the stomach.

But for all practical purposes, I think we may take it, that in the great majority of patients, the time of the appearance of the reaction is a sufficient test. We can, however, easily combine the two methods of estimation, and say positively, that if the first appearance of the salicylic acid is delayed, and if when it has appeared it lasts longer than twenty-seven hours, then there is certainly insufficient peristalsis.

EXAMINATION OF THE CONTENTS OF THE STOMACH.—It is my deliberate conviction that the chemical examination of the stomach contents is of little or no use in the diagnosis and treatment of cases of indigestion.

When first introduced by Ewald, and other Continental specialists, it was supposed that a method of diagnosis had been discovered which would greatly simplify the differentiation of the various gastric derangements. But further experience has demonstrated the fact that such is not the case, as we find widely-varying local conditions in the course of the same maladies. Besides which, the chemical processes and manipulations necessary are so complicated as to be quite beyond the power of the ordinary medical practitioner.

Again, the results we arrive at by these methods could have been ascertained by much simpler means, and in most cases only tell us what we already know.

For example, if we find the presence of HCl in abundance in the stomach we may conclude that there is no abnormal fermentation there. Yes, but can we not just as well ascertain that fact by observing the absence of flatulence and eructations? And we can always find out if there be an excess of acid in the stomach by the simple expedient of giving a pretty large dose of bicarbonate of soda.

Should the discomfort be caused by hyperacidity of the stomach it will be promptly relieved by the dose. And in this instance we can conclude with almost absolute certainty that the excess of acid is butyric, acetic and lactic, because it is so extremely rare to find increase in the amount of hydrochloric.

Boaz is of the same opinion* as to the uselessness of absolute estimation of the stomach contents. He states that 'both diminution and increase of hydrochloric acid are functional anomalies found in the most various diseases of the stomach and other organs.'

Again, 'the many statements *re* the amount of lactic acid found in diseases of the stomach, which have been made in the publications of the last few years, are devoid of any value so long as one does not know the amount of lactic acid present in normal digestion' (which we do not). He then proceeds to point out the fallacy of the Leube-Riegel test meal, and the results derived therefrom, in which the ascertained amount of lactic acid may just as well be referred to the results of fermentation. He then describes a ready method of determining the source of the lactic acid fermentation in cases where we conclude that it is in excess in the stomach. He gives the patient a small quantity of white bread to chew, and makes him spit it into a glass vessel, and puts the mass with some water into an incubator or in a warm place. Under such circumstances, when the mouth and teeth are healthy, one obtains hardly a trace of lactic acid after half an hour. In this case the cause of any increased formation of lactic acid in the stomach *must* arise in that viscus itself, and may either be traced to an ulceration or some motor disturbance which prevents the food from entering the duodenum at the proper time.

If, however, a considerable quantity of lactic acid forms in the chewed bread, a condition is demonstrated which is

* Boaz, *Op. cit.*

amply sufficient to account for any abnormal fermentation in the stomach. The organisms which produce the fermentation are swallowed with the food and set up the process in the stomach.

In order, however, to add to the completeness of this work, I shall now describe a scheme for an examination of the stomach contents which will be complete and exhaustive enough for clinical purposes, and which one may perhaps occasionally have an opportunity of performing when the ingesta have been accidentally vomited. Or, in certain cases, it might be excusable to administer an emetic for the purpose of obtaining them, and thus clearing up a doubtful diagnosis.

Scheme for Examination of the Stomach Contents.—
A sufficient quantity having been obtained and filtered—

1. Test the reaction with litmus paper.
2. A known quantity, say 10 cc., is tested to determine the total acidity by the phenol-phthalein test. This is done as follows:—

Method of Performing the Phenol-Phthalein Test for Total Acidity.—10 cc. of the liquid under examination are put into a porcelain capsule, and two or three minims of phenol-phthalein solution (1 in 500 of proof spirit) added. A decinormal solution of sodium hydrate is now added drop by drop with a pipette. As each drop falls into the liquid a pink coloration is formed, which disappears on agitation. As soon as this colour ceases to disappear, and the liquid remains permanently slightly tinged, you stop, and read off how much sodium hydrate solution has been used.

Each .1 cc. used will denote .063 parts per 1,000 of total acidity as compared with oxalic acid. The same process is used in estimating the total acidity of urine.

3. Another portion of 20 cc. is examined to show the presence of pepsin and the milk-curdling ferment. This is done as follows:

For Pepsin place 7 cc. in a test tube with a couple of drops of a 1 per cent. solution of hydrochloric acid.

Place 7 cc. in another test tube.

In each tube put a bit of washed fibrin, and place both tubes in an incubator at the body temperature. If after six to twelve hours the fibrin in neither tube is dissolved, there is evidently want of pepsin in the sample. But should the fibrin in the tube containing the hydrochloric acid be alone digested, then we have ascertained that the gastric juice contains pepsin, but no hydrochloric acid. If, on the contrary, the gastric juice is normal, the fibrin in both tubes should be dissolved in about two hours.

For the Milk-curdling Ferment.—5 cc. of cow's milk of neutral reaction are boiled, and to them is added an equal quantity of the filtered stomach contents, which has been neutralized and filtered. The tube containing this mixture is then placed in an incubator as before. If the ferment is present, the casein of the milk will be precipitated in flakes within thirty minutes.

4. The presence of free hydrochloric acid may be ascertained by one of the following tests :

Benzo-purpurin.—Test-papers are prepared by soaking strips of filter-paper in a saturated watery solution of benzo-purpurin, 6 B, and allowing them to dry.

If one of these be placed in the gastric juice, it will stain a dark blue, if HCl be present in not less a proportion than .4 per cent.

Congo-red.—Filter-papers prepared with this reagent turn blue or blackish-blue if free hydrochloric acid be present. This effect is not produced by organic acids or acid salts in dilute solutions.

Although many other tests have been proposed, these two are undoubtedly the most reliable.

If free hydrochloric acid is found to be present, it should be quantitatively estimated by Sjöqvist's method.

This process is given by V. Jaksch* as follows :

Ten cc. of the gastric juice are filtered and placed in a platinum or silver crucible, and carbonate of baryta *free from chlorides* added in excess. The fluid is then evaporated to dryness at a gentle heat, and the residue charred, and strongly heated for some minutes in a muffler. The residue is cooled, extracted with boiling water, and filtered ; the filtrate evaporated on a water-bath to a volume of 100 cc., and dilute sulphuric acid added. The precipitate (sulphate of barium) is placed on a thick ash-free filter, washed with water, fused in a platinum capsule, and thence removed with the usual precautions. The result is calculated thus : 233 parts by weight of barium sulphate correspond to 73 parts of hydrochloric acid, and the quantity of the latter contained in 10 cc. of the gastric juice may be calculated from the following formula :

$$x = \frac{73}{233} \times M = 0.3132 \times M$$

where M = the quantity of barium sulphate obtained from 10 cc. of gastric juice.

x = the quantity of hydrochloric acid required.

5. A rough estimate may be made of lactic, butyric, and acetic acid as follows :

Lactic Acid.—2.5 drops of liq. ferri perchlor. are mixed with 50 cc. of water. The faint-yellow colour of this fluid, whilst not affected by hydrochloric, butyric, or acetic acid, is intensified by lactic acid.

Butyric and Acetic Acids.—Strips of filter-paper, which have been soaked in bilberry die and dried, are inserted in the fluid under examination. If a rose colour be produced, which is entirely destroyed by treatment with ether, it indicates the presence of considerable quantities of lactic, butyric, and acetic acids.

A rose colour obtained when the degree of total acidity

* Clinical Diagnosis, p. 100.

is slight, and *persisting* after the addition of ether, denotes the presence of hydrochloric acid only.

6. Examination for proteids.

The substances for which we have to test are albumin, hemialbumose, peptone, and syntonin, the presence or absence of which will give us valuable data by which to determine the functional condition of the stomach and the normality or otherwise of the stages of digestion (see page 12).

About 20 cc. of the filtrate will suffice, with a little practice, for a complete examination.

The first thing to do is to test for albumin and hemialbumose. To do this the following methods in succession should be made use of :

(1) *Nitric Acid and Heat*.—A small quantity of the liquid is boiled. If a precipitate falls which is not dissolved by the addition of a small quantity of nitric acid (sp. gr. 1.18), or is increased thereby, albumin is present.

If the precipitate falls on cooling, albumose is present.

This test, however, is not conclusive, as there may be certain conditions present which will tend to vitiate the result ; we, therefore, proceed at once to examine a second portion of the filtrate with :

(2) *Acetic Acid and Ferrocyanide of Potassium*.—A mixture of a few cc. of acetic acid (sp. gr. 1.064) and a little ferrocyanide of potassium is made, and carefully poured upon the surface of the liquid under examination in a test-tube. If albumin, globulin, or albumose are present, a white ring forms at the point where the two fluids come in contact.

The next step will be to take a fresh portion of the filtrate and neutralize it with bicarbonate of sodium. If syntonin be present it will be precipitated.

Should albumin, albumose and syntonin prove to be absent, we may at once proceed to the biuret test to determine the presence of peptone.

(3) *The Biuret Test.*—A small quantity of the filtrate is placed in a test-tube, and a few drops of a saturated solution of caustic potash added. A dilute solution of sulphate of copper is then introduced drop by drop. As each drop falls into the liquid, a green precipitate is formed, which re-dissolves on shaking. If peptone be present, a red coloration becomes apparent as the precipitate disappears.

It is important to note that if there is either albumin, albumose, or syntonin in solution, a reddish-violet colour appears, which might possibly be mistaken for that given by peptone. For this reason we can only use the biuret test directly, when we know for certain that they are absent. Otherwise, before we can ascertain the presence of peptone by this test, we must perform certain preparatory processes for their removal. And this can be effected in the following manner, if enough filtered stomach contents remain to be worked upon.

The clear filtrate is acidulated with hydrochloric acid (if hydrochloric acid is not already present in excess), and phospho-tungstic acid is added until a precipitate ceases to form with it. The fluid is then filtered. The precipitate is now washed upon a filter with dilute sulphuric acid (5 in 100) until the fluid which passes through is colourless. The wet precipitate is washed from the filter into a watch-glass with as small a quantity of water as possible. Barium carbonate is now added until the mixture is alkaline, and the latter placed on a water-bath at boiling point and heated for ten or fifteen minutes. The biuret test is then applied.

Peptone is here shown by the formation of a colour varying from bluish-red to violet, and varying in depth according to the amount present.

Should the presence of the barium precipitate tend to obscure the result to any extent, the mixture must be placed in a test-tube and allowed to stand for a few minutes.

The precipitate will then sink to the bottom, and the supernatant fluid will exhibit the red coloration if peptone is present, or be of a greenish colour if it is not.

7. Test for starch and its digestive products.

If starch be present, a blue colour will be produced by the addition of iodine in iodide of potassium solution.

If erythrodextrin is present, the colour with the same reagent will be red.

In a normal stomach neither of these should be found in the filtered contents an hour after food has been taken.

If such be the case, we may conclude either that the amylolytic process has been slowed from a saliva deficient in diastase, or from excessive secretion of free acid at the beginning of digestion ; or that starchy food has been taken in too large quantity.

8. The remainder of the fluid is distilled and the residue shaken up with ether, in order to determine the quantity of lactic acid present.

The ether is then distilled off and the residue dissolved in water. To this solution a little basic acetate of lead is added. It is then filtered, the filtrate treated with sulphuretted hydrogen, again filtered, and finally digested on the water-bath. Lactic acid remains behind in the form of a syrup. From this the zinc salt may be obtained by the addition of carbonate of zinc, and the lactic acid it contains calculated in the usual manner.

THE EXAMINATION OF THE URINE, AND ITS DIAGNOSTIC SIGNIFICANCE.—The points which are useful to us in the diagnosis of disturbance of digestion are :

1. The acidity of the urine.
2. The amount of chlorides.
3. The amount of urea.

The Acidity.—It was first pointed out by Bence Jones in 1819* that fluctuations took place in the reaction of the

* *Philosophic. Transac.*, 1819, s. 235.

urine, and that these bore a definite relation to the ingestion of food. After a meal the urine gradually becomes alkaline, and this condition reaches its highest point about three hours after breakfast and three to five hours after dinner. The cause of this phenomenon is the fact that acid is abstracted from the blood to form the gastric juice. Therefore, as we might expect, the introduction of hydrochloric acid into the stomach will increase the acidity of the urine, and the exhibition of alkaline carbonates will have the opposite effect. The important point, however, for us to notice is that *when acid gastric juice is not secreted in sufficient quantity, the urine remains abnormally acid.* This is of immense value to us in the investigation of cases of indigestion, as we are thus enabled to tell whether an acid dyspepsia depends upon increase of hydrochloric acid secretion in the stomach, or upon organic acids derived from the fermentation of the stomach contents. In the former case 'the alkaline tide' will be observed following the meal at the proper time; in the latter, the urine will remain acid; and I believe that we can by this means arrive at results quite as accurate for all practical purposes, and with much less trouble, than by a chemical examination of the contents of the stomach. The estimation of the total acidity of the urine may conveniently be carried out by the phenolphthalein test described on p. 88.

The Chlorides in the Urine.—In cases of excessive secretion of HCl in the stomach, the amount of chlorides in the urine diminishes in a very extraordinary manner. This was first pointed out by Jaworski and Rosenthal,* the latter finding considerable diminution in cases of hyperacidity from disordered nerve-action. This phenomenon is only what we should naturally expect to find, taking into consideration the mechanism of the secretion of acid in the

* Ueber Vomitus hyperacidus n. das Verhalten des Harns. Berl. klin. Wochenschr., 1887, No. 28.

stomach. The chlorine of the HCl is, we know, derived from the chlorides of the blood, and, consequently, any increase in the former must necessarily be associated with diminution of the latter. This deficiency is much more marked when there is a constant removal of HCl from the stomach as fast as it is formed, which occurs in persistent vomiting, because in this case the opportunity of reabsorption into the system along the stomacho-intestinal tract is wanting. For the same reason the amount of chlorides in the urine are diminished when the absorptive power of the stomach and intestines is weakened.

Estimation of Chlorides.—For practical purposes the rough estimation of the amount of chlorides in the urine may be effected with sufficient accuracy by the nitrate of silver test. A solution of nitrate of silver added to urine throws down both phosphates and chlorides. If, however, a few drops of nitric acid be added previously, the phosphates will be held in solution, and only the chlorides fall as a dense opaque white precipitate of chloride of silver.

A 1 in 8 solution of nitrate of silver should be used.

When urine contains the normal amount of chlorides— $\frac{1}{2}$ to 1 per cent.—a single drop of the nitrate of silver solution will precipitate the chlorides in cheesy lumps, which are not further divided, or do not make the urine more milky on agitating the glass.

If the chlorides are diminished to $\frac{1}{10}$ per cent. or less, the addition of a single drop of the silver solution no longer produces the white cheesy lumps, but a simple cloudiness, and the entire fluid appears equally milky.

If the chlorides are entirely absent, there will be no precipitate whatever.

The Amount of Nitrogen as estimated by Urea.—If the amount of nitrogen as estimated by urea be *largely increased* in a case of indigestion, we should suspect cancer of the stomach. This fact has been established by the experiments

of Fr. Müller,* who found in seven cases of cancer of the stomach that the N secretion exceeded the ingestion, and who explained this fact on the supposition that the body was losing some of its albumin.

The amount of urea is *diminished*—

1. In cases due to gout.
2. Where the food passes through the intestinal canal without being completely digested.
3. Where the absorptive power of the gastro-intestinal tract is much diminished.

Indican.—The recognition of abnormal amounts of indican in the urine is of considerable importance, as when present in large quantities it implies that abundant albuminous decomposition is actively progressing in some part of the system. It is very often a sign of intestinal putrefaction, and usually varies directly with the activity of that process.† Its presence in the urine in excess will often therefore afford us a clue to the significance of certain symptoms of disturbed digestion. Under normal circumstances 5-20 milligrammes of indigo-blue can be obtained from the urine passed in twenty-four hours. The method by which it becomes increased in certain cases is as follows:

Whenever a substance named *indol*, and first discovered by Bayer, is introduced into the blood, indican is increased. It was found by Kühne‡ that indol was always produced during the artificial digestion of albumin, in the presence of minced pancreas. It is therefore more than probable that the indol thus produced during intestinal digestion is absorbed into the system, and converted in the blood into urine-indican. It

* Stoffwechseluntersuchungen bei Krebskranken. Zeitschr. f. klin. Med., Bd. XVI., s. 496.

† Fr. Müller, Mittheil. aus der Würzburger Klinik, II. 341, 1886. Ortweeler, *Ibid.*, p. 153.

Ewald, Virchow's Archiv., LXXV., 409, 1879.

‡ Virchow's Archiv., vol. XXXIX.

is now a well-known fact that in ordinary normal digestion very little indol is produced ; but whenever intestinal digestion is delayed, or interfered with, more is produced, absorbed, oxidized, and secreted as indican.

Indican is a colourless substance, which is converted by acids into indigo-blue and indigo-red, and it is by means of these coloured bodies that it is identified.

The presence of indican can be ascertained by—

1. *The Indigo-blue Test.*—A few cc. of hydrochloric acid are added to an equal quantity of the urine, and a solution of a hypochlorite is added drop by drop from a pipette, and shaken up with the fluid. A little chloroform is then added. Indigo-blue is formed, which dissolves in and colours the chloroform a deep blue.

2. *Indigo-red Test.*—A sample of urine is boiled, and whilst boiling, nitric acid is added by drops until it assumes a deep Burgundy-red colour. The froth on shaking is blue-violet. By cautious neutralizing with ammonia one can gradually produce a flesh-red, and then a permanent red-brown coloration, whilst as each drop of the alkali is added, a precipitate of a blue-red colour is thrown down, re-dissolving on agitation.

As regards the diagnostic significance of the presence in the urine of the peptic ferment, peptone, phenol, and the aromatic oxy-acids, the subject has not been sufficiently worked out to be of any practical use in the investigation of cases of indigestion.

CHAPTER V.

CLINICAL VARIETIES OF INDIGESTION, WITH SPECIAL REFERENCE TO DIAGNOSIS.

Methods of classification—Acute catarrh of the stomach—Acute catarrh of the duodenum—Chronic catarrh of the stomach—Its differential diagnosis from functional dyspepsia, cancer, and ulcer—Functional indigestion—Its differential diagnosis from chronic catarrh—Chronic catarrh of the duodenum—Method of interrogating a patient.

ALTHOUGH attempts have been made by many writers to classify the various forms of indigestion, an absolutely perfect arrangement appears to be impossible.

The one which I shall adopt, and which I venture to hope will be found a very convenient one, is as follows :

I. ACUTE INDIGESTION.

- A.* Acute gastric indigestion or catarrh.
- B.* Acute duodenal indigestion or catarrh.

II. CHRONIC INDIGESTION.

- C.* Chronic gastric catarrh.
- D.* Functional gastric indigestion (Atonic dyspepsia), there being no structural alteration.
- E.* Chronic duodenal indigestion.

As regards chronic gastric indigestion, I believe all cases may be brought either into class *C.* or *D.*, and I believe that much of our success in practice will depend upon the facility with which we can differentiate these two varieties the one from the other, as the respective treatment is

diametrically opposite. I shall give in this chapter a short description of each group, recapitulating the leading symptoms which are peculiar to each and attempting to show how they may be distinguished the one from the other. And although in doing so I must necessarily repeat certain facts which I have previously stated, yet I do not think that I shall be doing wrong, as being differently arranged they will present the subject from another point of view, and they cannot be too firmly impressed upon the mind.

A. Acute Gastric Catarrh.

Ætiology.—The causes of acute catarrh of the stomach are—

1. Irritating substances which have been taken into the stomach and produce inflammation of the mucous membrane by their direct action. These may be—

- a.* Chemical poisons such as arsenic and antimony.
- b.* Vegetable irritants, fungi, poisonous berries, unripe fruits.
- c.* Animal irritants, *i.e.*, decomposing food containing ptomaines, or articles of diet containing an irritant (as mussels).
- d.* Excess of ordinary food.

2. Irritants generated in the stomach itself.

These arise from abnormal processes of fermentation in the stomach contents and the consequent development of microbes, due to alteration in the gastric juice or the abnormally long stay of the food in that viscus.

3. Exposure to extreme heat.

Cases have been recorded where workmen have been seized with vomiting and pain in the stomach after having been exposed to the heat of a furnace.

4. Catarrh of the intestine.

5. Acute diseases, especially of an infectious character,

such as cholera, scarlet-fever, erysipelas, measles, diphtheria, small-pox, etc.

Subjective Symptoms.—There is generally complete loss of appetite, although sometimes it remains good, but the patient is afraid to eat, knowing that it will cause him subsequent pain. Nausea and retching and sometimes actual vomiting are present. The breath is offensive and there is a pasty taste in the mouth. Thirst is often extreme. There is generally headache, drowsiness and occasionally vertigo. The patient often experiences a sensation of great prostration and lassitude, with aching in the limbs. Constipation or diarrhœa.

Objective Symptoms.—Tongue is coated with a thick yellowish fur, although sometimes it is raw and red and denuded of epithelium.

The breath is offensive and occasionally there is an herpetic eruption on the lips.

Stomach is usually tender on pressure and the epigastric region often hard and swollen. This tenderness is diffused over a considerable area and not limited to a circumscribed spot. Sometimes there is pain at the sternum or in the back. The motor and absorptive functions of the stomach are diminished.

Stomach Contents.—The vomited matters show an absence or diminution of HCl, but are strongly acid from the presence of quantities of lactic and butyric acids. They also usually contain mucus in considerable amount, ferments, and undigested food that has undergone fermentation from remaining too long in the stomach.

Fæces vary both in consistence and quantity and are very foetid.

Urine, diminished in quantity and high-coloured.

Clinical Variations met with in Practice.—1. There is first the simple form of acute dyspepsia due to indiscretion in eating and drinking, so commonly met with in practice.

In these cases the patient after having committed an excess of diet goes to bed apparently in his usual health, but awakes in the middle of the night feeling faint and sick. He perspires profusely and vomits the contents of his stomach, with perhaps a little bile. He has perhaps, also, slight diarrhœa. This terminates the attack, and he goes to sleep and awakes in the morning in his usual health. In some cases I have known the attack to occur in the daytime with a fit of syncope, during which the patient vomits and apparently brings up all that he has eaten for the last few days. In this case the fainting is evidently caused by irritation of the pneumogastric nerve which inhibits the heart's action. It is a curious fact about these cases that the contents of the stomach come up with very little fluid, no matter how much has been taken with the meal that caused the trouble.

This is really the only form of acute gastritis to which the name of acute indigestion should properly be applied, but in order to facilitate diagnosis the other varieties are here briefly described in addition.

2. Cases due to irritant poisons.

In investigating a case of acute gastritis the possibility of this cause must always be borne in mind.

Among the substances which have been known to cause acute gastritis are strong mineral acids, oxalic acid, caustic alkalies, carbolic acid, phosphorus, arsenic, antimony, and absolute alcohol.

The symptoms will vary with the nature and quantity of the poison taken. Corrosive poisons will usually act upon the lips and mucous membrane of mouth and pharynx as they are being swallowed, and will thus leave a clue to the nature of the case.

Excessive pain in the stomach with vomiting of blood-stained matter will be an early symptom. One can often detect the poisonous material itself in the vomited matters

by its smell, and almost always by its chemical reactions. Afterwards follow drowsiness, small, feeble and irregular pulse, collapse, cyanosis, and clammy sweats.

In poisons which have a general systemic, as well as a local action you will find their characteristic effects upon the organism.

Death may take place either at once from collapse, or later on from the remoter effects of the poison. In cases of poisoning by corrosives which have not an immediately fatal issue, you will probably get resulting partial atrophy of the mucous membrane of the stomach, or stricture of the œsophagus from cicatrical contraction.

3. According to Fagge* 'there is a clinical group of cases in which somewhat severe epigastric pain is accompanied by vomiting, first of the contents of the stomach, then of a considerable quantity of mucus, and lastly of bile. There is a thickly-coated tongue, considerable thirst, and as a rule constipation. These symptoms occur in elderly rather than in young patients, and may come on in the course of chronic Bright's disease (quite apart from uræmic vomiting) or other lingering malady. But they are most often seen in combination with bronchitis and myalgia. In such cases we find the heart and the kidneys unaffected, and no evidence of more than moderate catarrh of the large bronchial tubes. The temperature is not raised, but the pulse is quick and irritable and the "Muscular Rheumatism" severe, particularly in one or other shoulder, and in the back and loins; or there is decided pleurodynia, but no pleuritic rub or effusion.'

Differential Diagnosis of Acute Gastric Catarrh. — The chief diseases with which acute gastric catarrh may be confounded are enteric fever and peritonitis. From the former it may be distinguished by the absence of rose spots, swelling of the spleen, cæcal pain and gurgling, and

* Fagge, Principles and Practice of Medicine, II., p. 321.

the characteristic diarrhœa. From the latter by the circumscribed character of the pain, the more gradual onset, less distension, and absence of collapse as a rule.

Course.—In most cases it is not dangerous except when the result of irritant poisons, ptomaines, or when occurring in the course of acute infectious diseases. In young children, on the other hand, it is not unfrequently fatal.

In some cases acute gastritis passes into the chronic form.

Morbid Anatomy.—According to Zeigler the following changes are observed :

The mucous membrane is swollen and of a dark-red colour with small extravasations of blood, and covered with a film of mucus, changed epithelium and leucocytes.

The cylindrical epithelial cells of the ducts of the glands have undergone mucoid change, and many of them have desquamated.

The epithelial cells of the peptic glands are more granular than usual, and often detached. There is infiltration of leucocytes between the tubules, into the subglandular tissue, and the submucous layer.

B. Acute Duodenal Dyspepsia.

This is met with in practice in two distinct forms.

1. *Secondary Duodenal Dyspepsia.*—This occurs as a sequel and necessary concomitant of acute gastric catarrh. The acid undigested contents of the stomach having reached the duodenum, neutralize the alkaline secretions there. The consequence is, that all duodenal digestion is arrested, the intestinal peristaltic movements are increased, and a kind of diarrhœa is set up, the object of which is to expel the offending material.

The symptoms naturally are abdominal pain, diarrhœa, and mental depression.

2. *Primary Duodenal Dyspepsia.*—This is caused by improper food, such as excess of vegetables, starch, and

substances generally which are digested in the duodenum. There may also be added a deficiency in the biliary and pancreatic secretions.

The symptoms are those of the first form.

C. Chronic Catarrh of the Stomach.

Subjective Symptoms.—Appetite is capricious. Sometimes completely lost; in other cases voracious. Sometimes perverted. As a rule sufferers from this complaint eat very poor breakfasts.

Taste.—There is often a bad taste in the mouth, especially on first rising in the morning.

Excessive thirst between meals is often present.

Eruclations are very common, and occasionally heart-burn.

Vomiting is the exception rather than the rule, although nausea is often complained of. A sensation of internal heat, which is relieved by drinking, is frequently present.

The nausea is characteristic, occurring when the stomach is empty, especially before breakfast, and that meal is often brought up. The explanation of this appears to be the quantity of irritating mucus that accumulates in the stomach during the night.

The bowels are generally constipated, unless the catarrh extends to the intestines.

A feeling of malaise and drowsiness after eating is often complained of. In some cases we find headache, giddiness, palpitation of the heart, and hypochondria in various degrees.

Pain.—This is a most constant symptom, and is generally a feeling of weight and discomfort rather than actual pain. In many cases it is merely a feeling of fulness in the epigastric region. In some cases it is a burning soreness behind the sternum, coming on two or three hours after meals.

Objective Symptoms.—Gums are often red, spongy, and bleed at the slightest touch.

Breath is offensive. The lips are sometimes cracked and dry.

Tongue is sometimes coated with a brown or yellowish fur, or on the other hand may be of a bright-red colour, with projecting papillæ. Frequently the sides and tip are red, whilst the back and dorsum are furred.

Saliva is frequently secreted in excess, and, particularly in cases of excessive smoking, may escape at night from the mouth and wet the pillow.

The pharynx is also frequently the seat of chronic granular inflammation, attended with the secretion of a thick tenacious mucus, which leads to frequent hawking, or a slight hacking cough, worse in the morning.

Patients suffering from chronic catarrh of the stomach almost always emaciate and grow thin, and slight evening rise of temperature is not at all uncommon.

The whole epigastric region is often swollen, particularly after meals, and generally abnormally tender on pressure.

The peristaltic movements of the stomach are often diminished, and the gastric secretion below the normal, both in quantity and quality.

Examination of the Contents of the Stomach.—When vomiting occurs in dyspeptic patients the ejected matters are generally very sour, and this is not usually due to excessive secretion of hydrochloric acid, but to the formation of abnormal quantities of lactic, butyric, and acetic acids. In some cases, however, the amount of hydrochloric seems really to be increased. In most, there is a large quantity of mucus. In simple chronic gastritis, and in those cases where there is an abnormal quantity of mucus, the rennet ferment and pepsin are diminished to a marked degree. (For more detailed account, see p. 23.)

Urine is diminished in quantity, and rich in urates.

Course.—Under proper treatment this condition can be usually cured, but it is very liable to relapse, especially if bad habits are persevered in. If it persists it causes habitual dyspepsia, with its resulting loss of strength and capacity for work. If not cured it may eventuate in atrophy of the mucous membrane of the stomach, which in turn may lead to a cachectic state, or even, according to Dr. Fenwick, to cases indistinguishable from pernicious anæmia. According to Ewald,* the initiation of pulmonary phthisis in those predisposed to it may be often ascribed to chronic catarrh of the stomach. It appears to me, however, that in these cases it is not unlikely that the tubercular disease may have preceded the gastric affection which was really the first symptom of the former.

Dilatation of the stomach is also not uncommonly the result of neglected catarrh of the stomach.

Morbid Anatomy.—In long-standing cases the walls of the stomach are thickened and vascular, and present numerous slate-coloured patches of pigmentation and occasionally minute ulcers. Near the pylorus the mucous membrane is often mammillated, or wrinkled.

Diagnosis.—The affections of the stomach from which it has to be especially distinguished are functional dyspepsia, ulcer of the stomach, and cancer.

Diagnosis from Functional Indigestion.—There is more epigastric tenderness.

There is more often a burning sensation, and feeling of heat in the stomach. Local symptoms are hardly ever entirely absent, and follow ingestion of food.

There is a greater degree of nausea, persistent anorexia, and eructation of gas.

There is also more often an appearance of premature decay, and a greater tendency to hypochondriasis.

* Zeit. f. klin. Med., Bd. XVI., s. 395.

In addition there are some special points which should guide us.

1. The condition of the tongue.
2. The slight fever often present.
3. The vomiting of mucus.
4. The length of time that the disease has lasted. It is very chronic.
5. The results of treatment. All the symptoms are made worse by the treatment appropriate to functional dyspepsia.

6. Stimulants are not as well borne as they are in functional dyspepsia. Alcohol usually produces distress.

Diagnosis from Cancer.—It is not impossible to mistake chronic gastric catarrh for cancer when it is accompanied by nausea, vomiting, hæmatemesis, general pallor, and loss of flesh.

Cancer may be distinguished by the fact that when it is present—

1. Vomiting takes place when the stomach is empty, as well as when it is full of food.
2. Pain is greater.
3. The tenderness is more marked.
4. Emaciation and pallor are more steadily progressive.
5. There is often 'coffee-ground' vomit.
6. The disease makes more rapid progress.
7. The existence of a distinct tumour may sometimes be made out.

Diagnosis from Ulcer of the Stomach.—In ulcer—

1. Pain is more pronounced and constant, and more centrally located.
2. Vomiting after food is more immediate and persistent.
3. The tongue is generally clean.
4. Flatulence is rare.
5. Anæmia is generally present, and the patient very often a young girl.

D. Functional Dyspepsia, or Indigestion without Concomitant Catarrh of the Stomach.

In addition to cases where extreme pain is the most prominent symptom, and to which the name 'nervous dyspepsia,' or 'neurosis of the stomach,' was originally applied, it is clear that we must place under this heading all cases of dyspepsia which are not due to or accompanied by local changes in the stomach. In other words, all derangements of digestion—not due to external irritations or to tissue change—must logically be spoken of as functional, and must, in the great majority of cases, be due to some defect in the innervation of the stomach.

It not unfrequently happens that dyspepsia of this kind is one of the first signs of commencing exhaustion of the nervous system, and may be the earliest indication that the bodily strength is beginning to give way. It is also a fact that severe functional disorder of the stomach may exist for a very long time—it may be months or even years—before any further mischief can be observed in the brain or spinal cord.

The symptoms of functional dyspepsia are mainly subjective, the objective being, in certain cases, increased amount of HCl in the stomach and impairment or increase in the motor power of the stomach-walls.

The subjective symptoms are mainly those of chronic gastric catarrh, but differ in degree and combination, and are chiefly the following :

1. Alterations in the appetite and desire for food, and
2. Abnormal sensations referred to the epigastrium.

As a rule discomfort, and a sense of sinking or 'all-goneness,' rather than actual pain. Occasionally the pain may be very severe, and the only symptom present, when it is usually described as 'gastrodynia.' It is extremely probable that these abnormalities in appetite and unusual sensa-

tions are due to varying degrees of anæsthesia or hyperæsthesia of the nerves of the stomach. A very common phenomenon with dyspeptics of this class is the occurrence of sudden flatulent distension coming on when the stomach is empty (see page 66). In the form of functional dyspepsia depending on nervous exhaustion, although as a rule sufferers are relieved by food, exceptions are sometimes met with where persons become utterly prostrate for an hour or so after a full meal. This phenomenon is quite intelligible when we bear in mind that the stomach robs the brain of nerve-force and blood during the period of primary digestion.

3. Headache and giddiness are also not unfrequently met with.

4. Acid eructations, regurgitation of food, nausea and vomiting are also sometimes present.

Diagnosis.—The diagnosis from chronic catarrh is made by attention to the following points :

In functional dyspepsia we find that—

1. The symptoms are not so continuous.
2. There is less epigastric uneasiness.
3. Less tenderness.
4. Less thirst.
5. Not so great a degree of emaciation.
6. The nausea and loathing of food is not such a constant symptom.
7. There is less general disturbance of the system.
8. Tongue is less thickly coated and not so well marked.
9. Urine is usually pale, sometimes neutral, depositing oxalates and excess of phosphate, instead of the uric acid excess and abnormal deposit of urates met with in chronic gastric catarrh.

One must rely for a diagnosis mainly upon the appearance of the patient, the absence of definite physical signs and

the presence of an adequate degree of general nerve disturbance to account for the stomach trouble.

In cases of functional dyspepsia depending entirely upon nerve exhaustion there are, according to Beard and Rockwell,* several points which help one very much in differentiating it from other forms of indigestion.

‘First, in purely nervous dyspepsia, the patients feel worse when the stomach is empty, and are relieved by eating. Patients of this class often have the greatest distress before meals, or when a meal is long delayed—even over-eating is a relief to them. With these persons, mental or physical labour on a perfectly empty stomach is apt to cause distress—pain in the eyes, pain in the head, general nervous distress all over the body, and pain in the stomach itself—indeed, there is no part of the organism that will not suffer when mind or body is much exercised on a perfectly empty stomach.

‘Secondly, the symptoms of nervous dyspepsia are very capricious, coming and going without traceable cause.

‘Thirdly, nervous dyspepsia is most commonly found with the nervous diathesis, and is apt to be associated with other nervous symptoms in other parts of the body. In some cases nervous dyspepsia is a forerunner of a long list of nervous symptoms through all the different organs, as the eyes, the ears, the brain, the spine, and reproductive apparatus. In some cases it takes the place of many of these symptoms, being better when they are worse, and worse when they are better.

‘Fourthly, nervous dyspeptics are relieved by remedies that have a sedative and tonic effect in general, without any special reference to the stomach.’

And I must say that my own experience of this class of cases distinctly corroborates these statements.

Course of the Disease.—The patient is usually, if not en-

* Nervous Exhaustion, 1890, p. 73.

tirely, greatly relieved by the means that modern science has placed at our disposal.

E. Chronic Duodenal Dyspepsia.

This is the result of disturbance of the natural relations between the digestive secretions present in the duodenum and the chyme. The symptoms consist of—

1. Pain and uneasiness in some part of the abdomen.
2. Heartburn.
3. Mental depression.
4. Flatulence.

These come on two or more hours after a meal. There is also irregularity of the bowels, either constipation or, more frequently, diarrhoea; and the stools are usually pale, very offensive, and frequently contain undigested fat, starch, and milk. The paleness may be due to deficiency of bile, or as pointed out on page 16, to the presence of undigested fat.

METHOD OF INTERROGATING A PATIENT.

In order to arrive at a correct diagnosis it is of the utmost importance to conduct the investigation in a systematic manner; in order that no point or fact bearing upon the case may be accidentally omitted. And for this purpose it is of great advantage to ask your questions in a regular sequence.

The following is the arrangement which I usually adopt in my own practice, and which I believe will answer every purpose.

I endeavour to elicit the following facts in the following order, first of all taking the more general.

1. *The precise date when the indisposition appeared.*—It is sometimes rather difficult to arrive at this, as patients are often very perverse, and require to be cross-examined, as if in a witness-box, before they can be made to give a direct

answer. And as disorders of digestion are frequently gradual in their inception, it is not at all an easy matter to fix the exact time when they first began to make their appearance. But this difficulty may usually be overcome by asking the patient 'How long ago is it since you were quite well?'

2. *The manner of its access.*—Did it come on suddenly or gradually? And in what manner? What were the first symptoms noticed?

3. *The supposed cause.*—(Such as a chill, fright, excess of any kind.)

4. *The subsequent course of the illness, with the order in which the symptoms appeared.*

5. *The leading symptoms at the present moment, viz.*—The particular discomforts or painful sensations which have impelled the patient to consult you to-day.

These facts having been ascertained, one proceeds to investigate more particularly the symptoms referable to the organs of digestion.

A. The Condition of the Appetite.

Is it normal or abnormal? If the latter, is there complete loss of appetite, is it capricious—or, there being loss of appetite, does it return after a little food has been taken? Is there increase of appetite?

Is there a normal appetite, which disappears after a little food has been taken?

Is there a feeling of satisfaction after food or not? Is there a disagreeable taste in the mouth? If so, describe it. Is this latter constant or variable?

B. The Usual Arrangement of the Patient's Meals, with the Quantity and Kind of Food taken at each Meal.

Amount of alcohol, tobacco, tea, coffee taken. Is eating or drinking between meals a usual circumstance?

C. Sensations referred to the Gastric Region.

1. *Feeling of Pressure, or Oppression.*—The exact spot where it is felt. Does it come on after eating, or quite independently of taking food?

Does this sensation come on immediately after food has been taken, or not until some little time after? How long does it remain? Does the quantity of food taken make any difference as to its presence or intensity?

2. *A feeling of fulness after food.*—Is it present at other times, as well as after food? Is it limited to the epigastrium, or does it extend over the whole abdomen? Has the quantity of food anything to do with its intensity? Does it come on after a small meal the same as after a large one? Is it more pronounced after a meal of animal or of vegetable food? Does it immediately follow a meal, or does it come on some time afterwards?

3. *Pain in the gastric region.*—Character or description of the pain. The precise spot where it is felt. Is it restricted to a circumscribed area, does it extend over the whole abdomen, or does it change its position from time to time? Has it any connection with meals? If so, does it come on during, directly after, or some time after? Is the pain relieved, increased, or uninfluenced by taking food? Does pressure on the painful spot relieve or exacerbate the pain?

D. Flatulence.

Does it come on after food, or when the stomach is empty? Does it observe any degree of periodicity? Does it follow any particular article of diet? Is it accompanied by other symptoms, such as headache, dyspnoea, or pain in the neck?

E. Eructations.

Are they slight or severe, noiseless or explosive? Their character. Are they acid, bad-smelling, bitter, or tasteless?

Are particles of food brought up as well? Do they occur during the process of digestion, or independently of it?

F. Vomiting and Nausea.

Get the patient to describe the vomited material. Does vomiting take place on an empty stomach, or only after food? If the latter, how long after food? How often does the vomiting take place? Are the attacks periodic, with intervals free from vomiting?

Description of the act of vomiting.—Is it preceded by pressure, fulness, retching, pain, or cramp? Does the act of vomiting relieve the pain or discomfort? Is there blood or bile in the vomited matters, and, if so, is such invariably the case?

G. The Condition of the Bowels.

Is there constipation? If so, are the bowels eventually opened by themselves? If not, what kind of assistance is given (purgatives, injections, etc.)? If the stools are abnormally frequent, of what quantity or consistence? Are hæmorrhoids present?

After these questions have been satisfactorily settled, any of the methods of physical examination which appear to be indicated should be had recourse to—as a rule, inspection of the tongue, gums, fauces and abdomen, palpation of the abdomen and examination of the urine being made use of on every occasion.

The special characteristics of the case under observation having been thus established, diligent search should be made for the cause, and for this purpose it will be often necessary to subject each of the organs and systems of the body to an exhaustive examination.

CHAPTER VI.

TREATMENT.

General Hygiene—Diet—Drugs—Artificial digestive ferments—Pepsin—Pancreatin—Papain—Electricity—Treatment of acute gastric catarrh—Of acute duodenal catarrh—Of chronic gastric catarrh—Of alcoholic dyspepsia—Of the dyspepsia of tea drinkers—Of gouty dyspepsia—Of functional indigestion—Of the dyspepsia of phthisis—Of chronic duodenal dyspepsia.

Special treatment of some particular symptoms and conditions—Anorexia—Acidity—Constipation—Dilatation of the stomach—Flatulence—Hiccough—Pain, gastrodynia—Pyrosis—Ulcer of the stomach—Vomiting.

THE remedial measures at our disposal for the treatment of indigestion may be grouped under several headings, which we shall consider in turn.

GENERAL HYGIENE.

In order to place the patient under the most favourable conditions for getting well, we must insist upon the due observance of the ordinary rules of health.

1. The skin must be kept in a healthy condition by a daily rubbing with a rough wet towel. This is preferable in many cases, especially where there is want of nerve-tone, to a cold bath, which is apt to prove too great a shock to the system.

2. The clothing should be suitable to withstand changes of temperature. Woven woollen material should be worn next the skin, and, as a rule, the ordinary long-cloth shirt discarded in favour of one either of flannel or of cellular cloth.

3. A proper amount of exercise and recreation must be insisted upon.

Horse exercise is by far the best, if it can be obtained ; after this comes walking. The great drawback to both, however, is the fact that they only exercise the lower extremities, and hardly at all the upper part of the body. Some additional exercise is therefore required, and this may be found either in the use of dumb-bells, or in one of the forms of pulley-weight apparatus. In fact, the latter may be used, with a scientific series of exercises, as a complete substitute for all other forms of exercise, provided that at least an hour be spent in the fresh air towards the close of the afternoon.

It is, however, very important not to take active exercise just before or after a meal (see page 32). The sharp walk before breakfast I am convinced is a mistake. If exercise is indulged in at so early an hour, a cup of cocoa and a slice of bread and butter should be previously taken.

DIET.—In the dietetic treatment of dyspepsia, the physician has two distinct indications to carry out—firstly, to give sufficient food to provide for the nutritive wants of the organism ; secondly, to adapt what he gives, both in form and quantity, to the digestive capabilities of his patient. And in order to do this successfully, he must devote his attention not only to the articles of diet, but also to the time when they are taken and to their quantity. An ideal diet-table for a patient should specify :

1. The exact time when each meal should be taken.

This is important, because indigestion is not unfrequently caused either by crowding all the meals into a short space of time, or allowing too long intervals to elapse between them.

It will be found that in most cases we shall have to order smaller and more frequent meals.

2. A list of forbidden and permitted articles of diet.

It too frequently happens that doctors curtail unreasonably the diet of their patients. *Never forbid any article of diet unless there is a distinct reason, based upon the pathological aspect of the case, why it should not be taken.* It is essential also to provide that the prescribed diet is not too monotonous, as thereby a temporary loss of appetite or loathing of food may easily be induced.

3. The quantity to be taken at each meal must be distinctly specified.

4. The manner in which the food is to be prepared should be sufficiently indicated.

In order to understand the scientific adaptation of diet to cases of indigestion, we must make ourselves thoroughly familiar with the theoretical dietetic treatment of the following groups :

1. Cases where the gastric juice is altered in quality or quantity.

2. Cases where the movements of the stomach are abnormal.

3. Cases of dyspepsia depending upon loss of nerve-tone.

1. **Alterations in the Gastric Juice.**—We may have

(a) *Increase in the quantity or acidity of the gastric juice.*

In these cases we shall naturally expect to find that albumin is readily dissolved, but that the digestion of starch and fat is considerably interfered with.

In the case of the starch, the excess of acid inhibits the action of both the salivary and the pancreatic diastase.

As regards the fat, the continual production of acid precipitates the essential constituents of the bile in the duodenum, and thus interferes with its fat-digesting action.

Under these conditions, therefore, common sense tells us that we may give as much meat and albumin in the diet as we like, but that we should limit the amount of fat and starch to the minimum absolutely necessary for the nutriment of the organism; and, moreover, we should convert

the starch as far as possible by artificial peptonization before administering it. We should also replace ordinary sugar (which has to be converted into invert sugar before it can be absorbed) by grape sugar, which can be assimilated without further change. We must also exclude entirely from the dietary vegetables containing much cellulose, such as cabbage, lettuce, carrots, etc.

As regards fat, it has been found that as a rule small quantities of good fats, such as butter, can be digested.

(b) *When the gastric juice is deficient.*—In these cases, although the digestion of albumin is carried on vicariously in the duodenum, yet it will require a longer time, as the food is passed through the stomach almost unchanged. Likewise, the presence of masses of undigested food remaining for some hours in the stomach will give rise to various subjective sensations of pressure or pain.

On the other hand, the digestion of starch will be improved from the fact that the salivary diastase is unneutralized in the stomach, and continues to act during the whole period that food remains in the stomach.

We must, therefore, reverse our measures in these cases, and limit the ingestion of meat, and peptonize that before giving it, or else administer one of the digestive ferments with it. We can also with impunity increase the quantity of starchy food.

Another practical point to observe is to limit the quantity of articles of food or drink which can readily ferment, since the antiseptic action of the HCl will be diminished. We should, therefore, allow in moderation articles of diet which act anti-zymotically, such as mustard and alcohol.

2. Where the Movements of the Stomach are Abnormal.—When there is an atonic condition of the walls of the stomach, we must obviously avoid overtaxing the lax muscular tissues, and must administer food rich in albumin and poor in water, in small quantities, at frequent intervals.

It is of the utmost importance in these cases that the stomach should not be overloaded with liquid. We may, therefore, with advantage in very severe cases, give nearly all the liquid required by the organism in the form of enemata.

3. **Nervous Indigestion.**—In cases where gastralgia is set up by certain articles of diet, such as cold drinks or highly-spiced dishes, we should obviously avoid these. But in ordinary cases we should not attempt to diet the patient at all. It is frequently found that articles of diet which will agree perfectly well at one time, at another will give rise to discomfort. In these patients, moreover, idiosyncrasies towards special articles of diet are often present, and these should be respected. It is a mistake to be over-rigid in the diet, as starvation of the body increases the atony of the stomach, and thus produces the very opposite effect to that which we require. There are three main principles to bear in mind :

1. Reduce the quantity of farinaceous materials, such as bread and potatoes.

2. Increase the amount of fresh meat taken.

3. Get the patient to take as much fat in a digestible form as possible, *e.g.*, fresh butter well rubbed into thin slices of stale bread ; cold boiled fat bacon.

In severe cases, peptones or pancreatized milk or milk foods.

As regards boiling milk which is to be used for food, the experiments of Vassilieff* establish the fact that, contrary to the popular opinion, milk so treated is not of so great value as food as in the raw state. He found that whilst in unboiled milk 6.42 to 7.62 per cent. of the nitrogenous substances, and 2.8 to 4.85 of the fatty constituents, are undigested ; in milk which has been boiled 7.86 to 8.79 per

* Bull. Gén. de Thérap., June 15, 1890, and Med. Chron., vol. XII., p. 496.

cent. of the former, and 4.53 to 6.99 of the latter, escape assimilation.

DRUGS.

We may almost say that the successful treatment of indigestion by medicinal agents virtually resolves itself into an intelligent and scientific manipulation of hydrochloric acid and bicarbonate of soda, assisted by the use of strychnia and other bitters, and certain sedatives, such as bismuth, and antiseptics. We also make use of certain agents, which have a topical action upon the stomach, such as nitrate of silver, and others which act as direct tonics to the nervous system. Alcohol should likewise be regarded as a medicinal agent. We shall briefly consider the drugs which have been thus found useful in alphabetical order, noting as far as possible the indications calling for their respective administration.

RESPECTIVE ACTION OF ACIDS AND ALKALIES.—It appears to be a general law of nature that acids will check acid secretions and promote alkaline ones, and that alkalies will do exactly the opposite.

Why this is so we do not know, unless it be that nature strives to neutralize; but we find experimentally that the fact is as stated.

An alkali put into the empty stomach increases the secretion of acid gastric juice, and indirectly the pancreatic secretion, as the more acid the chyme is when it passes into the duodenum, the greater will be the flow of the alkaline fluids which have their sphere of action there.

An alkali introduced into the stomach after a meal will tend to render this chyme less acid, and thereby reduce the secretion of pancreatic juice.

Conversely, a dilute acid taken on an empty stomach will diminish the subsequent flow of gastric juice. Taken after a meal it will increase the pancreatic secretion.

This is the key to the scientific treatment of dyspepsia.

Alcohol.—This must, I think, be regarded as a medicinal agent rather than as a food accessory, as it is of undoubted value in the treatment of the class of cases under consideration. It is now a well-recognised fact that alcohol is an important stimulant of the process of stomach digestion, and it is not unlikely that most of the much-recommended tinctures and elixirs and ‘bitters,’ with more or less elaborate names, really owe their action to the alcohol that they contain.

As far back as 1760 and 1846, investigators, such as Gosse and Frerichs, had arrived at the conclusion that alcohol promoted the secretion of gastric juice, but later experiments with artificial digestive processes (in the laboratory) appeared to negative this conclusion.

It was found that when alcohol was added to a meat solution, digesting in a beaker over a water-bath, a delay was effected in the process, varying from a slight slowing to an entire cessation of the process, according to the quantity added. And it was therefore erroneously concluded that the same held good of digestion in the human stomach.

But the careful and critical researches of Gluzinski * and L. Wolff † have demonstrated beyond a doubt that such is not the case.

These observers have established the fact that alcohol, when taken into the stomach along with the food, has two periods or phases of action.

During the first of these the digestion of albumin is impeded. But after the alcohol has been absorbed, a second stage ensues, in which the secretion of HCl increases to two or three times the amount which would otherwise

* Ueber den Einfluss des Alcohols auf die Funktionen des menschlichen Magens. Deutsch. Arch. f. klin. Med., Bd. XXXIX., s. 405-430.

† *L.c.*, s. 229.

be the case. And this increase varies up to a certain point directly with the amount of alcohol taken. After the stomach-digestion is completed, the secretion of HCl also continues longer than in cases where no alcohol has been taken. This, however, only holds good for the normal healthy stomach. *Alcohol does not have this stimulating effect in pathological conditions where the HCl is either diminished or increased in amount.*

Alcohol also, according to Klemperer, increases the peristaltic movements of the stomach.

This latter fact agrees with the results of my own observations. I have often found that cases of extreme flatulence, with temporary distension of the stomach coming on at a time when stomach-digestion ought to have been completed, and which are evidently due to abnormal retention of food in that viscus, were promptly relieved by a dose of alcohol, generally *without* any eructation of gas to speak of. In these cases I have determined in several instances, by percussion, that the stomach was filled with solid and fluid materials rather than with gas. And I have always explained the relief on the hypothesis that the alcohol stimulated the stomach to contract, and to expel its offending contents into the duodenum.

We may therefore, I think, come to the conclusion—

1. That alcohol, in moderate doses *with meals*, is harmless or even beneficial to healthy people.
2. That it is decidedly beneficial in cases of indigestion where the motor power of the stomach is impaired, such as nervous dyspepsia.
3. That it is contra-indicated where profound alterations exist in the quantity of HCl, unless there are other indications present for its administration.

Antiseptics.—These are used to disinfect the contents of the stomach and prevent the growth of micro-organisms.

Those mostly in use are—

Charcoal, tannic acid, creasote, sulphuric acid, sulphite of sodium, hyposulphite of sodium, sulpho-carbolate of sodium, and salol.

Salol is used when we wish to render aseptic the small intestine, as it passes through the stomach unchanged, but is split up by the alkaline contents of the duodenum into phenol and salicylic acid.

Charcoal appears to be especially useful when there is marked flatulence (see page 126). Of these agents sulpho-carbolate of sodium appears to have the greatest action in arresting fermentative processes in the stomach. It may be given in doses of 10 or 15 grains shortly before food.

Aromatics, Antispasmodics, and Carminatives.—These are used for the relief of flatulence and to remove uneasy sensations. They appear to stimulate the nerves of the stomach and enhance the activity of the gastric circulation, at the same time increasing the peristaltic movements and relaxing the cardiac orifice. The result is eructation of wind and the relief of cramps and spasms.

Assafoetida, ammoniacum, valerian, camphor, oil of chamomile, oil of rue, are the most used. Mustard, horse-radish, and capsicum, also act in a similar manner.

Arsenic.—This drug is of great value in small doses in irritable conditions of the stomach. It acts upon the mucous membrane and stimulates the vessels and nerves. It thus increases appetite to a marked degree. In cases of so-called 'irritative dyspepsia,' where the symptoms of indigestion are associated with a furred tongue with red and prominent papillæ, small doses of arsenic do a great deal of good. It will also, according to Ringer, stop the morning vomiting of drunkards; but in my own hands I have found greater benefit from papain, given in the morning on an empty stomach before rising, and followed by a tumbler of hot water.

Bismuth.—The subnitrate and the carbonate, when taken

internally, exercise a powerful sedative action upon the stomach. They are used for the relief of pain and vomiting, and also in reflex or nervous sickness. Bismuth must be given in doses of 20 grains or upwards to do any good, and is usually combined with bicarbonate of soda and hydrocyanic acid or opium. A little mucilage is also generally added to suspend it.

Bitters (Pure Vegetable), such as quassia, gentian, rhubarb, hop.—These from time immemorial have been supposed to stimulate the appetite, and they apparently do so. But from the investigations of many competent observers,* it appears that this is not the result of any local action upon the stomach, modifying in any way the secretion of gastric juice, but is a purely nervous phenomenon.

The nerve terminals, being irritated, stimulate reflexly the hunger centre in the brain.

Bicarbonate of Soda.—This is administered in dyspepsia in two different ways, to produce two distinct—and we may almost say, opposite effects :

1. In large doses (gr. xxx. to \bar{z} j.), taken some time after meals, it is used to neutralize the contents of the stomach when too acid.

2. In small doses (gr. v. to gr. xv.), taken shortly before a meal, it will increase the flow of acid gastric juice.

Alkalies in neutralizing quantities are indicated in cases where the HCl secretion in the stomach is in excess. They are of advantage, both by protecting the mucous membrane of the stomach from the irritating action of the acid, and by neutralizing the excess of HCl present in the stomach, and thus enabling the salivary ferment to again become active. (See page 6.)

* Jaworski, Zeitschr. f. Therapie, 1886, No. 23.

Steekhoven, Weekbl. v. ht. Nederl. Tydschr. voor Genees'k, 1887.

Reichmann, Zeitschr. f. klin. Med., Bd. XIV., H. 1, 2.

Wolff, Zeitschr. f. klin. Med., Bd. XVI., s. 222.

They also prevent the too great acidity of the chyme as it enters the duodenum from interfering with the proper action of the bile and pancreatic juice.

It is also a fact to be remembered, that the continual administration of alkalies appears to diminish the constipation which is present in many cases of this kind of dyspepsia. They probably effect this both by the improved digestion which ensues, and also by limiting the inhibitory action of the HCl upon the peristaltic movements of the stomach and intestines. Bicarbonate of soda also certainly increases the secretion of bile.

According to Sir W. Roberts, for purely neutralizing purposes, chalk and carbonate of magnesia are superior to bicarbonate of soda; $3\frac{1}{2}$ grains of the former and $2\frac{1}{2}$ of the latter together equalling in their action 10 grains of bicarbonate of soda.

Cannabis Indica.—This is a drug which is of very great value in the treatment of dyspepsia, and has not received the attention which it merits. In my hands it has proved of remarkable value, especially in cases depending upon defective innervation. It is a sedative tonic which improves the appetite without producing constipation. Its reputation for untrustworthiness and unreliability are entirely undeserved, if proper care be taken in the pharmaceutical preparation of the drug.

Prof. Sée considers it a true gastric sedative, without the disadvantages of bismuth, bromides, or antipyrin. He uses three kinds of extract, made in the following manner:

1. Made with 90° alcohol.
2. Made with 60° alcohol.
3. Made by dissolving No. 1 in butter by the aid of heat.

The relative strengths should be as 100, 25, and 5.

He gives the last in doses of $\frac{1}{4}$ grain three times a day. He asserts, and my experience confirms what he says, that

painful sensations are relieved and the appetite re-established. He gives it in the following conditions :

Inorganic affections, including chemical changes in the gastric juice, especially neuroses, even if accompanied by variations in the composition of the gastric juice.

I find it useful in painful sensations, localized or not, either occurring spontaneously, or set up by contact of food with the walls of the stomach ; pyrosis, vertigo, migraine, insomnia, somnolence, palpitation, and oppression.

It may be given in doses of 5-10 min. of the B.P. tincture, or more commonly in doses of $\frac{1}{5}$ of a grain of the solid extract.

Charcoal.—This substance was introduced into the practice of medicine for the treatment of flatulence because it was known that charcoal possessed the power of absorbing many times its bulk of gas. But the fact was overlooked that this is only true of *dry* charcoal. Wet charcoal has no such action. Nevertheless, it was employed with great success in many diseases of the stomach, and was of marked use in flatulence. It probably acts by arresting fermentation. But I think that we must concede to it a dynamic action of some kind upon the organism, as I have myself on many occasions seen very small doses relieve very extreme degrees of flatulence. It is a curious fact that the kind of flatulence relieved by charcoal is *probably not due to fermentation*, as the gas is generated in enormous quantities very soon after eating, and five or ten grains of vegetable charcoal will often give speedy relief.

Creasote.—Creasote has long been used by practitioners in derangements of the stomach, and was usually prescribed under the idea that it had an antiseptic action. It is now known that it both stimulates the peristaltic action of the gastro-intestinal canal and increases the secretion of gastric juice. Indeed, Klemperer attempts to explain its undoubted beneficial effect in cases of phthisis upon this

hypothesis alone, rather than upon any anti-bacillary action that it may exert in that complaint.

It is most conveniently given either dissolved in wine or in capsules.

Bouchard's formula is as follows :

Creasoti	-	-	-	13·5
Tinc. Gentian	-	-	-	20
Vin. Xerici	-	-	-	800
Sp. Vini	-	-	-	200

Hydrastis Canadensis.—This bitter tonic depends for its action upon two active principles, berberine and the alkaloid hydrastina that it contains. It is an undoubted stomachic tonic, and is much more used in America than in this country. It appears to exercise a specific action upon the mucous membranes, checking any abnormal discharges from them.

In the form of the tincture, it is of the greatest value in the treatment both of chronic gastric catarrh and functional dyspepsia. In the former it is chiefly useful in the chronic stomach catarrh of alcoholism, and is perhaps the best aid which we have to enable a man to give up alcohol, as it relieves almost immediately the distressing sensation of sinking and 'all-gone-ness' at the epigastrium so frequently experienced under those circumstances.

It is also extremely useful in atonic or functional dyspepsia, especially when associated with constipation, as it has a direct stimulating action on the liver.

Its concentration, hydrastin, which consists principally of the hydrochlorate of berberine with extractive matters, has almost the same action, and furnishes a very convenient way of prescribing the drug, as it may be given in pill form (2-6 grains), thus enabling the patient to avoid the rather nauseous taste of the medicine.

Dilute Hydrochloric Acid.—This acid is administered in dyspepsia for two purposes :

1. As a stimulant to the secretion of gastric juice.
2. As an antiseptic, to limit the fermentative processes in the stomach.

As we have seen (page 9), the digestive proenzymes (pepsinogen, etc.) are not converted into active agents until they come in contact with HCl. When, therefore, we have reason to suppose that these are in normal quantity, and that the HCl in the stomach alone is deficient, we should give the acid. In many cases HCl appears to cause by direct stimulation an increased flow of normal gastric juice.

As an antiseptic, it is given when the first stage of the digestive process is unduly prolonged, to prevent the secondary fermentations from taking place in the stomach.

Hydrocyanic Acid.—The dilute hydrocyanic acid is a direct sedative to the mucous membrane of the stomach, and is chiefly used to check vomiting. For this purpose it is usually prescribed either in an effervescing mixture, or in combination with bismuth, soda and morphia.

Ipecacuanha.—Whilst large doses taken into the stomach act as a direct irritant, and produce vomiting, smaller quantities apparently merely act as stimulants, increasing the secretion of mucus. It is therefore of great use in catarrh of the stomach.

According to Ringer,* it will check the following kinds of vomiting :

1. The vomiting of pregnancy.
2. The vomiting which occasionally occurs during suckling.
3. The vomiting occurring in connection with the menstrual periods (either before, during, or after).
4. The morning vomiting of drunkards.
5. The morning vomiting which sometimes accompanies general weakness or convalescence from acute diseases.

* Handbook of Therapeutics.

6. Vomiting in children with acute stomach catarrh.
7. The vomiting which is occasioned in whooping-cough by the violence of the cough itself.
8. Vomiting occurring after food without nausea or pain.

Neutralizing Agents (Antacids). -- Besides the bicarbonate of soda, already considered, we have in constant use :

Liquor potassæ.
 Bicarbonate of potash.
 Carbonate of ammonia.
 Aromatic spirits of ammonia.
 Magnesia.
 Carbonate of magnesia.
 Solution of carbonate of magnesia.
 Lime-water.
 Saccharated solution of lime.
 Chalk.

For purely neutralizing purposes, the bicarbonates are to be preferred to liquor potassæ, as their action is milder and longer continued. Magnesia is useful when the bowels are confined, and lime-water if they are relaxed. Liquor potassæ is, moreover, a sedative to the stomach, and may be employed if there is much pain.

Ammonia, either in the form of the carbonate or of the aromatic spirit, is especially indicated when there is want of tone in the stomach and duodenum. It is thus a useful anti-spasmodic, as it allays spasmodic action and tones up the relaxed mucous membrane. It is especially useful in the irritable stomachs of chronic alcoholics, when given in an effervescing form. It is important to remember that ammonia must not be given for too prolonged a period, as it is apt to excite catarrh of the stomach and intestines.

Magnesia and Carbonate of Magnesia.—For purely neutralizing purposes, these are sometimes to be preferred to the bicarbonate of soda, lime, or potash, because

1. They have a larger saturating capacity for acid.
2. They are purgative.
3. They are harmless when given in excess on account of their insolubility.

The great disadvantage of these substances is their bulk. As an antacid, magnesia is to be preferred to the carbonate, as the latter gives off so much gas that the stomach may become disagreeably distended.

Preparations of Lime.—Generally, other agents of this class are to be preferred. Lime-water is chiefly used as an addition to milk, given to children to prevent the formation of too thick a clot of casein. It is also very useful in chronic vomiting and diarrhoea in young children.

Nitrate of Silver.—As it is taken into the mouth, if in solution, a certain proportion is changed into albuminate, and what remains enters the stomach. The same thing takes place here, and it is only the balance that has been unacted on that has any effect upon the coats of the stomach.

Its specific action upon the stomach is that of an irritant, something like arsenic. In small doses it will check the pain of chronic catarrh, of chronic ulcer, and even of cancer. In these two latter cases it probably acts in the same way that it does in checking pain on other mucous surfaces; it deadens pain by coagulating the superficial layer, and thus rendering it more difficult for the nerve terminals to receive painful impressions.

Nitro-hydrochloric Acid.—This acid is chiefly useful, in the treatment of dyspepsia, as a hepatic stimulant. Clinical experience has long held it to be such, and the experiments of Rutherford on dogs confirmed the fact.

It is a most valuable medicine in the form of indigestion

so frequently met with in strumous children—children with thin skins and fine hair, with delicate complexions, whose stomachs are getting out of order at the slightest provocation. In these cases it is best given combined with taraxacum.

In adults it is indicated in cases where there is mental despondency, oxalates in the urine, sallow complexion, and eructations of offensive gas.

Orexin.—Where anorexia is the only prominent symptom, a new drug, hydrochlorate of orexin, has been strongly recommended by Penzoldt.* Experiments made by Hofmann and Munter showed that fifteen grains could be given for a dose without any untoward effect. When a dose of seven and a half grains was given a strong feeling of hunger was produced. As the result of the examination of a test meal, it was found that the free hydrochloric acid appeared in the stomach in from half to one hour sooner than when the drug was not taken, and that digestion was accelerated by that amount of time. In subsequent experiments upon thirty-six patients suffering from anæmia, tuberculosis, gastric catarrh, etc., the appetite was greatly increased in all but five, and several phthisical patients gained in weight whilst taking it. It was given in doses of five to seven grains once or twice a day in capsules, a cup of beef-tea being given at the same time.

Boaz confirms these observations in the main, but expresses his opinion that a larger number of cases must be treated, and a more accurate clinical differentiation of their precise conditions must be made before we can arrive at any definite opinions as to its exact sphere of action. This is all the more essential, seeing upon how many different conditions loss of appetite may depend, and the improbability that orexin will prove equally beneficial in all of them.

* Therap. Monatsch., 1890, p. 59.

Penzoldt usually prescribed the following formula :

℞. Orexin, 2·0 grammes.
 Ext. Gentian }
 Pulv. rad. alth. } q.s., ut fiant pil. xx.

Sialogogues.—Since the presence of alkaline saliva in the stomach, as we have pointed out, is an important factor in determining the flow of gastric juice, it is evident that sialogogues can very materially assist digestion. The normal sialogogue is the reflex irritation caused by the mastication of food in the mouth. This we assist by pungent and aromatic additions to our food. And it is an important point to remember that we must not allow the food we give our patients to be *too* bland and un-irritating.

All bitters, especially nux vomica, and stimulating substances, like ginger and cayenne, increase the flow of saliva. Sialogogues are also useful to correct undue acidity of the stomach. The proper flow of alkaline saliva will gradually neutralize the excess of acid, and render the patient much more comfortable. For this reason we may with advantage treat acid dyspeptics with lozenges containing stimulants to the salivary flow, in preference to antacids.

Strychnia and Nux Vomica.—These agents are, without doubt, among our most valuable weapons in the management of dyspepsia.

1. Like other bitters, they stimulate the hunger centre.
2. They increase the flow of saliva.
3. They give tone to the muscular walls of the alimentary canal, and increase the frequency and extent of the peristaltic movements. They are thus useful in constipation.
4. They act in some unknown manner through the nervous system in removing a certain group of symptoms, viz., furred tongue, weight at the pit of the stomach, flatulence, heartburn, and vertical headache.

Strychnia also has the action of removing, to a great extent, the craving for drink in chronic alcoholics.

Strychnia and galvanism are our two main agents in curing temporary dilatation of the stomach, the result of atony of its walls.

Taraxacum is at once a simple bitter, a chologogue, and a mild laxative.

To be of any use it must be given in much larger doses than is recommended in the text-books. From a half to a tablespoonful of the succus is not any too much, and will give good results when smaller doses are quite useless.

Valerian.—In the forms of valerianate of soda and valerianate of zinc, this drug is of immense value in the treatment of that form of indigestion depending upon exhaustion of the nervous system. And it is a significant fact that, although in books little value is attached to this agent, yet the more experience a medical man has in the treatment of this class of cases, the more important a place do valerian and its salts assume in his armamentarium. With this drug alone, I have no hesitation in affirming, can be cured inveterate cases of dyspepsia in overworked city or literary men, cases where all ordinary remedies have been fruitlessly tried, and where the diet has been cut down to a minimum without good result.

DIGESTIVE FERMENTS.

MALT EXTRACT AND MALT INFUSION.—We possess in these agents a means of artificially assisting the digestion of starch in cases when that process is inefficiently performed from either of the following causes:—

1. From the diastatic power in the saliva and pancreatic juice being presumably deficient.
2. When we can reasonably infer that these fluids are

unable to exercise their diastatic function owing to abnormal conditions obtaining in the stomach or duodenum.

As regards the former, we possess very little absolute knowledge of abnormalities of the salivary diastase, and none at all respecting that of the pancreas.

The latter occurs presumably in cases where there is excessive secretion of HCl in the stomach.

We have seen that in the process of normal digestion the action of the salivary ferment is arrested by the acid gastric juice, and again revived when the contents of the stomach become alkaline. When the hydrochloric acid is in excess, its long-continued and powerful action so lowers the vitality—if one may use such an expression—of the ptyalin, that if it is not absolutely destroyed, it is yet unable to recover itself. In these cases also the abnormally acid chyme that is thrown into the duodenum will act in a similar manner towards the diastatic ferment of the pancreatic secretion, which can only be active in the presence of an alkali.

We thus have the diastatic action almost in abeyance, and we must strive to assist nature to dispose of the starchy portion of our food, or it will pass through the system undigested, producing various discomforts as it does so.

According to Sir William Roberts,* we possess in infusion of malt a vastly superior agent to the malt extracts of commerce, and which may often be taken when the latter disagree. It has also the advantage of being within the power of anyone to prepare. The following method is the one he recommends :

Three ounces (or three piled-up tablespoonfuls) of crushed malt are thoroughly well mixed in a jug, with half a pint of cold water. The mixture is allowed to stand over-night, that is to say, for ten or twelve hours. The supernatant

* Digestion and Diet, 1891, p. 229.

liquor is then carefully decanted off from the sediment, and strained through two or three folds of muslin until it comes through fairly clear and bright. The above quantities yield about six ounces of extract.

The action of the above upon starch is quite as powerful as the average specimens of malt extract. It should be prepared fresh for each day's consumption, or if it is required to be kept, a few drops of chloroform should be added to it, and the bottle containing it well corked. If, before using it, the dose is placed in a saucer two or three hours previously, and allowed to stand in a warm place, the chloroform will evaporate, and the original flavour of the extract be restored.

Malt extract may be given in two ways :

1. With the food. (It is best used as a beverage, and sipped whilst the farinaceous part of the meal is being taken.)

2. Three or four hours after the meal, in conjunction with a dose of alkali.

It is best given this way in cases of hyperacidity of the stomach, or duodenal dyspepsia.

The dose of either the malt infusion or the malt extract of commerce is one or two tablespoonfuls.

PEPSIN AND PANCREATIN.—For some years I have ceased to prescribe pepsin, as I have come to the conclusion that it is almost useless as a help to the digestive processes when given by the mouth. First of all, because I believe that the commercial preparations are almost inert; and, secondly, because I believe that it is very seldom indicated. In support of my belief I can produce very strong evidence.

The most important investigation of late years as to the nature and digestive properties of the commercial pepsins on the market, was made, in 1890, by Dr. R. G. Eccles, and his results were communicated to the American Phar-

maceutical Association in a paper entitled 'What is Pepsin?' *

His experiments were conducted with *select qualities of the very best commercial pepsins*, procured direct from the makers themselves, with the maker's knowledge of the use that was to be made of them. The names of the makers are given in full, and include most of the well-known brands.

Their purpose was to ascertain the solubility of the pepsins in various media, the effect such media had upon the pepsins in the direction of destroying their peptonizing power, and the real amount of albumin that the pepsins would digest.

The conclusions he arrives at are as follows :

1. That all solutions of pepsin will deteriorate with time through the action of the solving acid alone.
2. That all solutions that contain alcohol will, in time, result in the total destruction of the pepsin.
3. That the dose of pepsin as usually given is of very little use for purposes of artificial digestion, and that its dissolving power has been greatly overstated by the makers, as half a grain of the very best in the market can only complete the digestion of a hundred grains of albumin or fibrin in six hours.

digest a pound of beef-steak at this rate would require over $2\frac{1}{2}$ drams of pepsin !

4. That in the Pharmacopœial and other tests for the strength of pepsin, the real action is accomplished by the hydrochloric acid, which is always directed to be mixed with it.
5. That the hydrochloric acid alone will do almost the same dissolving work under the same conditions.
6. That the pepsins of commerce are largely composed of inert ingredients.

* A full reprint of this paper will be found in the Druggists' Circular and Chemical Gazette of October, 1890. Published in New York.

To quote his own words: 'There is no such thing as pure pepsin on the market, and the distance we are from having one is so very great that it is almost with fear and trembling that the indicated amount in the very best goods is given. The brand giving the very highest digestive power that the writer has yet been able to secure, only contained 27 milligrams in a gram. Just think what this means—100 grains of the very best pepsin known contains only 2.7 grains of the pure ferment, if our conclusions are reliable.

'One make that was sent me as a sample of a really superb article, contained barely 2 milligrams in 1 gram, or 1 grain in 500, and its proteolytic power, as tested on albumin, agreed with this figure. . . .

'What we at present call pepsin is always a variety of foreign substances containing a minute quantity of real pepsin.'

We can thus easily see that 'wines' and 'elixirs' of pepsin become soon inert from the alcohol which they contain.

And what shall we say to the probable action in aiding digestion of a much advertised and prescribed preparation now upon the market, which contains:

1. Pepsin, which only acts in the presence of an acid.
2. Pancreatin, which only acts in the presence of an alkali.
3. Alcohol in sufficient quantity to render both inert.
4. Syrup, which presumably affords nutriment to ferments.

Other preparations actually contain lactic acid, though the formation of this acid in excess is one of the principal causes of fermentative dyspepsia. It is, also, not at all uncommon to find pepsin put up in tablets in conjunction with bicarbonate of soda!

Secondly, as to the indications calling for the use of pepsin.—In my contention that pepsin is really very seldom indicated,

I am supported by Boaz, whose work* is, I believe, the most recent and authoritative upon the subject of diseases of the stomach.

The following is a translation of his words, the observations in brackets being my own :

‘The indications for prescribing preparations of pepsin appear to be theoretically clear; we ought to give it in cases where the mucous membrane of the stomach secretes too little peptic ferment, or none at all.

‘In practice, however, this rule undergoes essential limitations. We must distinguish between two different conditions. The first is when the secretion consists entirely or almost entirely of pepsinogen [that is to say, without any HCl]; the second is when very little or no ferment is secreted.

‘In the first case the administration of pepsin is not necessary, as only hydrochloric acid is required to convert the pepsinogen [proenzyme] into an active ferment.

‘In the second case, it is true, the introduction of a peptic ferment into the stomach is very desirable; but *pepsin is not suitable for this purpose*, on account of its requiring such an enormous quantity of hydrochloric acid to give efficiency to it, and this amount of acid cannot be administered without causing subjective or objective disturbances. [Note. You hardly ever get an absence of peptic ferment in the stomach without concomitant deficiency of HCl.]

‘Accordingly, in my opinion, the proper sphere of action of pepsin is limited to those exceedingly rare cases where there exists a disproportion between acid-secretion and pepsin-secretion.

‘This only occurs in cases of hyperacidity [of HCl] and excessive secretion of gastric juice [see Gastrixynxis, p. 24]. In severe cases of this kind one may essentially promote

* Allgemeine Diagnostik und Therapie der Magenkrankheiten. Berlin, 1890, pp. 254, 255.

digestion by the addition of pepsin, as Gerhardt and Sticker, likewise Bonk, have shown ; but according to Trzebinsky in my laboratory, such cases always have an acidity of over 25 per cent.'

Pancreatin would, at first sight, seem likely to be an efficient substitute for pepsin, until one remembers that its activity is destroyed by the presence of an acid. Moreover, even if combined with sufficient alkali to protect it in its passage through the stomach, the digestion which it would effect would be limited to the duodenum ; and our object is not to render this intestine a substitute for the stomach, but to promote digestion in the latter organ.

Boaz has also something to say upon this subject :

'The sole indication [that is, the only circumstance under which it can be given] is the deficiency, or better still, complete absence, of HCl. It is especially suited to those cases where it is improbable that there is any gastric juice secreted at all.'

In practice I consider that pancreatin finds its chief use in the preparation of predigested foods ; and it offers the great advantage over pepsin for this purpose, that the product is so much more agreeable.

But I shall say very little upon this subject, as, however useful these articles of diet may be in the treatment of acute diseases, they are very seldom indicated in cases of dyspepsia. I may even say that if we once commence digesting the food for a patient suffering from the ordinary forms of indigestion, we are deliberately throwing away his chances of ever regaining his normal digestive power. We must restore power to the stomach, not do its work for it. In my own practice I have long ago discarded pepsin and pancreatin given by the mouth, in favour of infusion of malt or malt extract, when I wish to help the digestion of starch ; and papain, when it is the proteids which I wish to act upon. The latter drug can be given with the best

results in the cases where we have seen that pepsin and pancreatin are contra-indicated.

PAPAIN.—This is the active principle of the juice of the trunk and fruit of the *Carica papaya*, or South American melon tree, which grows in the Brazils, West and East Indies, in the Molucca Islands, and, in fact, in all tropical climates.

It is prepared by treating the juice with alcohol, which precipitates the ferment.

The inspissated juice of the plant is also sold in this country in a powdered form under the name of 'Succus Papayæ,' but is far inferior to papain itself for medicinal purposes.

Papain was first isolated by Wurtz and Bouchut, who ascertained that it was capable of dissolving upwards of 1,000 times its own weight of fibrin. Control experiments, however, undertaken by Rossbach, Eulenberg, and others, appeared to show that its action was very unequal. We now know, however, that this lack of uniformity in the result obtained was due to a want of skill in the manufacture of the drug, with resulting variation in its strength.

It is to Dr. Finckler, Professor of Physiology at the University of Bonn, that the medical world is indebted for devising a method of preparation which removed this defect, and the papain which goes by his name, having been proved by experiment to be perfectly uniform, has now practically superseded all other makes in the treatment of disorders of the digestive organs.

Papain (Finckler) will digest 1,000 to 2,000 times its own weight of moistened fibrin when warm, and softens muscular tissue in half an hour.

Although so powerful, living membranes are not acted on, and 30 to 75 grains have been administered to dogs and rabbits without any untoward result.

It acts in either acid, alkaline, or neutral solutions, and

when it has once come into contact with fibrin adheres to it with such tenacity that no amount of washing will remove it or stop its action.

Amongst the product of its action are albumose and true peptone.

It has been asserted by some observers that the product of the action of papain upon meat and fibrin was not true peptone.

With the object of gaining further information as to the method of the digestion of meat by papain, and particularly of clearing up the point as to the precise nature of the product, I have for some little time past been making a series of experiments on the subject in conjunction with Mr. E. G. Clayton, F.I.C.

The result of these was to prove conclusively that the product of the digestion of meat and fibrin by papain contained *true peptone*.

In these experiments we made use of both the methods of Kuhne and Chittenden, and the more recent one of Denaeyer.

The former, which has practically superseded the method of König, which also we tried, but abandoned at an early stage of our experiments, may be briefly stated as follows:

After the removal of the albumin by means of heat and filtration, the filtrate is divided into two portions. In the one the albumose is precipitated by excess of ammonium sulphate, and in the other one both the albumose and the peptone are thrown down together by the addition of acid sodium phosphotungstate. The peptone is calculated out by the differential method. The method of Denaeyer differs from the former in several important points. The principal modification introduced by him is the precipitation by strong alcohol of all the proteid constituents of the digested meat solution, except the 'non-jellifiable' gelatin, which remains in solution. The precipitate is then digested

with hot water and washed on a tared filter (if albumin is to be estimated); the filtrate—jellifiable gelatin, albumose, and peptone—is next treated in suitable ways for the separation of its several constituents, this part of the process, as far as the peptone and albumose are concerned, being similar to Kuhne and Chittenden's method.

There is obviously a great advantage in having previously separated a constituent such as unjellifiable gelatin, which would otherwise contaminate the ammonium-sulphate and phosphotungstate precipitates, and thus vitiate the results.

As the outcome of these experiments, the following facts observed proved conclusively that true peptone was formed.

1. The biuret reaction was produced in the precipitate from the ammonium sulphate solution, after all the proteids likely to cause confusion had been removed by the different processes (hot water, strong alcohol, etc.). This reaction was much stronger in the acid than in the alkaline and neutral solutions.

2. The proteid matters in these filtrates passed through animal membranes and gave a decided precipitate with tannic acid.

3. Neither the tannic acid nor the biuret reactions were given by the filtrates from the acid phosphotungstate precipitates.

These results plainly proved to our minds that the last-named reagent *had precipitated from the solutions the only remaining proteid*, which could not possibly be anything else than peptone.

I think these experiments must be regarded as conclusive by establishing that peptone is really formed during the digestive action of papain, although for practical purposes it does not much matter whether such is the case or whether the change falls a little short of this, as the resulting bodies would be as easily dealt with in the organism as peptone itself.

For practical purposes, as a digestive ferment to be given medicinally, papain presents the following advantages over pepsin and pancreatin :

1. It will convert or digest many more times its own weight of meat than they are able to.
2. It can be used when pepsin and pancreatin are contra-indicated, or powerless.

This is the case when

(a) The stomach contents are too highly concentrated. Pepsin ceases to be able to act when this obtains beyond a certain point. On the other hand, papain acts energetically even when the sp. gr. of the stomach contents reaches 1.030 or over.

(b) When there is such a deficiency of HCl in the stomach that pepsin is inactive.

Pepsin, as we know, can only act efficiently in the presence of a certain quantity of acid. That is to say that the inactive proenzyme requires a certain percentage of acid to convert it into an active ferment. Papain, on the other hand, being independent of the presence of an acid, will do its work even under these conditions.

(c) When the stomach contents are so acid that when poured out into the duodenum they inhibit the action of the pancreatic ferment.

It not infrequently happens, in cases of hyperacidity of the stomach, that the intestinal juices are unable to neutralize the intensely acid chyme. As the pancreatic ferment can only act in the presence of an alkali, duodenal digestion is at once arrested, and various unpleasant symptoms supervene.

It is obviously of no use to give pancreatin by the mouth, as it is at once destroyed by the acid in the stomach. And in these cases it is of no use to give an alkali with it, as is often done, as it would be practically impossible to give a sufficient dose to neutralize the contents of the stomach

without damage to the organism. Papain is here of the greatest use, as it is not affected as to its activity by contact with acid.

3. As regards albumenoids, it combines in itself the joint action of pepsin and pancreatin.

4. It can be given combined with acids, alkalies, or antiseptics, as indicated by the demands of the case.

5. It has a local action on the stomach that pepsin has not.

(a) It has a distinct tonic action on the secreting mechanism of the stomach, stimulating the secretion of gastric juice.

(b) It has a local sedative action, relieving pain in a marked degree, and this it does whether the pain is due to the presence of irritating ingesta, or is a local neuralgia.

(c) It dissolves unhealthy mucus coating the interior of the stomach, and interfering with the gastric secretions and the absorption by the stomach walls.

This condition is met with chiefly in the chronic stomach catarrhs of children, in cases of alcoholic dyspepsia, and in most cases of chronic gastritis.

(d) It is distinctly antiseptic in its action.

It thus prevents the abnormal fermentative processes from taking place in the stomach and intestines. An important point in its favour is that it can be given in conjunction with other antiseptics, such as salol, when necessary, without its action being in any way interfered with. This is not the case with pepsin.

6. And last, but not least, it is not so repulsive in idea as pepsin, as it is purely vegetable.

With animal ferments, prepared from stomachs of pigs and other animals, there is always a possible doubt as to the freshness or healthy condition of the material. If at all tainted it may contain bacilli, ptomaines, and other

toxic substances, particularly as in preparing pepsin and pancreatin, it is impossible to raise the temperature high enough to destroy these without rendering the ferment also inert.

From a consideration of the foregoing we see that papain is indicated in the following conditions :

1. Deficiency of the gastric juice from—

(a) Atrophy of the gastric follicles.

This is usually consecutive to long-standing chronic catarrh.

(b) Deficient blood supply.

This occurs in anæmia and general debility.

2. Excess of unhealthy mucus in the stomach.

This occurs in chronic gastric catarrh, chronic alcoholism, and in the chronic stomach catarrhs of children.

3. Irritable conditions of the stomach associated with pain and vomiting.

4. Duodenal dyspepsia.

When its local action is desired it is given on an empty stomach, and when it is administered for its digestive effect it may be given either with the food or shortly after.

The most important papers that have appeared upon the subject are the following :—

Wurtz et Bouchut. Sur le Ferment Digestiv du Carica Papaya. Compt. Rend., Bd. LXXXIX., 1879.

Finckler. Comparative Experiments between the action of Papoid and Pepsin. Therapeutic Gaz., 1887, Aug. 15.

Albrecht. Mittheilungen über den Milchsaft von Carica Papaya, etc. Schweiz. Correspondenzbl., Bd. X., 1880.

Rosbach. Physiologische und therapeutische Wirkungen des Papyotin. Zeitschr. f. klin. Medicin, Bd. VI., 1880.

ELECTRICITY.

There can be very little doubt but that electricity is one of the most valuable agents that we possess in the treatment of indigestion depending upon exhaustion of the

nervous system. By its means we are enabled to influence for good cases in which medicines appear to be absolutely powerless; and it is particularly useful where temporary dilatation of the stomach depends upon loss of tone of its muscular walls, and in constipation.

But to be of any use it must be applied by an expert, and *never by the patient*, as it requires a considerable amount of technical knowledge and experience to produce good results.

In my own practice I have found it almost invariably produce the most surprisingly brilliant results upon properly selected cases.

There are two methods of applying it which are of use in the treatment of this form of indigestion, viz.:

1. Central galvanization, and
2. General faradization.

Local faradization of the stomach is also very useful in the treatment of atony of the muscular walls of the stomach.

For particular directions as to the precise methods of application, I must refer the reader to a paper I wrote last year,* or to one of the standard treatises upon the subject.†

In treating cases of nervous exhaustion, the immediate effect of an application of galvanism is usually a sense of exhilaration and *bien aise*, and, perhaps, an inclination to sleep.

The permanent or tonic effects generally appear early in the treatment, and, as a rule, in the following order:

IMPROVEMENT IN SLEEP.—This is generally the first effect of the treatment that attracts the attention of the

* The Treatment of Nervous Exhaustion. Prov. Med. Journal, Dec. 1890.

† Erb, Electro-Therapeutics. Von Ziemssen's Handbook of General Therapeutics.

Beard and Rockwell, Medical and Surgical Uses of Electricity.

patient, and is one of the first signs that the applications are beginning to do good.

INCREASE OF APPETITE.—A keen appetite is very often developed about two hours after the application, and great improvement in this respect is usually experienced after ten or twelve sittings.

LOSS OF FLATULENCE AND DYSPEPSIA.—In cases of exhaustion of the nerve-centres, flatulence is often one of the most distressing symptoms. The stomach will dilate suddenly with wind (see p. 66), and cause great distress by its pressure on surrounding organs. This arises in many cases from deficient muscular and nervous tone in the organ itself. The galvanic current, by restoring power to the parts, very soon effects a considerable improvement. An immediate expulsion of wind from the stomach, indeed, often occurs during the sitting, and the patient soon finds that he is able to indulge with impunity in articles of diet which he was previously obliged to abstain from, owing to the distress which invariably followed their ingestion.

REGULATION OF THE BOWELS.—As soon as the nervous system begins to recover its normal tone, a remarkable improvement in the action of the bowels is usually experienced. The liver secreting more bile, the pancreas more pancreatic juice, and the glands which line the walls of the intestine throwing out increased quantities of their own special secretion, the fæces are rendered more liquid. The increased quantity also of bile that they contain stimulates the peristaltic action of the intestines. The result is an easy and natural evacuation. Habitual constipation, more often than is generally realized, depends upon an irritable, exhausted, or congested condition of the spinal cord.

Electricity cures constipation by acting as follows :

1. The tone of the whole system being raised, the function of defæcation participates in the general improvement.

2. It has a tonic effect upon the spinal cord where the nerve-centres which preside over defæcation are situated.

3. The faradic current has a direct action in giving tone to the muscular tissue in the stomach and intestines, thus making their movements more powerful and effectual.

TREATMENT OF ACUTE GASTRIC INDIGESTION.

The first thing to do is to ascertain that the stomach is empty. If we suspect the presence of undigested food, an emetic should be administered. We may generally recognise this condition by the presence of nausea, cramp-like pain, faintness, and ineffectual attempts to vomit. If vomiting cannot be induced by a draught of lukewarm water, aided by tickling the fauces, ipecacuanha wine, or infusion of chamomile, are the best emetics in these cases (Fox). At the same time a sharp purge will be beneficial, and may consist of three to five grains of calomel, followed by a black draught, or a dose of blue pill and colocynth, with a seidlitz powder the next morning. *But in any case neither the emetic nor the purge should be repeated.*

The great remedy, whether the stomach has been evacuated or not, is complete abstinence from food for several hours, during which time the patient may with advantage suck small pieces of ice. If there is great prostration, but not otherwise, small quantities of well-diluted brandy may be cautiously given.

After the acute symptoms have subsided, any of the following articles of diet should be given in small doses every two hours :

Milk and soda-water, milk and lime-water, veal broth, chicken broth, barley-water, rice-water, or thin soup.

In some instances the patient will be practically well after the contents of the stomach have been evacuated ; but in other more severe cases this will not be so, and he

should be kept upon the following regimen for several days, only being allowed to return very gradually to his ordinary diet :

At 10 o'clock.—A small glass of milk and lime-water ; or, a cup of beef-tea, with a small piece of toast.

1 o'clock.—A basin of soup or beef-tea, with a little toast.

4 o'clock.—A cup of thin cocoa, made with half milk, or a cup of weak tea, and a thin slice of bread and butter.

7 o'clock.—A basin of soup or broth.

9.30 to 10.—A cup of water-arrowroot, with a tea-spoonful of brandy in it, or a glass of milk and lime-water.

Mellin's food, peptonized milk, or milk gruel, may be substituted for any of the above articles.

As convalescence approaches, the patient may be allowed purées of meat or chicken, lightly-boiled eggs, boiled soles, or raw oysters ; but for some little time he should confine himself to the diet given for chronic gastric catarrh.

As regards medicinal treatment, sedatives and antacids are indicated, bismuth being especially useful, and dilute hydrocyanic acid if vomiting is a troublesome symptom.

If there is much epigastric pain, hot poultices or fomentations should be applied to the epigastric region, and a subcutaneous injection of morphia administered ; or the opiate may be added to the bismuth mixture.

TREATMENT OF ACUTE DUODENAL DYSPEPSIA.

In the form of acute duodenal dyspepsia occurring as a sequel to acute gastric catarrh, the treatment will be included in that of the latter. The large dose of alkali which is usually given will lower the acidity of the stomach contents and prevent the subsequent irritation in the duodenum, and so modify, if it does not entirely obviate, the occurrence of symptoms referred to the duodenum.

In the primary form, where there is no preceding gastric disturbance, we should first try to neutralize the duodenal contents by the administration of large doses of bicarbonate of soda and an aromatic. If, however, we are too late to succeed in accomplishing this, we should clear out the bowel with a smart purge, and help nature to get rid of the *materies morbi*. In these cases castor-oil combined with small doses of opium give good results, as the former drug has a secondary sedative action upon the intestines, in addition to its purgative properties. Magnesia or its carbonate is also of great use, as it is immediately antacid, and subsequently laxative.

TREATMENT OF CHRONIC CATARRH OF THE STOMACH.

The first thing to do is to try and ascertain the cause, and remove it if possible. Bad habits must be corrected and imperfect teeth restored, meal-times made regular, proper food prescribed, and treatment directed to any other organ which may possibly be a factor in producing the morbid condition. Attention must also be directed to the general hygienic surroundings of the patient, and he should be encouraged to take a proper amount of rest and recreation.

In an ordinary case some such diet as the following should be insisted on :

BREAKFAST.—A basin of bread and milk, or a cup of Schweitzer's Cocomatina, a little boiled fish, or a poached egg and a slice of dry toast.

LUNCH.—The lean of a mutton chop, or a grilled sole. A slice of toast. A glass of milk and soda-water, or a little weak spirit and water (1 in 10). In some cases a little custard-pudding only, or a few oysters may be taken.

DINNER.—Boiled or grilled white fish ; boiled, roast, or grilled fresh meat. A tablespoonful or so of boiled green vegetables. Potatoes cooked in their skins, mashed with milk,

and passed through a hair-sieve. A little stewed fruit or milk-pudding. A little weak spirit and water, or a glass of any light wine, or a small bottle of Apollinaris water.

It is of the utmost importance in these cases to insist upon three meals a day, and no more, and these at intervals of five or six hours. *Nothing whatever must be taken between meals.*

On rising in the morning, a tumbler of hot water should be slowly sipped whilst dressing. This will wash away any mucus which may have accumulated during the night, and will materially increase the appetite for breakfast. This *toilet of the stomach* is most important, and puts this organ into the best possible conditions for undertaking the digestive duties of the coming day.

If there is any tendency to morning sickness, the water should be taken in bed before rising, and half a teaspoonful of bicarbonate of soda should be added to it.

It is important to make the patient understand perfectly that the water is not to be drunk off at once, *but to be slowly sipped*, and that it must be as hot as can be taken with comfort.

If there is any tendency to constipation, a teaspoonful of Carlsbad salt may be added to the water as often as may be necessary to secure a daily action of the bowels.

As regards medicinal treatment, if there is any pain or irritability, a powder may be taken before each meal, consisting of bicarbonate of soda, carbonate of bismuth, and pulv. rhœi.

If there is a feeling of weight and fulness, or actual pain after meals, dilute hydrochloric acid and infusion of calumba should be taken directly after each meal.

If there is evidence from the sensations of the patient that the stomach does not empty itself before the next meal-time, strychnia is indicated, and may be added to the acid mixture in doses of 3-5 min. of the liquor.

In some cases the best results are obtained by giving 5 min. of tincture of nux vomica before each meal.

It is in the treatment of chronic catarrh of the stomach that a course of purgative mineral waters, taken at a foreign spa, has been found to give such striking results, and is part of the routine treatment on the Continent.

In this country, although the same diseases which are thus so beneficially affected are to be found in the same abundance, yet this method of treatment has never hitherto gained any great ground, from the fact that we have no purgative mineral springs in England of any value, and that the great majority of patients cannot afford a long Continental holiday. It has often been pointed out that there is nothing magical in the locality where the spring is situated. It is the strict diet imposed on the patients, the regular exercise in the open air, and the systematic method of administering the water, that do the good. And we do not sufficiently realize that all the benefits which are to be obtained by a course at Kissingen or Carlsbad can be procured at home by a careful and scientific administration of imported waters.

To produce this valuable result, all we have to do is to imitate, as closely as possible, the essential conditions under which the waters are taken at the foreign watering-places.

In starting a patient on a course of purgative water, you must try and imitate the *essentials* of what his life would be at a foreign spa. That is to say, you must insist upon a sufficient amount of exercise in the fresh air, a diet which contains the minimum of saccharine and fatty matters, and absence of worry and business cares to as great extent as possible.

But as a little concrete teaching is always worth more than a much larger amount of purely abstract consideration, we will take a supposititious case of a city man, who

is suffering from lithæmia, or, as he would call it, 'torpor of the liver,' associated with severe dyspepsia, and see what one day of his life would be, supposing that we were giving him a six weeks' course in imitation of that at Carlsbad.

He should rise at seven o'clock, and after having well rubbed himself down with a towel wrung out in warm water, finish off with brisk friction with a dry flesh-glove. Then after a ten minutes' spell with light dumb-bells or the pulley-weights, he should proceed to dress leisurely. Whilst he is doing so he will drink by sips a tumbler of hot Carlsbad water, containing as much of a stronger purgative water as he has found by experiment to be required to produce a single action of the bowels. By Carlsbad water, I mean that imported in stone bottles, which has not the purgative action of the so-called *Carlsbad salts*. Perhaps the Carlsbad alone will be enough. The water is brought to the required temperature by standing the vessel containing it in a basin of hot water.

After this a gentle walk of half an hour or so, and breakfast about 8.30. For this meal he may take a little white fish or an egg, cold meat or game, dry toast, *with very little butter*—but if he can be induced to forego the latter it will be better; weak tea or Schweitzer's Ccoatina, sweetened with one of any reliable make of saccharin tabloids.

Lunch should consist of little more than a lean mutton-chop or steak, with green vegetables, stale bread, and mashed potatoes. A little sound hock or table claret may be taken, or a little weak, well-diluted spirit.

Finishing his business not later than four or five o'clock, he should take exercise for at least an hour or an hour and a half in the open air, gently walking or riding, and dine about seven.

For dinner a clear soup, grilled or boiled fish, roast or

boiled meat ; plain boiled green vegetables ; stewed fruit, sweetened with saccharin ; drink, the same as lunch.

The essential points in the diet are : to avoid almost entirely fat, sugar and the stronger forms of alcohol, and to leave off eating *before the appetite is quite satisfied*.

After dinner, gentle recreation in the open air or a game of billiards.

Retire to rest early, after ten minutes at the dumb-bells or pulley-weights.

In my experience I have found that, from a course of treatment carried out in this manner, the patient will derive almost as much benefit as if he had gone to Carlsbad or Kissingen.

There is no doubt that we are enabled, by a prolonged and carefully regulated course of purgative waters, to exert a profound curative and alterative action upon the system.

In certain cases of chronic catarrh of the stomach I have frequently found the greatest benefit to follow a rather unorthodox procedure. It is to let the midday meal consist *entirely* of fresh ripe fruit. Whilst fruit eaten with other articles of diet at a mixed meal will often disagree, yet taken in this manner, I have found it tolerated to a surprising extent, and with marked improvement in the general condition of the patient. It interposes, as it were, a barrier between the two fermentable farinaceous and albuminous meals, and enables the stomach to get rid of all unhealthy mucus and abnormal ferments. But no bread or anything at all except the fruit must be taken. The acidity of the fruit appears to act as a direct tonic to the stomach, and the acid salts contained supply a systemic want, as dyspeptics of this class are rarely able to take sufficient vegetables.

ALCOHOLIC DYSPEPSIA.

Of course the first thing to do is to absolutely prohibit alcohol in every form, or in slight cases, to cut it down to a minimum.

IN SLIGHT CASES the diet I usually prescribe is as follows :

A tumbler of hot water to be sipped on rising.

Breakfast—A little grilled fish or bacon, a lightly-boiled egg. Dry toast, weak tea or thin cocoatina.

Lunch at 1—The lean of a mutton chop, or a slice from a roast joint of beef, mutton or lamb, or a little chicken or game. A little boiled green vegetable, and a tablespoonful or so of well-mashed potato. Dry toast or stale bread. One tablespoonful of whisky in a bottle of Apollinaris water, or a glass of milk and lime-water.

4 p.m.—A cup of weak tea and a biscuit.

Dinner at 7.—The same as lunch, with the addition of a little stewed fruit or a milk pudding.

IN MORE SEVERE CASES.—A glass of hot water before getting out of bed, slowly sipped.

Breakfast at 8—A basin of soup with a bit of toast, or a cup of beef-tea or chicken broth.

At 10.30—A tablespoonful of any reliable meat juice, such as Valentine's, or a cup of peptonized milk.

Dinner at 1—The lean of a mutton chop, or a slice of underdone roast meat that has been passed through a sausage machine and warmed up with a little gravy (from the meat). Dry toast; a tumbler of milk and soda water. A few oysters may be allowed.

4.30—A cup of weak tea and a little toast.

Supper at 7—A basin of soup or mutton broth, with a rusk or a little toast.

10.30—A glass of hot water.

MEDICINAL TREATMENT.

In these cases oxide of zinc in doses of 3 grains has been found of great benefit.

Hydrastis canadensis will also be found of value. It has had, in my hands, a wonderful power in allaying the distressing sensation of 'sinking' at the epigastrium so often met with, and should be given in doses of 10 min. of the tincture well diluted about half an hour before meals.

The following I have also proved to be extremely useful :

Nux vomica (see page 132).

Arsenic (see page 123).

Ipecacuanha (see page 128).

Coca in doses of ʒj of the fluid extract.

One must not forget that it is almost impossible to restrain a patient from flying to alcohol to relieve his uneasy sensations unless we provide him with a substitute, and in addition to drugs we shall find that Valentine's meat juice, or an equivalent preparation, will be of great use for this purpose.

DYSPEPSIA OF TEA-DRINKERS.

There is nothing very special to be said about the treatment of sufferers from this variety of dyspepsia except to cut off entirely their tea. The diet should be the same as that given for other cases of gastric catarrh. *Strychnia* will be found to be of the very greatest service, and must be given in rather large doses upon an empty stomach.

Tea Drinkers.—Dixon * advises 2 min. of carbolic acid, 5 grains of bicarbonate of soda, 25 min. of sal-volatile in an ounce of water in the dyspepsia of tea-drinkers, especially

* British Med. Journ., March 7th, 1885.

if it is associated with gastric tenderness, acidity and flatulence. This experience receives the confirmation of Mr. Berdoe,* who, however, gives 5 to 10 min. of glycerine of carbolic acid in aq. menth. virid., and if there is much pain he adds to each dose 5 or 10 min. of liq. opii sed.

GOUTY DYSPEPSIA.

In the treatment of this form of indigestion, we must neglect, to a certain extent, the local condition and direct our attention to the diathesis. We must remember that the immediate cause of the trouble is the irritation caused by the excretion of uric acid through the stomach walls, and must try to procure its elimination by other channels.

Dr. Mortimer Granville † gives the following drugs as applicable to this condition :—

Taurocholate of soda, gr. iij, in the form of a keratin-coated pill three times a day half an hour after meals.

He believes that this will do much to relieve the dyspepsia, by compensating the deficient action of the liver and supplying better bile.

The keratin coating of the pill, being only soluble in an alkali, protects it from solution until it reaches the duodenum.

He advises in addition one of the following stomachic tonics to be taken :—

1. Tincture of nux vomica with capsicum and cusparia.
2. Tincture of red cinchona bark with calumba, ginger, and gentian.
3. Carbonate of lithia, benzoate of soda, with compound infusion of gentian.
4. Liquor sodæ arseniatis with tincture of eucalyptus, syrup of Virginian prune and infusion of calumba.

* British Med. Journ., March 21st, 1885.

† Gout in its Clinical Aspects, 1885, pp. 223, 224.

5. Bromide of lithia, hippurate of soda, tincture of serpentaria and infusion of gentian.

6. Phosphate of soda, benzoate of soda, tincture of gentian and infusion of cusparia.

TREATMENT OF FUNCTIONAL INDIGESTION.

We may take it that, with very few exceptions, the cases of functional or atonic dyspepsia that we meet with in practice at the present day, are due to want of nerve tone, and the success of our treatment will depend very largely upon whether we recognise this cause or not. And, moreover, these cases are often much more complicated than they at first appear to be. For example, the defective innervation of the digestive apparatus leads to imperfect digestion and, consequently, diminished assimilation of food. The body is therefore imperfectly nourished. As a necessary consequence the nervous system participates in the general malnutrition, and, reacting again in turn upon the stomach perpetuate the dyspepsia. *Thus is set up a vicious circle of disease which it is very difficult to break.* Now we can easily see that we cannot possibly hope to cure a case of this kind by further restricting a diet which the patient has in all probability himself curtailed below the requirements of health; by voluntarily leaving off everything that he has found to disagree with him.

We have here to pursue the exact opposite course to that required in chronic catarrh. There we had to limit the food, here we have to build up, and must consequently try and induce the patient to take as much nourishment as possible, *whether it produces discomfort or not.* It is therefore almost impossible to prescribe a strict dietary table. Rather administer food according to the following rules:

Do not restrict the diet, beyond avoiding things which are palpably indigestible. Rather increase the number of meals.

If it is found that any article of food (not naturally indigestible) disagrees, *do not cut it off entirely*, but merely restrict its quantity. This is very important, as the stomach, through disuse, may easily, so to speak, *forget* how to deal with any particular article of food on a future occasion.

Of course all this only applies to plain, wholesomely-cooked food. All made dishes, smoked or highly-seasoned entrées must be avoided, but the diet must not be allowed to become too monotonous, or the appetite may fail. We must tempt the patient to eat with delicately-prepared and dainty dishes. But, above all things, we must avoid giving food that is *too* digestible. Bland, unirritating food, carefully freed from cellulose and vegetable and animal fibres, is not sufficiently stimulating to the alimentary canal to cause a daily evacuation of the bowels. In short :

(a) The food must be nutritious and plainly cooked.

(b) It must be given at comparatively short intervals. A raw egg, beaten up with a teaspoonful of old brandy and a little milk, may often be given with great advantage between breakfast and lunch, and between lunch and the late dinner.

(c) The appetite of the patient must be taken as the best guide to the most suitable kind of food. It will frequently be found that what patients *fancy* will frequently agree, if they are allowed to take it at the time they fancy it. Nature is not such an unreliable guide, if we listen to her dictates with discrimination.

(d) The food must be well masticated. If necessary the teeth should be put in order by the dentist.

(e) In cases where there is excess of acid secreted we may give an excess of animal food.

(f) Where we have reason to suppose that the gastric juice is defective we may either peptonize the articles of diet, or administer one of the digestive ferments at meal times.

As regards the Medicinal Treatment.—If we wish to succeed in the treatment of functional dyspepsia depending upon nerve exhaustion, we must discard almost entirely the traditional method of prescribing. For example, we have a case of dyspepsia in a nervously-exhausted individual, with the leading symptoms as follows: Epigastric discomfort and sinking before meals, the food giving temporary relief. About an hour or two after the meal, pain or discomfort at the epigastrium, feeling of constriction in the throat, flatulent distension of the stomach, which is tympanitic, and which by impeding the descent of the diaphragm, produces alarming difficulty of breathing accompanied by, perhaps, a sense of impending dissolution. This invariably happens, whatever kind of food is taken.

The old routine plan of treatment would be to restrict the diet of the patient, and to give a soda and bismuth mixture before meals, with perhaps a few drops of hydrocyanic acid.

But to be effect a cure we must recognise that this stomach trouble is but a local manifestation of a constitutional state and treat it accordingly.

The bismuth and soda mixture certainly gave relief, but it was only temporary. Let us administer instead, three grains of the valerianate of zinc three times a day, and pass the continuous galvanic current, daily, from the nape of the neck to the pit of the stomach, and we shall probably find that, in a few days, the patient can eat with impunity those very articles of diet which formerly disagreed with him.

The following are the drugs which I have found most useful in the treatment of this variety of dyspepsia.*

As regards the treatment of functional dyspepsia, I have, in my own practice found most benefit from the use of

* For the use of the Digestive Ferments and Galvanism, see pages 133, 145 respectively.

Valerianate of Zinc. Dose 2-5 grains.—In cases of distinctly nervous origin, especially when presumably depending upon spinal exhaustion, and *a fortiori* if there are any tender spots upon the spinal column. It is most conveniently given in the gelatine or sugar coated pills prepared now by many good makers.

Dilute Hydrochloric Acid.—See page 127.

Dilute Nitro-hydrochloric Acid.—See page 130.

Quinine.—This is extremely useful in elderly people and in dwellers in towns. It is a moderately powerful antiseptic, besides being a tonic, and may therefore, with advantage, be combined with dilute hydrochloric acid in the treatment of excessive fermentations in the alimentary canal.

Strychnine and Nux Vomica. See page 132.—Especially useful in cases of want of muscular tone in the stomach. It is best given before meals. Dose: ℞ 3-5 of the liquor strychniæ, or ℞ x of the tincture of nux vomica.

Nitrate of Strychnia is a form of the drug which is of the greatest use in cases of atonic dyspepsia, and is, I believe, practically unknown to all except a few medical men. It is made by adding strong nitric acid to strychnine and diluting to the required strength—that is to say, the same relative strength as the liq. strychniæ.

For the special treatment of incidental symptoms, see page 163, *et seq.*

The experiments of Dr. N. Butragin, in 1888, have demonstrated that in badly-nourished people the saliva is considerably diminished in power, and that by boiling starchy foods, which are to be given to the sick, they become easier of digestion—the boiling compensating for the lessened activity of the saliva. He found that it required three hours cooking to render rice and peas digestible by a badly-nourished, nervous, hysterical woman,

whereas one hour was quite long enough in the case of a healthy man.

Dr. McCall Anderson* gives diluted hydrochloric acid in doses of ℥ 8 or 10, just after meals, with or without strychnine and vegetable bitters. In these cases, also, he gives digestive ferments by the mouth. He also advises the administration of small doses of iron and arsenic when chlorosis is present, and if he can make out any spinal irritation he applies leeches and counter-irritation to the spine.

Leyden† thinks that more attention should be paid to the state of the nervous system than to the condition of the stomach. He recommends a mountain climate, absence from business cares and irritations, regulation of meals, exercise, and complete rest. In suitable cases, hydrotherapy, electricity and massage.

THE TREATMENT OF THE DYSPEPSIA OF PHTHISIS.

Klemperer‡ states that since in the first stage of phthisis the HCl of the gastric juice is either increased or normal, it is not indicated as a medicine. Likewise alkalies should be avoided, as they are likely to increase fermentative processes. He finds most benefit from alcohol and creasote. Creasote especially is of great service, and he gives it in doses of .005 to 0.2 grm. a quarter of an hour after meals three times a day, either in pills, capsules, or alcoholic solution. He asserts that it exerts a remarkable action on the motor power of the stomach, and he believes that its beneficial action in phthisis is not due to any anti-bacillary action that it possesses, but simply to its local action upon the stomach. He also advises the use of strychnine, rhubarb, gentian, massage, and electricity.

* Glasgow Med. Journ., March, 1885.

† Berl. klin. Wochenschrift, 1885, XXX., 3.

‡ *Ibid.*, No. 11, 1889.

TREATMENT OF CHRONIC DUODENAL DYSPEPSIA.

The treatment of this form of indigestion is almost entirely preventive. The patient must avoid, as far as possible, all food which is not digested in the stomach or which can undergo fermentation in the intestine. He should therefore eat sparingly of fat, sugar, and starch, avoid all made dishes, and confine himself for a time almost entirely to lean meat, dry toast, and hot water. Extract of malt is also useful (see page 133). In severe cases peptonized milk-foods may be given, and I have seen the best results follow the administration of papain (see page 143).

As regards drugs, alkalies should be given an hour or so after meals in tolerably large doses.

It is also advisable to raise the tone of the sympathetic nervous system by the application of galvanism.

SPECIAL TREATMENT OF SOME PARTICULAR SYMPTOMS AND CONDITIONS.

It is almost impossible, whilst describing the treatment of any one of the main clinical groups into which the subject of indigestion is divided, to devote much attention to special symptoms without impairing the coherency of the whole. I shall therefore devote a special section to their consideration. And this is all the more necessary as not infrequently, in practice, a single symptom may comprise the whole complaint, and although, theoretically, the relief of special symptoms is a bad practice, yet circumstances occasionally arise in which it is necessary to pursue this therapeutic method, and under these circumstances it is frequently a convenience to have the different measures collected together. I shall attempt to recapitulate very briefly the drugs which have been found beneficial in each case.

ANOREXIA.—In the special treatment of loss of appetite, the first thing to do is to ascertain that it does not depend upon any local condition in the mouth. Patients with gingivitis, purulent periodontitis, alveolar pyorrhœa usually have no appetite.

The medicinal agents which increase the appetite are—

Alcohol.—Small doses, well diluted, before or during meals.

The Vegetable Bitters, especially strychnia.

Orexin.—See page 131.

ACIDITY.

Dilute Hydrochloric Acid.—This should be given in small doses just before meals for simple acid pyroses, but after meals in larger doses if the acidity is due to butyric or acetic acid fermentation.

There is no doubt but that this acid is the most useful agent that we have in the treatment of acidity, from whatever cause.

Alkalies.—These are only palliative, and should only be given as a temporary expedient to relieve extreme distress. Monin* recommends the following :

- R. Pulverized phosphate of zinc, 10 parts.
- Calcined magnesia, 3 parts.
- Pulverized vanilla, 1 part.

One teaspoonful to be taken when required in a wine-glassful of water.

Magnesia is usually to be preferred to soda if troublesome eructations of gas are caused by the latter. The oxide is better than the carbonate of magnesia.

Bismuth.—This is useful, and is generally combined with bicarbonate of soda and morphia or opium.

Ipecacuanha.—In the acidity of pregnancy.

* L'Union Médicale, Feb., 1886.

Lemon Juice.—When acidity is associated with gout.

Mercury.—When acidity is accompanied with light clayey stools half a grain of Hyd. c. cret. three or four times a day will give good results (Ringer).

Nux Vomica.—This is indicated in the acidity of pregnancy and in acidity associated with slow digestion. Small doses should be given diluted upon an empty stomach.

Phosphate of Lime.—In acidity of young subjects with a tendency to phthisis.

Pulsatilla.—In acidity associated with slow digestion. Five drops of the tincture three times a day.

Dr. Wolff* has tried the following formula with great success :

R. Sulphate of soda, 30 gr.
 Sulphate of potash, 5 gr.
 Chloride of soda, 30 gr.
 Bicarbonate of soda, 25 gr.
 Biborate of soda, 10 gr. M.

Half a teaspoonful of the mixed salts dissolved in half a glass of warm water to be taken three times a day while fasting.

CONSTIPATION.—The following remedies have been given with success in the treatment of this condition :

Ammon. Carb.—This has been found useful in cases which depend upon an interruption in the natural habit of periodic discharge, especially in gouty cases. It should be given in 5-grain doses combined with ʒj of the ammoniated tincture of valerian (Granville). It should be taken the first thing after *rising* from bed, not on awaking, in the morning.

Alum.—Paradoxical as it may appear, alum has been found to give good results in cases where the glandular secretion throughout the intestines is deficient. This being shown by the dryness of the fæces. It should be given in 10-grain doses with a bitter infusion three times a day after meals.

* Zeitsch. f. klin. Med.

Aloes, Ferri Sulph., Nux Vomica, Belladonna.—These are usually given in combination, and with the best results as to the permanent cure of habitual constipation.

Dr. Spender, in the *Medical Times and Gazette* for 1870, advocates a method of administering these drugs by which he claims to *cure* inveterate cases. He administers 1 to 3 grains of the sulphate of iron, combined with a grain of the watery extract of aloes, three times a day. As soon as a loose evacuation occurs, one of the pills is omitted, so that the number taken becomes gradually reduced, until, after a month or so, one pill two or three times a week is found to be sufficient to procure a daily motion of the bowels. At last all medicine can be left off. He adds in some cases either belladonna or nux vomica to the pill.

The following formula as a rule gives very good results :

R. Aloin, gr. $\frac{1}{5}$.
 Ext. belladon., gr. $\frac{1}{8}$.
 Ext. nux vomic., gr. $\frac{1}{4}$.
 Ft. pil., j.

To be taken once or twice a day.

Arsenic.—This is useful in small doses when the constipation is due to catarrh of the stomach and intestines.

Capsicum.—Useful combined with nux vomica, where there is a lax and torpid condition of the intestinal walls.

R. Tinc. nux vom., m. v.
 Tinc. capsici, m. iv.
 Syr. aurantii, m. x.
 Aq. ad \bar{z} j. M.

To be taken half an hour before meals.

With the addition of valerianate of soda this combination has been recommended in gouty constipation.

Cascara.—The great objection to this most useful drug is its bitter taste. It should therefore be given either in capsules of the liquid extract, or in pills of the solid extract.

The following is, however, an eligible preparation in the form of a wine :

Cascara wine.*

R. Ext. cascar. sag., $\bar{\zeta}$ j.
Vini Xerici, $\bar{\zeta}$ ix. M.

S. One liqueur or sherry-glassful to be taken daily.

In the treatment of habitual constipation, it may be advantageously given in the following combination :

R. Aloin, gr. $\frac{1}{6}$.
Ext. cascar. sag., gr. ij.
Ext. belladon., gr. $\frac{1}{8}$. M.
Ft. pil., j.

One of these pills may be taken regularly at bedtime until the bowels begin to act in a normal manner, when they should be taken less frequently, at first leaving out every alternate night.

Electricity.—When there is want of tone of the intestinal walls, strong faradization of the abdomen, one pole being placed over the lower dorsal vertebræ and the other passed over the abdomen in the direction of the colon. A large flat sponge-holder should be used (my sponge-holder for general faradization answers well), and slow interruptions. Or a rectal electrode may be used.

Central galvanization usually effects a great improvement in the action of the bowels after a few applications (see page 147).

Glycerine Injections and Suppositories.—The introduction into practice of the secret anti-constipation injection of Dr. Anaker was followed by the extensive use of glycerine for this purpose by the profession as soon as it had leaked out that the nostrum consisted merely of pure glycerine mixed with a small quantity of extract of conium. And it has been found to be of great use in suitable cases. By

* Therap. Monatsch., 1890, p. 320.

irritating the mucous membrane of the lower bowel, it excites the peristaltic action of the colon, and usually produces an action of the bowels in a few minutes. A dram of pure glycerine should be injected with a syringe specially made for that purpose. Lately suppositories have been made to answer the same purpose, which are of two kinds. The one consists of a hollow suppository of cocoa butter, which contains the pure glycerine in its interior; the other is made of gelatine, with as much glycerine incorporated with it as it can be made to take up. The latter kind has proved in my hands by far the most satisfactory.

According to Palubinski,* the best results are obtained when the rectum and sigmoid flexure are filled with scybala, and when the fæces are excessively hard and the act of defæcation is attended with much pain.

Phosphate of Soda.—This mild laxative is extremely useful in gouty cases, and may be added to any mixture in doses of 20 grains.

Hydrastis Canadensis.—In catarrh of the stomach, the addition of m. x. of the tincture to each dose of any medicine which is being given will often relieve any tendency to constipation.

Ipecacuanha.—This is especially indicated when the motions are hard and dry, and may be taken in combination with the alum mixture given on page 165.

Iridin.—In small doses at bed-time, when there is deficiency of the secretion of bile.

DILATATION OF THE STOMACH.

The temporary dilatation of the stomach so often met with in cases of chronic gastric catarrh is usually due to abnormal fermentation in a stomach that has lost to a great

* Deutsche Med. Zeitung, June 19, 1890.

extent its muscular tone. Its rational treatment, therefore, is to prescribe a diet which cannot ferment. We frequently find the greatest benefit to result from a diet for a time consisting of lean meat and water. This I usually prescribe in the following manner. Raw meat is passed through a sausage machine, made into cakes with a little yolk of egg, and grilled, or thoroughly cooked in a saucepan with a pint of stock added to every pound of the minced meat. The patient is allowed to eat as much of this as he likes three times a day, taking a little bit of dry toast with each meal. Nothing is drunk at the time of eating except a quarter of a pint of thin soup or beef-tea, but a tumbler of hot water is slowly sipped one hour before each meal.

In severe forms of dilatation of the stomach, it is quite impossible to effect a cure unless the stomach can be made completely aseptic after the process of digestion is finished, for if there be any residue of decomposing food left in the stomach when the next meal is taken, it sets up fermentation in it, and thus perpetuates the process. There are two ways of preventing this. One is to wash out the stomach, after each meal if the case is severe, or less frequently if the case is milder; and the other is to administer antiseptics, and thus chemically arrest the fermentative changes.

The process of washing out the stomach, although theoretically the best treatment and extensively practised on the Continent, is not used over here nearly so much, as patients are greatly prejudiced against it. Its good effects have been much overrated, and there are many indications against its performance.

Dr. Dujardin-Beaumetz* treats a case by first washing out the stomach, and then injecting a prepared meal through the tube into the stomach. This process he terms 'lavage' and 'gavage.' His method is as follows:

* Therap. Gazette, Dec. 15, 1884.

The lavage is performed once a day, before breakfast, with a soft indiarubber tube, used after the manner of a syphon (Dr. Leube's tube with funnel attached is the most convenient). For cases where the fermentation is slight, he uses the following solutions: Sodæ bicarb., one drachm to a quart; sodium sulphate, one drachm and a half to a quart; or Vichy and Chatel Guyon waters simply.

Riegel* advises that the stomach-tube should always be used when there is evidence that the duration of digestion is really lengthened, and where there is abnormal fermentation. In cases where the secretions are normal, and the slow digestion is the result of the loss of motor power of the walls of the stomach, he uses massage and electricity, at the same time diminishing the quantity of liquid taken and regulating the food. Dilatation with increased secretion requires diminution of amylaceous food, neutralization of acid, restriction of food, and washing out the stomach. Riegel thinks that it is best to wash out the stomach at bedtime, so as to give it as long a period of rest as possible. A second washing out may, in some cases, be required in the morning.

The same writer† is of opinion that before ordering hydrochloric acid in dyspepsia, we should ascertain whether that acid is or is not deficient in the stomach secretion. The test he uses is paper stained with congo-red, which turns blue with .0019 per cent. of HCl, and shows no change with lactic acid unless a proportion of at least 1 per cent. is present.

In putrid fermentation he advises the use of a 1 per cent. solution of boracic acid. If there is much pain, he prefers chloroform water, or carbon disulphide water, one-third of saturated solution to two-thirds pure water. He uses this treatment wherever there is dilatation, except in cases com-

* Zeitschr. f. klin. Med., Bd. XI., Heft 2 and 3.

† Deutsche Med. Wochenschrift., 1886, No. 35.

plicated with gastric ulcer. After the lavage, he either gives through the tube (gavage) mixed with milk, or gives by the mouth a meat powder, prepared by boiling the meat, drying it in a water-bath, and grinding it to powder in a coffee-mill. In the latter case, he mixes two tablespoonfuls of the powder with a pint of milk and a little old rum or brandy.

Washing out the stomach in the first stages is beneficial, but where the dilatation is due to heart, kidney, or lung diseases to nervous disturbance, or to superabundance of food, it will do little good. Where there is stricture of the pylorus little good will result. If the stricture is organic, nothing but surgery will be of use. According to Dr. Oser,* an ulcer of the stomach may cause spasmodic stricture of the pylorus, and consequent dilatation of the stomach, and when this has healed the stricture, and with it the abnormality of the stomach, may disappear.

I believe myself that washing out the stomach is never necessary in the cases of dilatation met with as the result of catarrh of the stomach, or of atony of its walls, *and I never use it in my own practice.* On the Continent even, where it was first introduced, its use is gradually becoming limited to a very few cases.

My own practice is somewhat as follows :

1. Comparatively unfermentable diet, with small quantities of liquid only.
2. An antiseptic, such as sulpho-carbolate of soda, shortly before the next meal.
3. Strychnia and electricity to raise the tone of the stomach walls.
4. Massage and movements of the trunk (Swedish movements), to facilitate the emptying of the stomach.
5. A large dose of bicarbonate of soda, when there is probability that the dilatation is due to spasmodic closure

* Oser. Med. Press, Sept. 25, 1889.

of the pylorus (probably reflexly excited by hyper-acidity of the stomach contents).

The following powders, recommended by Dujardin-Beaumetz* for use in cases of cancer, may be advantageously given in any case where it is desirable to secure antisepticity of the stomach, such as extreme flatulence depending on unhealthy fermentation. They should be given in cachets before each meal :

Formula I.

- R. Salicylate of bismuth,
Magnesia,
Bicarbonate of soda, āā. 150 grains.
To be divided into 30 doses.

Formula II.

- R. Salicylate of bismuth,
Beta naphthol,
Powdered charcoal, āā. 150 grains.
To be divided into 30 doses.

Formula III.

- R. Salicylate of bismuth,
Salol,
Bicarbonate of soda, āā. 150 grains.
To be divided into 30 doses.

Bardet† has found galvanization of the stomach useful in dilatation with atony and nervous vomiting. He uses the negative pole in dilatation, and the positive in vomiting and spasmodic affections, and introduces it into the stomach, the other pole being held in the hand. He uses the continuous current, and interrupts it about twice a second.

I myself always use the faradic current in these cases, and

* Journal de Médecine, 1890, p. 519.

† Bull. Gén. de Thérap., 1884, p. 529.

apply it *always externally*. I apply my large sponge electrode to the epigastrium, and a long spinal electrode over the lumbar and sacral vertebræ, and pass a current strong enough to produce contraction of the abdominal muscles. At the same time, I usually administer central galvanization to improve the general nerve-tone. And I believe that by these methods we can do a great deal more good than by any meddlesome washing out of the stomach.

Dr. P. Tytler* mentions a case in which he effected a cure in the following manner, after other means had failed. He restricted the diet entirely to milk and beef-tea, and made the patient lie on her back for two hours after each meal with a pillow beneath her buttocks. The rationale of the process was based upon the hypothesis that in a dilated stomach the food in the relaxed and flabby stomach hung down below the level of the pylorus, and the stomach was thus unable to empty itself. By elevating the lower part of the body, the food was placed in such a position that it could pass out of the stomach in the ordinary way.

FLATULENCE.

The remedies which relieve this disturbing symptom act in one of the following manners :

1. They are antacid, and neutralize acid in the stomach.
2. They are antiseptic, and arrest fermentation, some, like charcoal, absorbing gas. Or—
3. They are essential oils, which act in a mechanical manner—how we do not exactly know—causing eructations of the wind in the stomach.

As an example of this action, we are all, no doubt, familiar with the effect of pouring a drop or two of ether into a bottle of senega mixture, which has been frothed-up by shaking. The foam subsides as if by magic. Some-

* Brit. Med. Journ., May, 1885, p. 1041.

thing of the same action, no doubt, goes on in the stomach when we give a few drops of peppermint, ether, or the like by the mouth. We must not forget, however, that these agents have antiseptic actions in addition.

Huchard* publishes the following formulæ :

R. Aq. chloroformi, 150.
Aq. dest., 120.
Aqua menth. virid., 30.

M. Dose, \bar{z} ss. before or during a meal.

R. Powdered charcoal, \bar{z} ij.
Sodæ bicarb., \bar{z} jss.
Calcined magnesia, \bar{z} j.
Powdered calumba, \bar{z} ss.

M. Divide into 40 powders. One to be taken half or one hour before eating.

If an antiseptic action is desired :

R. Beta naphthol,
Salicylate of bismuth,
Magnesia, $\bar{a}\bar{a}$. gr. xiv.

M. Divide into 30 powders. One to be taken at meal-times.

Liquid extract of ergot, in drachm doses, is strongly recommended by Dr. Bonavia (1884), who records a case which was completely cured when in the last stage of exhaustion, after the failure of anti-spasmodics, narcotics, counter-irritants, and chloroform.

Nitro-glycerin, in doses of one minim of a 1 per cent. solution, was found useful by Dr. Schultz,† who cured with it an intractable case of nine days' standing.

* Les Nouveaux Remèdes, April 8, 1890.

† New York Med. Journ., Sept. 19, 1885.

HICCOUGH.

Camphor.—Doses of m. v of the saturated tincture.

Capsicum.—m. x of the tincture.

Charcoal.—When hiccough comes on after eating.

Chloroform and Opium.—m. j of chloroform, with m. v of tincture of opium.

Colchicum.—In cases of gouty dyspepsia.

Nux Vomica.—This drug is especially useful where the hiccough comes on before meals without apparent cause, when it is brought on by cold drinks, or is induced by smoking.

Dr. Phillips advises m. v of tincture of nux vomica to be given, combined with 15 m. of dilute nitric acid.

Morphia in the form of hypodermic injection.

Mustard.—ʒj infused in ʒiv of warm water.

Carbonate of Soda, with carbonate of magnesia and bismuth, when due to hyperacidity of the contents of the stomach.

PAIN—GASTRODYNIA.

In the treatment of this symptom we must, if possible, in the first place, ascertain the cause.

1. When pain is due to abnormal distension of the stomach, it will be relieved by agents which will either empty it or cause eructations of wind.

2. If pain is due to local hyperæsthesia, morphia and hydrocyanic acid will give the best results.

3. If purely neuralgic, arsenic and ergot.

4. As a symptom of locomotor ataxy, antipyrin and morphia are to be relied on.

Relief is often to be obtained by the application of mustard plasters or turpentine stupes to the epigastrium.

When gastrodynia is associated with intermittent pulse,

Dr. Lauder Brunton* strongly advises the late Dr. Warburton Begbie's prescription of powdered rhubarb, subnitrate of bismuth, bicarbonate of soda, nux vomica, and compound cinnamon powder.

Da Costa† recommends in obstinate cases the trial of the following:

- (a) Bismuth, with a little opium.
- (b) Nitro-muriatic acid, gt. ij-iiij diluted.
- (c) ℞. Morph. sulph., gr. $\frac{1}{32}$.
Acid carbol., gtt. j.
Aq. menth. pip. ad \bar{z} j ter die.
- (d) Sol. Fowleri, beginning with 1 drop, and increasing to 5 drops a day.

Dujardin-Beaumetz advises subcutaneous injection of a syringeful of the following:‡

- ℞. Hydrochlorate of morphia, $1\frac{1}{2}$ grains.
Neutral sulphate of atropine, $\frac{3}{20}$ of a grain.
Distilled water, 2 drams.

Hydrocyanic Acid will often cure rapidly when the pain is a simple neurosis.

Oxide of Zinc, Creasote.—Both are useful when gastralgia comes on after food.

Ergot.—Often relieves severe visceral neuralgias.

PYROSIS.

Dr. Carter§ advises opium and belladonna in small doses, and where the stomach is primarily at fault saline aperient given continuously for a considerable time. If the gastric catarrh is acute, the diet should be restricted

* Lettsomian Lectures. British Med. Journ., Vol. I., 1885.

† New York Med. Record, 1886.

‡ Dujardin-Beaumetz. Journ. de Médecine, 1890, p. 519.

§ Practitioner, 1890, p. 321.

for a time to alkalized milk. In certain cases he advises washing out the stomach.

Dr. Phillips* recommends the following :

Capsicum.—In small doses is useful in cases associated with heartburn and diarrhœa, occurring in atonic cases.

Pulsatilla.—m. ij of the tincture in phlegmatic subjects.

Podophyllin.— $\frac{1}{10}$ of a grain night and morning in obstinate heartburn, with liver derangement.

Nux Vomica, when associated with hiccough.

℞. Tinc. nux vom., m. v-x.

Acid nit. dil., m. xv. Aq. ad ʒj. M.

For one dose.

ULCER OF THE STOMACH.

Although this affection does not properly come within the range of this little work, except as regards diagnosis, yet it occurs with such relative frequency when a number of dyspeptic cases are seen, that it has occurred to me that it would be a convenience briefly to indicate its treatment.

For the first week the diet should be as nearly fluid as possible, and should be largely composed of peptonized milk. Unpeptonized milk must be avoided, as the curds which are formed in the stomach will act in every respect as solid food. If the bitter taste of the peptonized milk is complained of, the addition of a little coffee and sugar will render it unnoticeable. It is of great importance not to give any food which approaches in any degree to the solid form at first, as not only will it irritate the gastric mucous membrane, but it will also excite the muscular movements of the stomach, and prevent the healing of the ulcer.

* *Materia Medica and Therapeutics of the Vegetable Kingdom*, N.Y., 1879

After the first six or seven days the patient may be given meat broths, soups, and solution of peptone. If at this period there is evidence that nutrition is not being kept up, rectal alimentation should be given in addition, and for this purpose suppositories of peptone may be made use of, or injections of dried bullock's blood (*Sanguis Bovinus Ex.*, Parke, Davis and Co.). This latter, in my own hands, has given excellent results. The best way of preparing it is to place two ounces of warm water in a wide-mouthed four-ounce bottle; pour the dried blood upon the surface of the water, cork, and agitate until dissolved. At this stage of the treatment Mellin's infants' food, which is liquid after it is prepared, may be given with advantage. Later on solid food must be very cautiously introduced into the diet, and should consist of yolk of egg, and afterwards scraped meat.

As regards drugs, the only one which has given decidedly good results in my own practice is nitrate of silver. This should be given on an empty stomach in a dose of one ounce of a 1-in-500 solution. After it has been taken, the patient should lie for a quarter of an hour upon his right side, if it is judged that the ulcer is situated in the usual position, near the pylorus.

Pain is treated by magnesia in small doses, and bismuth and opiates.

Vomiting by ice to suck, morphia in small doses by the mouth or hypodermically, and by ice to the epigastrium.

In hæmorrhage the patient should lie on his left side, to remove the contents of the stomach from contact with the ulcer, and ice and morphia should be given, as in vomiting; and above all, the patient should be fed for the time entirely by the rectum.

The Constipation which is so frequent in these cases should be relieved by saline purgative waters, care being taken to use a natural one which has not been sophisticated before being placed upon the market.

Dr. Ter-Grigorianz* records a case which was cured by the administration of perchloride of iron in small doses, with a diet of iced milk and boiled water in equal parts, with later on well-toasted white bread. He also applied an ice-bag to the epigastrium.

Dr. McCall Anderson† advises black oxide of manganese in 10-grain doses as a sedative, and in chronic cases small doses of arsenic. He gives as diet, milk and lime-water or seltzer-water, buttermilk or koumiss, Savory and Moore's nutritive enemata, and Carnrick's beef peptonoids.

VOMITING.

One of the best remedies for this condition is pure carbolic acid in 2-min. doses, given in pills and frequently repeated.

Resorcin has been recommended by Andeer,‡ and by Cartier tincture of iodine in 10-min. doses, well diluted in water, and given in divided doses after a meal.§

Dr. Phillips recommends :||

Iris (Iridin) in vomiting with supraorbital pain.

Cocculus Indicus—in cerebral vomiting.

Dr. Ringer advises :¶

Ipecacuanha—in small doses in vomiting of nervous origin.

Nux Vomica—when the tongue is coated.

Bismuth—especially for children.

Mercury— $\frac{1}{3}$ grain of gray powder every two hours in children with clayey stools.

Veratrum album—in summer diarrhoea.

* Proceedings of Caucas. Med. Soc., Nov. 11, 1884.

† Glasgow Med. Journ., March, 1885.

‡ Centralblt. f. Med. Wissen., 1889, p. 864.

§ Union Méd., 1889, No. 148. Centralblt. f. klin. Med., 1890, p. 292.

¶ Mat. Med., and Therapeutics of Veg. Kingdom, N. Y., 1879.

|| Handbook of Therapeutics.

Waring* gives :

Creasote—especially in vomiting of cancer and gastric ulcer.

Pot. Bromide—in the vomiting of uterine disease.

Bartholow† advises :

Sulphurous acid—well diluted, when the vomiting is due to the acid fermentation of starchy elements.

* Practical Therapeutics, Philad.

† Materia Medica and Therapeutics.

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