The morbid states of the stomach and duodenum : and their relations to the diseases of other organs / by Samuel Fenwick.

Chas E. Hall
Boston

THE

MORBID STATES

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Relations to the Diseases of other Organs.

BY

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PREFACE.

Some apology appears to be necessary in introducing a work on the Diseases of the Stomach, when so many excellent treatises on indigestion have been lately issued. There are, however, two aspects from which we may regard the morbid states of an organ. We may either view them simply as altering the anatomical structure and impairing the efficiency of the part affected; or as influencing other portions of the system, modifying the progress of various maladies, and giving rise to changes in the texture and functions of the different structures of which the body is composed. With the former point of view late writers have been chiefly occupied; to the latter I am anxious chiefly to direct the attention of my readers.

The practitioner is constantly consulted for symptoms apparently unconnected with the malady with which a patient may be affected; thus, a person whom he knows to labour under a disease of the heart or kidneys, may be habitually seeking relief for sensations indicating a derangement in the functions of the brain or stomach. And, in other cases, although the chief complaint may be of the disordered action of the organ whose structure is most notably altered,

an imperfection in that of others may prove the main obstacle to successful treatment.

This contemporaneous affection of various organs in disease seemed to me so important, that I endeavoured to investigate microscopically the condition of all the principal structures in persons dying of different maladies. Traces of such attempt will be observed throughout this volume; but being unable to obtain sufficient materials for such an extended investigation, I was at last obliged to limit my observations to the digestive canal. I have therefore attempted to show whether, and how often, this part of the body is affected in different disorders, and how far such affections tend to modify the course, or increase the gravity of the original malady. In treating the subject in this way, a certain amount of repetition as regards the morbid appearances is inevitable, but I trust that this will be found to be no disadvantage by those who may follow a similar line of inquiry.

Another object I have endeavoured to keep prominently in view is, how far the derangements of digestion are capable of producing morbid changes in other parts of the body. The success which has crowned the use of physical means of diagnosis, tends to concentrate our attention upon the more striking structural alterations, to the comparative exclusion of minor changes, which we are liable to regard as trivial or unimportant, although they may possess much pathological significance and practical interest. When we see an aortic aneurism or a lung consolidated by tubercle, and hear that the disease had been diagnosed at an early period, we may feel proud

of the certainty to which our knowledge has arrived; but we ought not to forget that physical diagnosis only too often reveals the malady, when all hope of successful treatment has passed away.

Our chief aim therefore should be to ascertain from what causes the tubercular and atheromatous formations originally spring, and whether there may not be indications preceding their actual deposition.

Some explanation is requisite as to the manner in which the microscopical observations are described. The term "granular matter" for instance, is of such frequent occurrence, that its repetition will be probably wearisome to the reader. Nevertheless, in the description of any diseased structure it is necessary that nothing should be omitted; and I believe that in the amorphous materials so common in most morbid products, and in the various alterations which they undergo, we may discover a clue to the origin of many diseases; for it is probable, that just in proportion as these materials deviate in character from the normal exudation, they become insusceptible of being moulded by the formative power into normal structures, and liable therefore to pathological changes.

It will be seen that I have repeatedly referred to the diseases of the lower animals, and I regret that I have not been able more fully to illustrate my subject by this means. It seems to me that comparative anatomy is as necessary to the student of pathology as to the physiologist, and that any plan of investigation which neglects it must be necessarily imperfect.

Since the functions of an organ may be imperfectly performed even when its anatomical structure seems to be healthy, I have given the results of numerous experiments as to the amount of pepsin in the stomachs of persons dying from different diseases. Unfortunately I was unable to investigate the nature and the amount of the acid secreted in these cases, so that much of the value of the inquiry was lost.

It may be remarked that I have on various occasions quoted only isolated observations, when the subject would seem to require a greater number of facts. I have generally done this, in the hope of drawing the attention of others to points that I deemed worthy of further inquiry, but which I had not the opportunity of pursuing for myself.

I would take the opportunity of thanking Dr. Marston, Royal Artillery, for his very kind and valuable assistance in the preparation of this work, as well as for the various notes and cases to which his name is appended. I am obliged to the medical officers of the Middlesex Hospital, and particularly to Mr. Nunn and to other friends, for the opportunities of examining various morbid specimens, and also to Dr. Murie for some interesting examples of disease in the lower animals.

The plates are all drawn by Mr. Tuffen West from original specimens with the camera lucida. I am also indebted to this gentleman for his description of the fungus mentioned at page 254, and figured in plate 7.

31, Harley-street, Cavendish-square,
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DISEASES OF THE STOMACH AND DUODENUM.

CHAPTER I.

INTRODUCTION.

It is necessary that we should have clear ideas respecting the position, relations, structure and functions of the stomach and duodenum, if we would understand the changes produced in these organs by disease. An accurate knowledge of their position is essential for the diagnosis of many cases of ulceration and of tumour; an acquaintance with their relations to the other viscera explains their liability to be influenced by affections of the neighbouring organs, and how their diseases tend to produce morbid actions in the structures in their vicinity; whilst it is only by a clear perception of their healthy structure and functions that we can appreciate the alterations that result in them from disease.

The stomach occupies the left hypochondriac, epigastric, and part of the right hypochondriac regions. Superiorly it is in relation to the diaphragm and the

smaller lobe of the liver; inferiorly it is separated from the small intestines by the transverse colon; behind it lies the pancreas, whilst the spleen is attached to its most dilated part.

There is no organ so liable to changes in position as the stomach. On a full inspiration it is pushed downwards by the diaphragm, and in expiration the contraction of the abdominal muscles forces it upwards towards the chest. When empty, its lesser and greater curvatures look upwards and downwards; but when distended, they change their positions, and become respectively rather posterior and anterior.

The stomach is largely supplied with blood-vessels, nerves, and lymphatics. The arteries are derived from the cœliac axis, and their chief trunks run along the two curvatures of the organ, sending out branches on either side that perforate the outer tunics and ramify in the mucous membrane. The veins pour their contents into the vena portæ. The lymphatics arise both in the sub-serous and in the sub-mucous coats, and end in a number of small glands chiefly situated along the curvatures of the stomach. It is supplied with nervous influence from the pneumo-gastric nerves, and also from the solar plexus.

By physical examination we may, in most cases, ascertain the size, shape, and position of the stomach, and its relations to many of the surrounding organs.

Palpation is chiefly useful when we have reason to suspect the presence of tumours or of ulceration. If the patient is thin and the abdominal muscles are lax, the desired information can be readily obtained by this means; but in others, very considerable difficulty is experienced, especially in the detection

of deeply-seated tumours. When this method of examination is employed, the patient should be laid upon his back, the knees should be well raised and retained in that position, and the hand of the physician should be warmed before it is applied to the skin. In many cases, it is necessary to repeat the examination with the patient in different positions, as we may sometimes detect a deeply-seated tumour when he is in one posture which we are unable to perceive in another. As the position of the stomach is so liable to changes, we should, in doubtful cases, explore the epigastrium in full inspiration and in forced expiration; when it is empty, and when it is distended with food.

As the stomach always contains a certain amount of gas, percussion over it elicits a tympanitic sound; and, by a little practice, its boundaries can by this means be defined. When percussion is made over the part concealed by the liver, the stroke should be stronger than where it is only covered by the abdominal parietes. Many persons use an ivory pleximeter, but I prefer the finger, because we can better estimate the amount of resistance offered to it, as well as bring out the note produced by the stroke.

By far the best mode of defining the extent and position of the stomach is by "auscultatory percussion." I have been in the habit of using this means of examination for many years, and was not aware that it had been previously described; but the following extract from Dr. Aitken's "Practice of Medicine" shows that it has been applied to other organs:[1]—"A solid cedar cylinder, six inches in length and one inch in diameter, cut in the direction of the fibres, and

[1] Aitken's Science and Practice of Medicine, vol. ii. p. 706.

with an ear-piece attached, is applied to the centre of the præcordial region while the ear is applied to the other end; percussion is then made by another person from the point near where the cylinder is applied towards the limits of the heart in every direction. So long as percussion is made over the body of the heart a distinct shock is felt directly in the ear; but as soon as the limits of the heart are passed this sharp shock immediately ceases, even in passing from one solid organ to another in contact with it, as from the heart to the liver."—*Drs. Camman and Clark.*

The manner in which I employ "auscultatory percussion" to the stomach is as follows. The patient being laid on his left side, so that the gas contained in the stomach may rise to the pyloric region, the cup-shaped end of a "Camman's Stethoscope" is applied to a part in the epigastrium, where, by percussion, I have ascertained that the tympanitic sound exists. I then strike the epigastrium sharply with the fingers, commencing close to the point at which the stethoscope is placed, and mark with ink the line at which the shock of the blow ceases to be felt directly in the ears. By moving the patient, so that he lies first on the back and afterwards on the right side, the gas is made to distend each region of the stomach in turn, and so the outline of the whole organ is completed. There is a chance of error if the stethoscope be placed over a dilated colon instead of the stomach; but when there is reason to suspect that this is the case, the patient should be examined before food, and, the boundaries of the stomach having been marked out, the examination should be repeated when the organ is in a state of distension. I have often, after tracing

out the empty stomach, directed the patient to drink a little soda-water or an effervescing draught, and repeated the auscultation. Sometimes the drinking of a glass of cold water is sufficient to alter the form of the pyloric region. The cold seems to produce contraction of the muscular coat, and we can hear, through the stethoscope, the air forced onwards to the duodenal opening. In some cases, I have found even the repeated swallowing of the saliva sufficient to cause a slight increase in the size of the stomach, probably by the escape of the air contained in that viscid fluid. In others, it is necessary to unload the colon before making the examination, by an enema containing castor oil or turpentine. By the removal of flatus and fæculent accumulations, we are often enabled more clearly to define the lower boundaries of the stomach, or to satisfy ourselves as to the presence of deeply-seated tumours. It is a good plan to close the cup-shaped end of the stethoscope, by tying over it a fine piece of india-rubber, as by this means the force of the shock seems to be made more distinct.

The duodenum is a very important portion of the digestive canal, and there can be no doubt that many of the cases of dyspepsia, which we refer to disorders of the stomach, really have their origin in the derangement of the functions of this part. From its relations to the gall-bladder, the right kidney, the pancreas, and the colon, any disorder affecting it must tend to alter the functions of these organs, and thus render the symptoms of the case obscure.

Dr. Wilson Philip asserted that, in almost all long-standing cases of dyspepsia, a fulness could be discovered in the right side of the patient, which he

believed to arise from dilatation of the duodenum; but, according to my own observations, this enlargement, when it exists, is dependent on an atonic state of the colon, and not on an affection of the duodenum.

The stomach and intestines are formed of three coats: the outer, or peritoneal; the middle, or muscular; and the internal, or mucous membrane; each being united with the others by means of connective tissue. We must first consider the lining membrane of the organ, as in it we most frequently find indications of disease.

When the human stomach is laid open, its inner membrane is generally found to be covered with a layer of mucus, which is believed to be furnished by the cylindrical epithelium that clothes the whole of its internal surface. When the mucus is removed, the membrane usually appears of a red colour, which is brightest in the middle region, and is paler near the pylorus. The colour is most intense if death has occurred whilst digestion was going on; in cases where much venous congestion has existed during life it presents a much darker hue, whilst, in those patients whose death has been preceded by hæmorrhage, it has a pale and bloodless appearance. The thickness of the mucous membrane of the stomach is subject to great variety; it is thickest in persons who have died suddenly from accidents, and less so in females than in males. It is often firm and dense in cases in which congestion or chronic inflammation has been present, and it is generally very thin and soft in those who have died from fever or from any lingering disease.

When the stomach is empty, the mucous membrane

presents a number of folds, chiefly in a longitudinal direction, which are effaced when the organ is distended with food. There is a very common condition, termed "mammillation," which many authors have regarded as always resulting from chronic gastritis. In this state, which is most commonly met with in the middle region, the surface is raised into small irregularly-shaped projections. When the parts presenting this appearance are examined with the microscope, the secreting tubes are often found to be distended with their contents, but presenting no distinct evidence of disease. In other cases, the structures seem perfectly healthy, and the irregularities on the surface probably result from the contraction of the muscular fibres which run between the groups into which the secreting tubes are collected.

When the surface of the stomach is carefully examined with the naked eye, we can often recognise numerous small openings scattered over it. These are much more readily seen with the microscope, when the preparation is viewed as an opaque object. They are usually round or oval, sometimes irregular in shape, and measure from $\frac{1}{200}$ to $\frac{1}{350}$ part of an inch in diameter in the splenic and middle regions; while, near the pylorus, they often attain a diameter of $\frac{1}{100}$ part of an inch. In depth they are about $\frac{1}{6}$ or $\frac{1}{8}$ of the thickness of the mucous membrane, and when the mucus they contain is removed, three or four depressions of a circular shape come into view. These depressions are the upper ends of the secreting tubes. (See *p*, plate 2, fig. 3.)

The little pits just mentioned are surrounded by ridges, which separate them from each other. Some-

times, the ridges are but slightly raised, and are pale in colour; in other cases they are very prominent, and present a plexus of vessels loaded with blood. The openings of the pits are frequently very much narrowed by the congestion of these ridges; at other times they are so large, that the entire membrane seems everywhere studded over with minute holes. (See *r*, plate 2, fig. 3.)

The whole surface, both of the pits and of the intervening ridges, is covered with epithelium of the columnar variety. The separate epithelial cells adhere firmly to each other, and are attached by their smaller ends to the basement membrane, their opposite ends being free. They possess a nucleus situated near their attached end. They are stated, by Todd and Bowman, "to lie in a double series, the deeper being in course of development, while the more superficial is in the course of decay."* The truth of this statement I have been unable to verify, but it is probably correct, as we constantly find wasted, empty-looking, epithelial particles in the mucus covering the surface of the organ. (See *c*, plate 2, fig. 1.)

After death, the conical epithelium is generally detached, so that, at the time at which *post mortem* examinations are conducted on the human subject, we find the mucous membrane denuded. In some cases I have found the epithelium still adherent, especially in the pyloric region, and have seen it in the form of a thick, warty-looking mass, composed of different layers of cells. Ordinarily, the epithelial cells are intermixed with the mucus or other contents of the stomach, two or three adhering together. In other cases, they

* Physiological Anatomy, vol. ii. p. 192.

present a circular or tubular form, according as they have been detached from the ridges or pits of the membrane. Care must be taken not to confound these apparent tubes with the casts that result from inflammation.

The pyloric region is at times covered with small projections like the villi of the duodenum. These have been supposed by some authors to be always caused by the secretions being forced out of the tubes by pressure incautiously applied to the preparation. There can be no doubt that such an appearance may be produced in this way, when the tubes are overloaded with their secretions; but as I have been able, in some stomachs, to trace the basement membrane over the projections, it is probable that these elevations are often imperfectly formed villi.

When a perpendicular section is made of the mucous membrane of the human stomach, it is found that the principal part of this coat is composed of glandular structures packed together in the form of tubes. These pass perpendicularly downwards, from the pits into which they open on the surface, to a layer of connective tissue on which they rest. Each is slightly constricted shortly after its origin on the free surface of the mucous membrane, below which it gradually enlarges, and terminates in a bulb. This enlargement at its lower end is much more distinctly seen when the tube has been distended by inflammatory effusion. (See plate 2, fig. 1, and plate 3, fig. 1.)

It has been stated by some writers that the glandular structure always presents a compound tubular form at the cardia, like that which we see in many of the inferior animals. I have found this to be the case occasionally,

but in the majority of dissections, the whole of the glands that contain true gastric cells are in the shape of simple tubes.

The tubes vary in length and width in different parts of the organ. Thus, taking a considerable number of measurements at random from my note-book, I find that, on the average, they were $\frac{1}{252}$ of an inch in length in the splenic, $\frac{1}{253}$ of an inch in the middle, and $\frac{1}{258}$ of an inch in the pyloric region. In each case the length was reckoned from the lower termination of the tube to the free surface of the mucous membrane. In width, the average diameter was $\frac{1}{3810}$ of an inch in the splenic, $\frac{1}{3417}$ of an inch in the middle, and $\frac{1}{4184}$ of an inch in the pyloric region.

In many of the lower animals, and in the child in the human subject, the tubes are grouped together into bundles of threes to five or six; each group being separated from those adjoining it by partitions of fibrous tissue, muscular fibres, and blood-vessels. In the human adult, this arrangement is seldom to be perceived, but, at pretty regular intervals, we may observe divisions formed of firmer bundles of fibres and larger branches of blood-vessels than are met with between each individual tube.

These bundles of connective tissue are continuous below with the loose layer of fibres on which the tubes rest, and above they are attached to the edges of the projecting ridges that surround the pits on the surface of the stomach. Similar, but weaker processes, are sent up in like manner around each separate tube, so as to support it in its position. It results from this arrangement, that the gastric tubes are, in a healthy state, only firmly fixed at their attachments to the

pits into which they open; we can therefore teaze them out with needles, or in a section separate them one from the other by compression. In the pyloric region, the connective tissue is much stronger than in the other parts of the organ, and the tubes are consequently much more firmly fixed. One of the most evident effects of inflammation, when it attacks the connective tissue below and between the tubes, is to fasten them together, so that it is difficult or impossible to separate them without injuring their basement membrane. (See plate 5, fig. 1.)

The walls of the tubes are formed of a thin structureless membrane named the basement membrane. This is a continuation of a similar tissue, which constitutes the basis of the surface of the mucous membrane and of the pits into which the tubes enter. We may, therefore, look upon the tubes as merely reduplications of the inner surface of the stomach, surrounded by connective tissue and blood-vessels.

The tubes are filled with cells by which the characteristic secretion of the organ is elaborated. (See *g*, plate 2, fig. 1.) In the normal condition, the gastric tubes appear to have no cavity, although, in certain cases, I have seen the epithelium lining their sides separated by a considerable interval, the space between them being filled with the products of inflammation.

As it has been stated by some authors that the free ends of the tubes present a distinct opening, I attempted to determine the point by the following experiment. A small quantity of collodion was poured into a strong, wide-mouthed glass bottle, which was closed by a piece of healthy human stomach being firmly tied around its neck; the mucous mem-

brane being placed inwardly. The bottle was then placed in an inverted position for a short time in hot water, and the expansion of the ether forced the collodion into all the crevices in the surface of the mucous membrane with which it was in contact. When the stomach was removed, the collodion on drying left a film which could be readily torn off with forceps. Under the microscope this film presented a perfect cast of all the various inequalities of the mucous membrane, but I could not discover any openings in the tubes, excepting when the organ was diseased.

In the splenic and middle regions of the human stomach, the tubes contain only what are termed gastric cells; but, in the pyloric region, they are often lined throughout with the ordinary columnar cells which cover the surface and the pits of the mucous membrane. In cases of disease I have seen projections of the basement membrane passing between the gastric cells, and in some of the lower animals this arrangement may be generally observed.

The gastric cells are, when mature, oval or irregular in shape, and usually vary from $\frac{1}{1200}$ to $\frac{1}{1500}$ part of an inch in diameter. In cases of disease, they are often only $\frac{1}{2200}$, and, in other preparations, I have found them as large as $\frac{1}{1000}$ or $\frac{1}{900}$ part of an inch.

The cells are much less clearly defined at the bulbous terminations than towards the free ends of the tubes. They contain a well-defined nucleus, a number of granules, and usually fat globules. I have generally found in the lower animals the cells most distinctly fatty when death occurred whilst digestion was in progress. This fact should be borne in mind before we pronounce that fatty degeneration is present

in any specimen of gastric mucous membrane we may be examining.

Besides the tubular glands, we sometimes find in the mucous membrane of the human stomach a number of closed follicles similar in structure to the solitary glands of the intestines. These were first clearly described by Dr. Handfield Jones, and may be seen in the stomachs of many animals, as, for instance, in that of the pig, when the mucous membrane has been immersed in dilute hydrochloric acid. (See plate 8, fig. 1.)

In the human subject they are most frequently found in children, in whom the whole surface of the lining membrane of the stomach often seems studded with them. In the adult we frequently fail to discover any trace of them, but in those who have died from certain forms of cancer they appear everywhere disseminated over the mucous membrane. They are most common in the pyloric region and along the curvatures, especially in the smaller.

When examined microscopically, the solitary glands of the stomach seem to consist of an envelope of fibrous tissue, and are filled with nuclei and small cells. Sometimes no distinct limitary membrane can be seen, and they appear simply as a mass of cells and nuclei, of a round or oval form, situated below the secreting tubes. I have never been able to discover any outlet to them; but when injecting portions of the mucous membrane with collodion, I have found casts of small round sacs which communicated with the surface by very narrow openings.

The mucous membrane of the stomach is plentifully supplied with blood. The smaller arteries divide in the submucous tissue, and from these branches pass up

between the tubes, terminating in a beautiful network of capillaries around the openings of the pits situated on the surface. From this network arise the veins, which descend along the tubes, and pour their contents into the larger vessels situated below the mucous membrane. (See plate 5, figs. 2 and 3.)

The minute branches of the nerves have not been traced into the substance of the mucous membrane itself, although they no doubt pass upwards with the blood-vessels between the secreting tubes.

The stomach is surrounded with muscular fibres arranged in three separate layers. The most external are longitudinal, and are continuous with those passing downwards from the œsophagus. They are chiefly spread over the curvatures. The circular fibres envelope the whole of the stomach, and are thickest at the pylorus, where, with the mucous membrane covering them, they form the pyloric valve. The oblique muscular fibres pass obliquely round the organ, and are chiefly found at the splenic end, descending on its anterior and posterior surfaces.

The peritoneal is connected with the muscular coat by means of areolar tissue, and presents, when examined with the microscope, the same structure as membranes of a similar kind situated in other parts of the body.

The inner surface of the small intestines has numerous folds, by which the extent of the mucous membrane is greatly increased. These commence one or two inches below the pylorus, and are most fully developed in the lower part of the duodenum and the upper part of the jejunum.

The mucous membrane of the duodenum is not so

thick as that of the stomach, and is more firmly fixed to the subjacent coats. When a perpendicular section of it is submitted to microscopical examination, we observe in it a more complex arrangement of structures than in the stomach; inasmuch as it presents villi, Lieberkühn's follicles, Brunner's glands, and the solitary glands, together with blood-vessels, nerves, and lymphatics.

The villi are small projections, from $\frac{1}{69}$ to $\frac{1}{45}$ of an inch in length, situated on every part of the mucous membrane, from near the pylorus to the termination of the small intestine. In the duodenum they are generally flat; but, in the lower parts of the tube they are more conical in form, and often present a club-shaped end. They are covered with epithelium; but after death this usually falls off, and allows a clear view of the internal structure of the villus. (See plate 6, fig. 1.)

Immediately below the epithelium there is a fine structureless membrane, termed the basement membrane. In some cases this is so thin, that it is seen with difficulty; in others, it presents a considerable thickness. (See plate 6, fig. 3.)

The greater portion of the villus below the basement membrane seems to consist of imperfectly formed areolar tissue, in which are interspersed a variable number of cells and nuclei. The number of nuclei is generally greater at the apex than towards the base, and we can often observe an appearance of vesicles at this part. Sometimes scarcely any nuclei can be distinguished; at others, as in persons who have died of certain forms of cancer, the whole structure is loaded with them.

The villi are plentifully supplied with blood. An artery usually enters at their base; and at the apex breaks up into a network of capillaries situated immediately below the basement membrane; and from this the smaller veins arise, which pour their contents into the larger vessels situated in the submucous space.

There has been much difference of opinion amongst anatomists as to the origin of the lacteals. It is most probable that in each conical villus there is a central space, which is occupied by a single lacteal vessel, and that these vessels do not ramify, as was formerly supposed.

It has been for some time known that the villi possess the power of contraction; and Brücke discovered a layer of muscular fibres in their interior, external to the lacteal vessel.

Externally, as has been already stated, the villi are covered with a layer of epithelial cells of the columnar form. These adhere firmly to each other, and are implanted into the basement membrane by their sharper ends. Each cell seems to contain mucus and some granular matter, and is provided with a nucleus. Kölliker has stated that the free ends of the cells "are thickened, and very finely striated;" and that "in their totality these thickened parts represent a special membrane, covering the cells similar to the cuticula of plants."

When an animal is killed, whilst fasting, the villi have a shrunken appearance; but during digestion they are dilated, and contain innumerable cells, loaded with chyle.

The epithelium covering them is also found during digestion to be filled with fat globules, in place of the mucus which it at other times contains.

The follicles of Lieberkühn are straight tubes, placed perpendicularly to the surface. Each tube is lined by columnar epithelium, has a distinct cavity, and usually opens by itself on the surface of the mucous membrane. During inflammation their mouths are often greatly increased in size, and the epithelial cells are thrown off. Each tube rests upon a layer of areolar tissue, and is separated from those adjoining it by processes of fibres and branches of blood-vessels. They are more firmly fixed in their positions than the gastric tubes, which they so greatly resemble in appearance. (See plate 4, fig. 1.)

Brunner's glands are confined to the duodenum, and are situated below the mucous membrane. When perpendicular sections of the gut are made, their ultimate elements may be seen with the microscope to consist of circular vesicles arranged in bunches. Each vesicle is lined with a layer of round or oval epithelial cells. From a few vesicles a duct arises, which unites with others to form a trunk that perforates the mucous membrane. In some cases of disease the epithelium is found in a state of fatty degeneration; at other times the basement membrane is greatly thickened; whilst in others the glands are affected with fibroid degeneration.

The number of the solitary glands in the duodenum is liable to great variation. In some subjects they are numerous; in others, scarcely to be discovered. In structure they are precisely similar to those situated in the stomach.

The muscular coat of the small intestines consists of two layers. The longitudinal fibres are chiefly found at the part to which the mesentery is attached.

The circular fibres embrace the whole of the canal, and are, no doubt, the chief agents by which the motions of the intestine are effected.

The lining membrane of the stomach presents a different appearance, according as it is in a state of activity or repose. Dr. Beaumont, in his well-known observations on the stomach of St. Martyn, describes the gastric mucous membrane as of a "pale pink colour," and as covered with a thin layer of mucus when his patient was fasting; but no sooner was irritation excited, even by the bulb of a thermometer, than congestion of the blood-vessels took place, and gastric juice distilled in drops from every part of the surface.

Gastric juice, whether obtained from man or animals, is a clear, inodorous fluid, readily miscible with water. It has an acid re-action, and effervesces with alkaline carbonates; it coagulates albumen, possesses strong antiseptic properties, and may, when not mixed with saliva, be kept for many months without showing any sign of decomposition. Numerous chemical investigations have been made into its properties, and most observers agree that it contains hydrochloric acid, soluble chlorides, phosphates of lime, magnesia, and iron; together with a substance peculiar to it, which is named pepsin.

The secretion of the stomach has been more carefully studied by physiologists than that of any other organ, and most of those who have investigated its properties agree as to their main conclusions. They have found that the first effect of the gastric juice upon soluble albumen or casein is to

reduce these substances to an insoluble form. The mass is afterwards softened in its texture, and is so friable that it breaks up under the slightest pressure. Each piece becomes transparent at its edges, and gradually dissolves, so as to form a solution, which, although it presents the chemical composition and many of the characteristics of soluble albumen, differs from it in certain particulars. All other protein bodies undergo in the stomach similar changes, and the new substances thus produced have been named "peptones." The formation of peptones takes place without the evolution or formation of gas; so that any excessive amount of flatus that may occur during digestion is the result of imperfect or deranged action of the stomach.

The peptones are readily soluble in water and in diluted spirits; they are not coagulated by heat, and are diffusible through animal membranes. They are precipitated by tannic acid and bichloride of mercury, but not by other metallic salts.

Fat seems to be unaltered by the gastric fluid, but there is good reason to believe that it assists in the conversion of albuminous bodies into peptones. In certain cases of disease there can be little doubt that various fatty acids are produced, and that they give rise to some of the most distressing symptoms of dyspepsia.

Experiments have proved that no change takes place in the stomach in the other constituents of the food of animals; and that starch, gum, and sugar are unaltered by its secretion. It is therefore generally allowed that the sole effect of the gastric juice is to change the protein substances into peptones. The

gastric juice, however, antagonises fermentative changes, so that its tendency is to prevent the formation of the lactic, acetic, and alcoholic fermentations.[1] When these take place they result from a morbid process.

The conclusions at which chemists have arrived respecting the effects of gastric digestion on the various constituents of food are confirmed by microscopical investigations. I have studied part of the subject by examining microscopically the contents of the stomachs and intestines of different animals killed at various times after feeding.

In dogs, the first change that muscular tissue undergoes in the stomach is a cracking of the sarcolemma. Afterwards, this extends so as to separate the fibril into discs, which gradually soften down into a pulpy mass. We can, however, almost always find particles of muscular tissue, apparently little altered, in the upper part of the intestines. The connective tissue is also acted upon by the gastric fluid. The fibres of the thinner fasciæ become fainter and less distinctly marked, and gradually lessen in bulk. Pieces of thicker fibrous tissue, such as tendons, are very little altered; and they may be generally detected in the fæces. In many cases of dyspepsia portions of connective tissue are passed from the bowels unchanged, and their appearance in the stools often gives rise to the belief that the patient is affected with worms.

[1] Physiological Chemistry, by G. Lehmann (translated by Dr. Day), vol. ii. p. 56.

Plate 1

Fig 1.

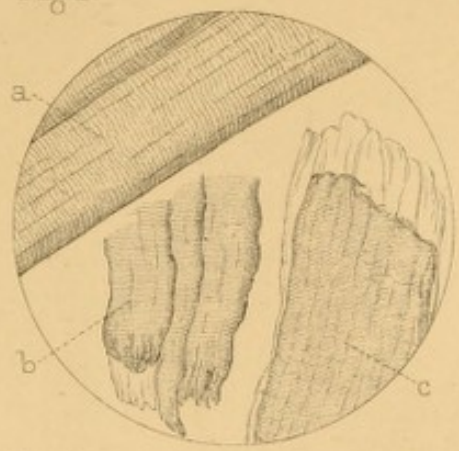

Fig 2.

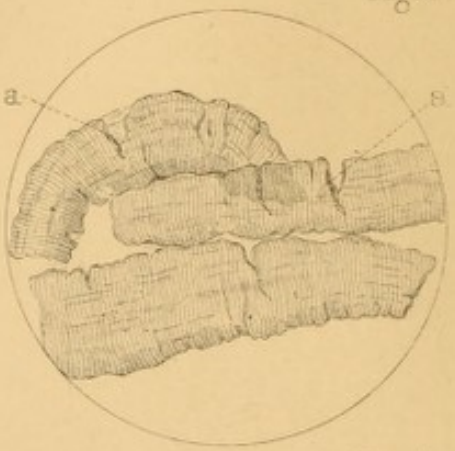

Fig 3.

Fig 4.

Fig 6.

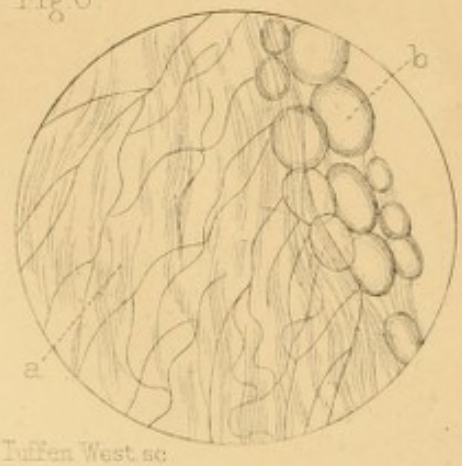

Fig 5.

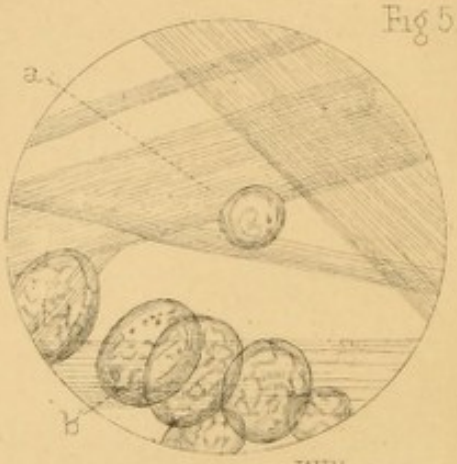

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PLATE I.

FIG. 1 shows the natural appearance of muscular fibres.

a. Fibre of beef.

b. Fibre of chicken.

c. Fibre of fish.

FIG. 2. The first stage in the digestion of muscular fibre in the stomach of a dog.

a. The cracks across the sarcolemma.

It will be observed that the cross-stripes of the fibre have become very clear and distinct.

FIG. 3. Further progress in the digestion of muscular fibre.

a. The fibres breaking up transversely.

FIG. 4. The further digestion of muscular fibre.

a. Muscular fibre breaking up longitudinally.

b. Separate portions of muscle.

c. Fat globules.

d. Granular matter produced by the breaking up of the muscle.

FIG. 5. The natural appearance of connective tissue and fat cells.

a. Connective tissue.

b. Fat cells.

FIG. 6. Connective tissue after being digested for some hours in a dog's stomach.

a. White fibrous tissue very transparent and partially dissolved.

b. Fat cells unaffected by the gastric fluid.

Starch granules, when taken uncooked, are not at all changed in appearance in the stomach. In the upper part of the intestines we generally first observe a crack across their envelopes. This extends, and one layer after another peels off and becomes disintegrated, so that the granules are smaller in size as we proceed downwards in the intestinal canal.

Cellulose is quite unaffected by digestion. The cells of vegetables become softened and separated from each other in the stomach, and still more so in the intestines; but both the cell-membranes and the spiral vessels can be always detected in the fæces of vegetable feeders.

There are various circumstances that seem to influence the digestive powers of the stomach. Thus, Bidder and Schmidt found that an admixture of bile, even although it was not sufficient to neutralise the acidity of the gastric secretion, put a complete stop to the solution of albumen. A copious supply of saliva acts in a similar way, but in a less degree; for the amount of albumen dissolved was greater in dogs in which the salivary ducts had been tied than in others where there was free access of the saliva to the stomach. Again, decomposition in the food seems to lessen the activity of the digestion; perhaps by altering the pepsin itself.

One of the most marked characteristics of the gastric juice is its acidity. This was observed by the earliest inquirers into its chemical composition, and Dr. Prout affirmed that this property was derived from the presence of hydrochloric acid. The truth of this statement has been much debated; some believing that lactic acid was the sole cause of the acid reaction. It

may, indeed, be supposed that when lactic acid has been present it may have been produced by the decomposition of the food; but this is evidently not always the case, for it has been detected in examples of gastric fistulæ, in which pure gastric juice has been extracted from the stomach after irritation had been excited by the swallowing of insoluble substances.

The nature of the free acid seems to vary at different periods in the same person; thus, in a patient affected with gastric fistula under the care of Dr. Grünewaldt, at one time no hydrochloric acid could be found; whilst at another, when a free secretion had been excited by the swallowing of dry peas, hydrochloric acid was discovered, without any admixture of lactic acid.[1] In dogs, Bidder and Schmidt found free hydrochloric acid in the gastric juice in eighteen experiments; in sheep hydrochloric acid was also present, but it was usually mixed with some lactic acid.

The only way, I think, in which the conflicting statements of chemists upon this point can be reconciled, is to suppose that the lactic, butyric, and other acids may be present from the decomposition of particles of food, which have been retained in the stomach; and also that the gastric juice may contain a certain proportion of any acid which may be present in salts admitting of ready decomposition, and with which the blood is charged at the time of digestion. The probability of the latter supposition will be better appreciated, when we remember that the mucous membrane of the stomach possesses the power of separating

[1] Chambers on Digestion, p. 92.

from the blood many abnormal materials with which that fluid may be contaminated.

It has been found by experiment, that either dilute hydrochloric or lactic acid will form an artificial gastric juice, when joined with the mucous membrane of the stomach; but that the other mineral and vegetable acids fail to transform albumen into peptone. The presence of a free acid is, however, indispensable; for the solution of albumen is arrested if an alkali be added in excess. It is, no doubt, chiefly in this way that the presence of bile or alkaline mucus, or an excessive secretion of saliva, acts injuriously on the digestive process. The antiseptic properties of the gastric juice seem also to depend on the acid it contains; for, when it is neutralized by alkalies, or when saliva is mixed with it, decomposition takes place. The addition of water to gastric juice which has been already saturated with a peptone enables it to transform a further quantity of albumen; and, in like manner, a fresh supply of acid restores, to some extent, its digestive powers.

Hydrochloric and lactic acids alone are not able to transform albumen into peptone. To enable them to do this, they must be mixed with some of the characteristic secretion of the stomach, which is named "pepsin." Pepsin is easily soluble in water, and may be kept for some time in the dry state without loss of its properties. It coagulates a solution of casein; but, without the addition of a free acid, it does not dissolve albumen. It is precipitated from its solution by bichloride of mercury, protochloride of tin, alcohol and tannic acid, and, in an imperfect manner, by neutral acetate of lead.

The amount of pepsin secreted seems to vary with the general health of the patient. In Dr. Grünewaldt's case, the gastric juice contained 43·4 parts in 1000 of solid matter, and 36·6 of this was pepsin, whilst the patient was well fed and under the observation of the physiologists; but "a great change was made by a return to the spare diet of an Esthonian cottage."[1] Dr. Schröder's analyses were made four months after Dr. Grünewaldt's and when the patient had been at home some time; and then, instead of 43, only $5\frac{1}{2}$ parts of solid matter, and in place of 36, 3 of ferment appeared. In my own experiments, I have found that in some diseases—as in typhoid fever and in certain forms of cancer—the amount of pepsin contained in the mucous membrane of the stomach was exceedingly small; although, to the most minute examination, the tubes and cells presented a normal appearance. On the other hand, the greatest amount of pepsin was found in the stomachs of those who had been killed by accidents, or who had died of diseases which had produced but little effect on the general health.

As it has been thus proved that the characteristic secretion of the stomach may be very small in amount, even where the structure appears to be normal, it seemed to me that it might be useful to ascertain the amount of pepsin contained in the gastric mucous membranes of persons dying from various diseases. The following plan was therefore adopted in a large number of cases. The stomach was emptied of its contents and placed in strong spirits of wine for a

[1] Chambers on Digestion, p. 95.

few days, so that sections of the mucous membrane might be obtained for microscopical examination. When this was done, the mucous membrane was carefully scraped from the subjacent coats, and its weight ascertained. One hundred and twenty grains of mucous membrane were beaten up with one ounce and a half of distilled water, and allowed to stand in a warm room for twelve hours, the mixture being afterwards passed through a coarse filter. To one ounce of this fluid fifteen minims of hydrochloric acid were added, and in it was placed a cube of hard boiled white of egg, the weight of which had been previously ascertained. The bottle containing this artificial gastric juice was kept for twelve hours at a temperature of 98°; at the end of which time the albumen was removed, and was again carefully weighed. The loss, of course, indicated the activity of the pepsin to the action of which the albumen had been subjected.

In the performance of such experiments there are two sources of error that should be carefully avoided. In the first place, all the more active parts of the mucous membrane may have been removed by *post mortem* digestion, and therefore we may err, both as regards the bulk and the activity of the glandular structure. Or, again, as the pepsin loses its activity by decomposition, we may be led into a mistake if we keep the stomach too long before testing its powers of solution. In order to avoid these chances of error, I have only quoted such experiments as were conducted during the colder months of the year, and I used stomachs that were but little altered by *post-mortem* digestion.

But we must remember that, as the activity of the digestive process depends as much upon the acid as upon the pepsin of the gastric juice, we cannot, by the above method of experiment, ascertain how the organ really performed its function during life. I regret that I had not the opportunity of testing the nature and amount of the free acid in the contents of the stomachs; for, although we should have had to make allowance for the chemical changes which might have taken place after death, yet I cannot help thinking that many valuable facts would have been in this way acquired.

The nature of the movements of the stomach has given rise to much discussion. Dr. Beaumont states that, as the morsel of food enters the organ, the lower fibres of the œsophagus contract so firmly as to make the mucous membrane covering them project into the cavity of the stomach. In like manner, the pyloric orifice is firmly closed in the earlier stages of digestion, and seems only gradually to relax when the food has been reduced to a state fitted for its admission into the intestine.

The contents of the stomach are firmly grasped, and slowly moved from place to place by the muscular coat. Any one who has shaken up half-digested albumen with water, and observed how rapidly it crumbles away, will see how greatly these movements must favour the solution of the food. As chymification proceeds, the muscular contractions become more energetic, and the food is forced more quickly into the duodenum.

It has been already noticed that the whole of the protein-bodies taken at each meal is not digested in the

stomach, but that these substances gradually dissolve in their progress through the intestinal canal. This change of albuminous matter in the intestine may be partly explained by the supposition that the process set up in the stomach is afterwards continued; and the probability that this is the case is shown by some experiments I performed. Pieces of hard-boiled white of egg were digested in a solution of pepsin to which no acid had been added. At the end of the time they appeared to be unaltered, but after being washed with a stream of water, when they were again digested in a weak solution of hydrochloric acid alone, they rapidly dissolved. In this case the albumen evidently absorbed a certain amount of pepsin, which was only brought into a state of activity by contact with the acid.

It has been proved, moreover, that the secretion of the intestinal canal does possess the power of changing albuminous substances into peptones. In order to test this, Bidder and Schmidt placed ligatures on the small intestines of animals, and after allowing some hours to elapse so that all their contents might be carried onwards or be absorbed, they inserted bags containing albumen and flesh into the gut. When the animals were killed some hours afterwards, the albumen and flesh were found much softened and reduced in bulk. A similar property has been claimed for the pancreas; but in my own experiments with this gland, although I have found albumen softened and reduced in weight, it seemed rather to have crumbled away than to have been chemically altered, as is the case when it is treated with the gastric fluid.

Although the bile has no solvent action upon albuminous substances, it plays a part—and by no means an unimportant one—in preventing that decomposition which would be otherwise set up in this kind of food in the intestinal canal. In dogs, in which biliary fistulæ had been formed, great flatulence was always observed, the fæces becoming fetid and smelling like carrion. These experiments seem to explain the cause of the flatulent distension so generally complained of by patients in whom there is an imperfect action of the liver.

We have seen that the gastric juice exerts no power over the carbo-hydrates which enter so largely into the food of man and many other animals. On investigation, however, it will be found that as much care is taken to fit these substances for their entrance into the blood as in the case of those composed of albumen.

It has been long known that saliva converts boiled starch into grape sugar almost instantaneously. This action was stated by Bernard to reside, not in the secretion of the salivary glands, but in that of the buccal mucous membrane. This was denied by Bidder and Schmidt, for they found, after tying the salivary ducts in dogs, that the secretion of the buccal mucous membrane had lost its power of changing starch. These physiologists conclude from their experiments that the secretion of the parotids (in the dog) is merely of use to moisten the food, and that the property by which starch is converted into sugar is only possessed by a mixture of the secretion of the submaxillary glands with that of the buccal mucous membrane.

Another very interesting point seems to be clearly established, viz., that the saliva of young sucking animals has much less action upon starch than that of the adult. This serves to explain the frequency with which indigestion occurs in infants who have been dieted on farinaceous food, and in whom the fæces often seem to consist almost entirely of unaltered starch.

The conversion of starch into sugar, although not promoted, is not prevented by the presence of gastric juice, so that we can generally find a certain amount of saccharine matter in the contents of the stomach.

The digestion of starch is actively continued in the small intestine. This was proved by placing boiled starch in a loop of intestine, both ends of which had been secured by ligatures. In three hours it afforded evidence of sugar, but none of the original substance

The pancreas is, however, the most efficient agent in the production of sugar, its secretion acting more rapidly and completely upon boiled starch than that derived either from the mouth or small intestines. There can be no doubt that the digestion of this portion of our food is the chief function exercised by this gland. Its sugar-forming power exists in its secretion alone, and is not, as in the case of the saliva, derived from an admixture of different fluids. Its action is unaffected either by the presence of gastric juice, of bile, or of free acids.

Another point of great importance is the state in which the sugar formed from the starch is absorbed into the circulation. Lehmann states that when sugar had

been injected into the stomach of rabbits, and the animals had been killed within two hours afterwards, this substance could be always detected in the stomach, duodenum, and jejunum; but that the contents of these portions of the digestive canal always had a strongly acid reaction, which was also the case with the cæcum In numerous experiments upon horses he could only sometimes obtain traces of sugar in the blood of the portal vein, and frequently he could find no indications of its presence. From such facts he concludes that a large portion of the sugar is converted into lactic acid previous to its absorption into the blood. Some chemists have supposed that one of the offices of the bile is to effect this change, whilst others have referred it to the action of the pancreatic fluid.

It has been already stated that fatty matters undergo no change in the stomach, and we must therefore ascertain in what manner they are fitted for admission into the blood. Bernard maintains that, one of the chief uses of the pancreatic juice is to form an emulsion with the fatty parts of the food, and to decompose them into glycerine and fatty acids. It is, however, clear that whatever effects the secretion of this organ may have upon fat, it is not the only, nor, indeed, the chief agent in fitting it for absorption. In experiments performed by Bidder and Schmidt, the pancreatic duct was tied in animals which were afterwards fed with food containing fat. When they were killed, some hours after a meal, the lacteals were found to be distended with white chyle, exactly as in the ordinary process of digestion.

There can be little doubt that the bile is the chief

agent in the digestion of fat. When fat is digested in this fluid at 100°, even for many hours, only a small quantity is dissolved; and this fact seems to have induced many physiologists to deny that it has any power to promote the absorption of this material. But a very different conclusion is arrived at when we examine the results of experiments performed upon living animals. Bidder and Schmidt fed a healthy dog with fat, the amount of which was carefully ascertained. By the examination of its fæces it was found that it had absorbed as much as 11·1 grammes of fat for each kilogramme of its weight in twenty-four hours. Another dog, in which a biliary fistula had been established, was similarly fed, the animal was allowed to lick some of the bile from the wound, and it was proved that only 2·24 grammes of fat had been absorbed for each kilogramme of its weight. In a third, in which all access of bile to the intestine had been cut off, only 1·56 gramme was absorbed. It is evident, therefore, from these facts, that the secretion of the liver is the main agent by which the absorption of fatty matters is promoted.

Further evidence of this function of the liver is afforded by the condition of the dogs in which biliary fistulæ have been established with success. They are found invariably to lose weight with great rapidity, and the appetite becomes voracious; nature, by demanding an excessive supply of nutriment, attempting to compensate for the waste of food caused by the diminished absorption of fat.

An attempt to explain the action of bile upon the absorption of fat has been lately made by Wistinghausen. He has shown that oil will rise many times

higher in a capillary tube wet with a solution of glycocholate and taurocholate of soda, than in a similar tube moistened only with water or with a saline solution; also, that it passes through animal membranes more rapidly when these are moistened with bile than when only water is used.

However physiologists may differ as to the value that should be attached to such experiments as the above, there can be no question, from others performed upon living animals, that the bile plays a most important part in digestion; and that therefore any great alteration in its chemical composition is liable to produce a general derangement in the health of the individual in whom such change may occur.

In no respect have modern researches into the digestive process more changed the opinions formerly entertained than as regards the quantity of the secretions poured into the stomach and intestinal canal. Instead of only a small amount of fluid being thrown out from the blood-vessels, Bidder and Schmidt compute that a man of ten stone weight secretes, in twenty-four hours, from twenty-one to twenty-five pounds of digestive juices; which, after being enriched with the food, are again absorbed into the circulation. This calculation is based upon the results of experiments on animals, and is probably below the truth; for whilst it only reckons the amount of gastric juice secreted in twenty-four hours at from fourteen to sixteen pounds, it was found that the mean daily quantity secreted by a woman affected with a gastric fistula, was thirty-one pounds, or more than one quarter of the weight of the whole body. It is impossible to consider this vast amount of fluid daily circulating

through the digestive canal, without believing that any long-continued diminution in quantity alone must be liable to derange the functions of some of the other organs of the body. Moreover, we are as yet ignorant what effects the non-excretion, or the resorption of the peculiar principles elaborated by this vast extent of glandular structure may have upon the general health; whether, for instance, the non-excretion or the resorption of the pepsin and lactic acid which must occur in many of the diseases of the stomach, gives rise to changes in the blood in the same way as the non-elimination of urea does in affections of the kidneys.

The question now arises, by what means is this vast amount of secretion returned into the general circulation? Physiologists at the present day are agreed that the blood-vessels are the chief agents by which the absorption of most of the substances taken into the digestive canal is effected, and the lacteals are also as generally believed to take up any fatty materials that may be present in the intestines.

It is admitted, however, that no satisfactory explanation has been given of the agency by which the lymphatics absorb fat. So long, indeed, as it was believed that the lacteals opened on the surface of the mucous membrane by mouths, physiologists got over the difficulty by assuming that these vessels possessed a power of selecting the more nutritious constituents of the food presented to them. But the use of the microscope dispelled the illusion of there being orifices in the villi; and the idea of a selective power has received no support from the numerous experiments performed upon

living animals, with the view of elucidating this point.

In discussing this question, it must be remembered that the lacteals are, like the lymphatics of all the other parts of the body, always full of fluid; and that the only change they present during digestion is that, in addition to their ordinary contents, they also contain a considerable quantity of fat in a minute state of sub-division.

Some authors have laid great stress upon the fact, that the conical epithelial cells covering the villi contain fatty matters during digestion. I do not see that this helps us to understand the agency by which the fat enters the villi; because, by whatever power the absorption is produced, the fat must pass through the epithelial covering before it can enter the villus itself, and it must therefore be visible in the cells when examined with a microscope. No doubt, the epithelial cells also contain salts and soluble albumen during digestion, for these substances must pass through them to reach the blood-vessels; but no one has supposed that by proving their presence in the epithelial covering of the small intestines he could explain the phenomena of venous absorption.

There is abundant evidence to show that the blood-vessels of themselves can absorb the fatty materials of the food. Capillaries in the villi have been seen by Brüch under the microscope to contain fat. The serum of the blood of the Vena Portæ has been found by Schultz and Simon, and by Lehmann, to be richer in fat during digestion than that drawn from the jugular veins of the same animals at the same time. It has been also proved by numerous experiments,

that on feeding animals with fatty food the cells of the liver become loaded with that material.[1]

While it can be thus demonstrated that the blood-vessels readily absorb fat, there is also every reason to believe that unless the circulation of the blood be in a normal condition the lacteals do not contain white chyle. In numerous experiments on animals, having cut off the circulation of the blood in portions of the intestines, I found that no absorption of fat took place into the lacteals in the parts thus isolated.[2] In the experiments of Bidder and Schmidt, the amount of absorption of fat was observed to be in the direct ratio of the freedom of the mucous membrane from inflammation. The chylous vessels were transparent when inflammation had taken place; but when there was no inflammation they were white with chyle.

If the blood-vessels absorb fat, and the lacteals do not contain it when the circulation of the blood is arrested or impeded, the conclusion seems evident that the fat is, in the first instance, taken up by the blood-vessels, and from them transferred into the lymphatics. The relative position of the blood and chyle vessels in the villi strengthens this idea. The former are placed nearer to the free surface of the villus than the latter. Therefore any fat that may be in the intestine must, in the process of absorption, pass through the capillary network before it can reach the more deeply lying chyle ducts.

By what means, then, may we suppose that the fat

[1] Frerichs On the Diseases of the Liver, vol. i. p. 281 (New Sydenham Society's translation).

[2] *Lancet*, 1845.

absorbed by the blood-vessels is transferred to the lacteals? Is it by secretion, or by a merely physical agency?

If we quite understood the method by which ordinarily the fluid parts of the blood pass into the lymphatics, we should no doubt be able satisfactorily to answer this question. We know that in two or three minutes after a salt has been introduced into the circulation it can be detected in the lacteals, and we are therefore sure that the transfer of the more liquid part of the contents of the blood-vessels into the lacteals is a process that is always going on. Nor is the objection that it is improbable that secretion and absorption should take place at once in the same organ of much weight; for we have already seen that these two opposite actions are always in operation in the stomach and intestinal canal during digestion.

The idea that the fat is transferred to the lacteals by secretion is, I think, improbable; inasmuch as no chemical alteration can be detected between the lymph and the liquid part of the blood, or between the fat in the lacteals and that in the cavity of the intestine. I cannot help, therefore, suspecting that the fat enters the lacteals by a physical agency; and that its transfer from the blood-vessels is produced by the motions of the villi already described. At each contraction of these processes the state of the circulation in them must be for the moment altered; their capillaries loaded with the fluids absorbed from the intestine must be subjected to a certain degree of pressure, and a part of their contents must be effused into the neighbouring structures; in which case, we know from experiment, it will enter the lacteals.

The subject of lacteal absorption is not one of merely speculative interest. From the calculations of Bidder and Schmidt, it would appear that in an adult man 28 lbs. of fluid are daily poured through the thoracic duct into the subclavian vein; and we know that this fluid is rich in cells destined to supply the daily waste of the cellular portions of the blood. It is, therefore, not improbable that future pathologists may be able to trace some local diseases, the origins of which are at present obscure, to derangements in the structure or functions of the lacteal system.

But besides secreting the gastric juice, and absorbing part of the food that has been digested, the mucous membrane of the stomach, in all probability, eliminates abnormal substances from the blood. It has been long known that certain poisons, when introduced into the circulation, exercise a special action upon this organ. For instance, tartar emetic, when injected into a vein, excites vomiting; and arsenic applied to a wound has been known to produce gastritis.

The experiments of Bernard show most clearly, that certain glands eliminate some substances from the blood, whilst they refuse to separate others. Having formed a salivary fistula in a dog, he injected into the jugular vein a liquid containing prussiate of potash, iodide of potassium, and sugar. The iodide of potassium appeared immediately in the saliva, without any trace of the other two substances. In seven minutes he found the prussiate of potash in the urine; but he was unable to detect the sugar in that fluid until twenty-five minutes, and the iodine until three hours after the operation. The saliva

contained neither the sugar nor the prussiate of potash at the end of four hours; although the iodine was present during the whole of that time. He also mentions that, in a dog having salivary, gastric, and biliary fistulæ, he found iodine in the saliva and gastric juice some time after he had introduced it into the circulation, although it could not be detected in the urine or the bile.

It would also appear that the stomach acts chemically upon certain substances, and thus permits them to be eliminated by glands through which they otherwise could not pass. Bernard injected lactate of iron into the stomach of a dog having a gastric fistula, and could afterwards find no trace of the iron in the saliva. An hour subsequently he introduced a solution of iodide of potassium into the stomach, and the saliva then afforded decisive evidence of the presence of both the iodine and the iron. But if these substances were separately injected into a vein, so as to enter the circulation without passing through the stomach, no iron appeared in the saliva; although a solution of iodide of iron, when introduced directly into the blood, was eliminated by the salivary glands.

These powers of the stomach to excrete abnormal substances that may be present in the blood, and to alter the chemical composition of others placed in contact with it, confer probability on the supposition that the nature of the free acid contained in its secretion is liable to vary with different conditions of the circulating fluid.

As we before found that we could ascertain during life the size and shape of the stomach, so the micro-

scope frequently shows us how the digestive process is being performed, and sometimes reveals to us the condition of its lining membrane.

Although the time required for the completion of digestion varies greatly with the nature of the food, the stomach when healthy is usually empty from four to six hours after a moderate meal. When, therefore, we discover that a considerable quantity of what has been eaten is still contained in the organ much beyond this period, we are certain that the process of digestion has not been properly performed. If, for instance, we induce vomiting in a patient in the early morning, and find that a quantity of the food taken the previous evening is rejected, we may be certain that there has been some difficulty in the digestion, or some obstruction to the free passage of the aliment into the duodenum.

In some cases of disease vomiting takes place spontaneously, and the microscope shows us that vegetable organisms, such as torulæ and sarcinæ are present in the vomited matters; proving that the amount of gastric juice secreted has been insufficient to prevent fermentation.

When a considerable amount of food has been vomited we should take a drop or two from the bottom of the vessel in which it is contained, and a little weak solution of iodine should be added before it is submitted to microscopic examination. The use of the iodine is to change any starch that may be present to a blue colour; whilst, at the same time, it turns the sarcinæ brown, and thus renders their recognition more easy.

In certain cases of inflammation of the mucous

membrane of the stomach, we discover in the vomited matters fibrinous casts of the upper parts of the gastric tubes and of the pits into which they open. In others, casts formed of cells and granules are found, which may be readily recognised by their shape and size.

In persons affected with cancer of the œsophagus or stomach, portions of the new growth are said to be often discharged, and can be found in the fluids vomited by the patient. Even in cases of simple ulceration of the stomach I have detected minute portions of the gastric mucous membrane; and in one case I discovered what seemed to be a fragment of the pancreas.

In all examinations with the microscope of vomited matters, supposed to contain either casts or portions of mucous membrane, it is necessary that the fluid should be as free as possible from particles of food. It is from the neglect of this simple precaution that so little success has hitherto attended such examinations. As vomiting is usually easily excited in cases of serious disease of the stomach, all that is generally necessary is to give the patient when fasting a little warm water, or chamomile tea.

The fluid that may be rejected should be mixed in a conical-shaped vessel with a little distilled water, and allowed to stand, so that the heavier particles may subside. No iodine should be added, as it is apt to coagulate the mucus, and might thereby give rise to mistakes. When employing the microscope, especial care should be taken not to allow the covering glass to crush the particles contained in the fluid. The best plan of procedure is to use

shallow cells formed of vulcanite, and to place in them only small quantities of the sediment. Casts are sometimes rendered more visible by the addition of a solution of majenta to the fluid, and in other cases glycerine will be found useful.

As we have seen that the gastric juice dissolves all albuminous substances with which it may come in contact, we are naturally led to inquire the reason why the coats of the stomach itself are not also digested during life. It is clear that the vital powers of the organ do not, as was formerly supposed, protect it; for parts of living animals have been dissolved when introduced into gastric fistulæ. The most probable explanation is, that the mucous membrane is defended from the action of its own secretion by the mucus and epithelium that cover it.

After death the epithelium, as has been already stated, is detached; and the mucous membrane, in the majority of cases, is to a greater or less degree digested. It is necessary that the changes thus produced should be most carefully studied, if we would avoid confounding them with the alterations produced by disease.

The description of *post-mortem* solution of the stomach given by John Hunter can scarcely be improved upon. He says, "There are very few dead bodies in which the stomach at its great end is not in some degree digested; and one who is acquainted with dissection can easily trace these gradations. To be sensible of this effect, nothing more is necessary than to compare the inner surface of the great end of the stomach with any other part of its inner surface: the sound portions will appear soft, spongy,

and granulated, and without distinct blood-vessels, opaque and thick; while the others will appear smooth, thin, and more transparent, and the vessels will be seen ramifying in its substance; and upon squeezing the blood which they contain from the larger branches to the smaller, it will be found to pass out at the digested end of the vessels, and to appear like drops on the inner surface."[1] When the gastric juice has acted more quickly, the stomach is often found perforated, and its contents effused into the cavity of the abdomen; in other cases the adjoining organs, such as the œsophagus, spleen, and liver are also affected.

John Hunter was the first who noticed the effects of *post-mortem* digestion; and, although the truth of his observations was confirmed by others, the subject was lost sight of, and numerous foreign pathologists attributed all the changes found in the stomach to disease. Since the revival of the subject by Dr. Carswell, these effects of *post-mortem* digestion have been generally allowed; but the opinion still seems to prevail abroad that it is possible to distinguish, by the naked eye, between the softening produced by disease and that occurring after death. Dr. Budd, and other writers in this country, have been induced, on the contrary, to attribute all cases of softening of the gastric mucous membrane to *post-mortem* solution, and to view with suspicion any attempt to class them as the productions of disease.

In discussing this subject, the first point to be settled is, whether considerable softening can take

[1] Hunter's Animal Economy, Owen's edition, p. 119.

place in the gastric mucous membrane as the result only of changes occurring during life. It is almost impossible to determine this point on the human subject, on account of the long time after death at which *post-mortem* examinations are usually conducted. But in the lower animals there is not the same difficulty. In cattle plague, for instance, we find the mucous membrane of the stomach very red, thickened, and often excessively soft. In such cases there was no ground for doubt as to the cause of the softening, for the animals had been slaughtered, and the stomach removed and examined immediately. We can therefore arrive at no other conclusion than that the mucous membrane of the stomach is liable, like other organs of the body, to softening from inflammatory action alone.

Cruveilhier describes a gelatinous softening of the stomach which he believes to take place during life; Rokitanski distinguishes two kinds of softening as resulting from disease. Although I admit that in the majority of cases the softening is due to *post-mortem* solution, the following experiment suffices to show that the appearances presented by the mucous membrane, even when it has been acted upon by the gastric juice, depend much upon its condition during life.

I placed in an artificial digestive fluid three pieces of human stomach, one of which was healthy; the second presented appearances of fatty degeneration along with destruction of the tubes; in the third, the tubes were mostly replaced by fibrous tissue, and the vessels were loaded with blood. After a few hours' digestion, the first piece was reduced to a pulp,

capable of being washed away by a gentle stream of water; the second was gelatinous, of a yellow colour, transparent, and although softened, tolerably firm; the third formed a black, opaque, gelatinous mass, quite unlike either of the others.

It is very evident from this experiment that, although we may attribute the act of softening in most cases to *post-mortem* digestion, the various appearances of the mucous membrane should be carefully noted, as they may represent very different conditions that had existed during life.

There are three circumstances that seem chiefly to determine the amount of *post-mortem* digestion, viz., the heat of the weather, the nature of the contents of the stomach, and the condition of the gastric mucous membrane itself.

It is only in the warmer months of the year that we meet with the perforation of the stomach and the softening of the neighbouring organs described by John Hunter; and at this season there are few bodies that do not, in some degree, present the effects of the gastric juice upon the mucous membrane. It will be, therefore, advisable for those who wish to investigate the diseases of the stomach to pursue their inquiries only during the colder months.

The nature of the contents of the stomach also determines the activity of *post-mortem* digestion. Thus, in persons killed suddenly by accidents, or who have died whilst digestion was going on, the mucous membrane is usually found much dissolved. Acidity after food is a prominent symptom in a large number of those who are affected with phthisis, and in this class of cases we also find that softening of the

stomach is very generally met with after death. In persons who have died from brain disease, *post-mortem* digestion is of frequent occurrence; and the cause of this seems to be explained by the experiments of Bernard, who found that any irritation of the pneumo-gastric nerves gave rise to an increased secretion of gastric juice.

The amount of *post-mortem* digestion depends also, in a great degree, on the condition of the mucous membrane itself. This is a point which has not attracted the attention it deserves. When the glandular structure is thickened by chronic inflammation, not only is the secretion of the gastric juice diminished, but the texture is also more impervious to the fluid which the stomach may contain. In order to prove this, I placed in artificial gastric juice four pieces of gastric mucous membrane. One was taken from a healthy dog; the second from a human stomach, the splenic end of which was found dissolved after death, the portion selected, however, being not softened; the third and fourth were from females who had died from cancer of the breast, both stomachs being much diseased. After the digestion had been continued for three hours at 100°, the first broke up into fragments when touched with the forceps; the second was reduced to a pulp; and the third and fourth showed only a little softening on their surface, but were in other respects unaltered.

As, therefore, the amount of the gastric juice secreted is smallest, and the state of the mucous membrane renders it least liable to be affected when it is most diseased, so we find that the cases in which there is the greatest amount of morbid change

are those which are least affected by *post-mortem* digestion.

Since the mucous membrane of the stomach is so liable to *post-mortem* changes, it is necessary we should be very careful in the method we employ for preparing it for microscopical examination.

The first and most important point is to harden it, either by alcohol or chromic acid. I generally prefer the former, as it does not make the preparations brittle, and causes less obscurity than the latter.

The surface of the mucous membrane should be viewed as an opaque object, by which method the condition of the openings of the ducts, and of the ridges surrounding them, can be readily noted.

To investigate the gland structure, we may either tear it asunder with needles, or make fine sections through it. The former of these methods, although occasionally useful, is very apt to mislead, as the relative positions of the various parts are so much displaced by it. In making sections, the best plan is that recommended by Dr. Habershon, viz., to stretch the piece of stomach tightly across the thumb-nail of the left hand whilst the section is effected with a Valentin's knife held in the right. The cut should be made quite perpendicularly, as a slanting direction gives the connective tissue surrounding the tubes the appearance of being much more thickened than it really is. If the tissue is soft or fatty, we should carefully avoid any pressure upon it by the covering glass, the structure being in these conditions very readily injured.

CHAPTER II.

ACUTE GASTRITIS.

Few diseases have given rise to more discussion than acute inflammation of the stomach. Many of the older medical writers speak of it as of not infrequent occurrence; some of the best morbid anatomists of modern times, on the contrary, have altogether doubted its existence, except as the result of irritant poisons. This difference of opinion is capable of explanation. The former class appears to have comprised under the head of acute gastritis, cases in which the appearances found after death were the effects of *post-mortem* solution, or of simple vascular congestion; the latter has refused to consider any change in the mucous membrane as the effect of disease, unless the alterations were such as accorded with its ideas of what acute inflammation ought to produce in such a tissue.

It must be remembered, that there are reasons why acute inflammation should not leave in the gastric mucous membrane appearances as striking as those found after inflammation of other organs. The stomach, in a state of health, is liable to congestion; its vascular system is constituted so as to

permit of the ready escape of any unusual quantity of blood that may be contained in it, and therefore a smaller amount of redness remains after death than is the case in many other structures.

Nor are we justified in accepting, as many have done, the appearances observed after irritant poisons as merely those of acute gastritis; for such morbid changes are often the results of chemical action, or of congestion resulting from the effects of the poison on the heart and lungs.

Again, it is difficult to estimate alterations in the bulk of the mucous membrane of the stomach on account of its natural tenuity, and our attention is therefore not likely to be attracted by any moderate enlargement of this structure, as is the case in acute inflammation of many other parts of the body. Softening, which is another product of inflammation, is also inadmissible as an evidence of acute gastritis, as it is a common result of *post-mortem* changes, and by a certain number of pathologists is always referred to this cause.

Although the appearances presented by the gastric mucous membrane, after acute inflammation has been present, are often uncertain when viewed by the naked eye, yet a careful examination with the microscope will generally enable us to discriminate the products of disease from *post-mortem* changes, and thus remove all doubt upon the subject.

It is a matter not only of scientific interest but of practical importance, to determine whether there is a form of disease to which we are justified in applying the term of acute gastritis. When a person suffering from some chronic malady is attacked with symptoms

indicating a severe affection of the stomach, the treatment is necessarily dependent on the views of the practitioner as to the nature of the gastric complication. If he looks upon it as arising only from irritation, his efforts will be directed to the relief of the primary disorder; but if he believes that gastritis of a dangerous character has supervened, he will spare no effort to subdue the secondary affection as quickly as possible.

The following cases are intended to serve as illustrations of a form of disease occasionally affecting the stomach, which, on account of the severity of the symptoms and the danger to life which accompany it, we are justified in considering as acute gastritis.

"Case 1.—M. K., aged 24, admitted into King's College Hospital, August 20, under Dr. Beale, who was attending for Dr. Todd. The patient had latterly been employed in the ward in which were two cases of scarlatina. Previously to her present illness she had always enjoyed excellent health. On August 19th she felt feverish and generally ill."

"*August 20th.*—This morning she complained of headache and sore throat, and vomited occasionally. The face, chest, and arms were completely covered with the rash of scarlatina. The tonsils, pharynx, and palate were of a deep red colour, and the tonsils much enlarged; skin hot and dry; appetite bad; bowels freely open. P. 108; R. 24."

"21*st.*—Was very much purged during the night, and vomited several times, the vomiting being immediately excited by the beef-tea. This morning

she complained of pain and tenderness over the epigastrium, the pain being increased by food."

"*Evening.*—The vomiting and purging had continued during the day, and she had kept down neither food nor medicine; she was very restless, and a little delirious. P. 122, feeble."

"22*nd.*—The bowels had not been opened since the administration of the enema. She still vomited occasionally after taking her food, but retained the brandy. She slept pretty well, but seemed weaker this morning."

"23*rd.*—She continued to vomit occasionally during yesterday afternoon and in the night, but did not reject the iced brandy. In the night she slept badly, and was delirious. This morning, about seven a.m., she vomited up with some bile a piece of the epithelial coat of the stomach, about the size of the palm of the hand. Since this time the pain and tenderness of the stomach increased, and she vomited everything she took. P. 134; R. 35."

"24*th.*—She slept a little during the night, and retained the enemata. There was less pain and tenderness of the epigastrium. She complained much of thirst, and wandered a little. P. 114."

"25*th.*—She was very delirious during the night, and got no sleep. There was less tenderness at the epigastrium, and she did not complain of pain after taking the brandy and water."

"26*th.*—She got no sleep during the night, and continued very delirious; towards morning she got much weaker, and when seen, at nine a.m., was in a state of low muttering delirium. She died at four p.m."

"*Post-mortem Examination* (*twenty-four hours after death*).—The lungs, liver, and kidneys were much congested; the other abdominal and thoracic organs appeared healthy, with the exception of the stomach. The mucous membrane of the stomach and duodenum was much congested, but there was no extravasation of blood in any part. The muscular coat, towards the pyloric extremity, was firmly contracted, and the mucous membrane thrown into rugæ; but the cardiac portion was relaxed, and the coats in this region seemed very thin: the mucous membrane was not thrown into rugæ."[1]

Few persons will refuse to recognise this case as one of acute gastritis. There was pain in the region of the stomach, accompanied by incessant vomiting, a portion of the epithelial coat of the mucous membrane being rejected; and after death there was evidence that the organ had been inflamed.

In the following case fibrinous casts of the stomach tubes were discovered in the matters vomited, and a microscopical examination of the mucous membrane confirmed the diagnosis made during life, that the case was one of acute gastritis.

Case 2.—A man about fifty-five years of age had been seriously ill for two weeks before I saw him. He complained of constant pain at the epigastrium and between the shoulders, increased immediately after food. He described the character of the pain as "scalding." All food was vomited a few minutes after it had been taken. The bowels were

[1] Beale's Archives of Medicine, vol. i. p. 198.

obstinately confined; the urine was scanty and albuminous. Some of the fluid he had vomited was found, when examined by the microscope, to contain blood and fibrinous casts of the gastric tubes. It appeared from his account, that twenty-four years previously he had been affected with dropsy, from which he recovered and remained apparently well for twelve years. He then had another attack of the same nature, but was again relieved by medical treatment. Since that period he had never enjoyed good health. He had been subject to winter cough, expectoration, and œdema of the legs, and the urine had been albuminous. The symptoms were not on this occasion relieved by treatment, and a day or two after I saw him he was attacked with convulsions, and died.

Post-mortem Examination.—There was a little fluid and some recently effused lymph in the pericardium, and a small amount of fluid in each pleura. The lungs were healthy. The liver was attached by old adhesions to the walls of the abdomen, and was also connected with the colon.

The stomach was contracted and empty, and its lining membrane was covered with a thick layer of tenacious mucus. The surface was everywhere greatly congested; on microscopical examination the gastric tubes were found to be closely adherent. The duodenum was empty, but was coated with mucus even more thickly than the stomach. The mucus in both the stomach and duodenum was very alkaline, but more so in the former than in the latter. Both kidneys were greatly congested; they were small, and the cortical portions were much wasted.

In the next case I did not examine the mucous membrane with the microscope, but the symptoms during life, and the appearances after death, left no doubt in my mind that the patient died of acute gastritis.

Case 3.—A lady about thirty-five years of age had for a long time been under treatment, on account of a disease of the uterus. The catamenia were excessive in amount, and returned every ten or fourteen days. There was also a systolic murmur at the apex of the heart, and she had suffered severely from rheumatic fever some years previously. She was occasionally under my care, chiefly complaining of flatulence and feeble digestion. When in her usual state of health she was suddenly attacked with severe illness. She had excessive pain in the epigastrium and between the shoulders, and refused to take any nourishment on account of the increase of suffering it produced. Her face was exceedingly anxious, and the pulse small and fluttering; she vomited all food, and also a quantity of thick mucus. She died in two or three days after the commencement of these symptoms. On *post-mortem* examination the stomach was found much congested, of a dark colour, and covered with a thick layer of tenacious mucus. The heart was enlarged, and the mitral valve thickened and imperfect. The uterus was large, and contained three fibrous tumours.

Many of the older writers mention inflammation of the stomach as often occurring from suppressed gout, but of late years the existence of this form

of gastritis has been very generally denied. It has been supposed that the cases formerly described were only instances of severe indigestion. The following case, however, shows that acute inflammation of the stomach may occasionally arise from gout, and be connected with symptoms of a most alarming character.

Case 4.—I was requested to see a gentleman about fifty years of age, who had been dangerously ill for two days. I found him lying on his back, in a state of great prostration, and suffering from violent retching. At each attempt to vomit he discharged, with urgent straining, a little glairy mucus streaked with blood. He refused any nutriment, and if persuaded to drink, the fluid was almost immediately returned. He complained of intense pain in the stomach and chest, increased by food, and he seemed unable to bear the least pressure on the epigastrium. There was frequent and distressing hiccough; the pulse was quick, very irregular, and intermittent; the face pale, and exceedingly anxious; the urine scanty, but not albuminous. The bowels had not been opened for two or three days, and a pill containing croton oil had been administered without producing any action a few hours before I was requested to see him. I learned that he had formerly suffered much from gout, but had not experienced any attack of it for the last year. For some weeks before his illness he had been subjected to great mental anxiety, and had been almost incessantly employed in writing or dictating; often sitting up half the night in order

to complete his work. His appetite had been very bad, and he consequently had recourse to stimulants more freely than had been his custom.

I recommended that his bowels should be relieved by enemata, that a mustard poultice should be applied to the abdomen, and that all nourishment should be withheld, excepting a little iced brandy and water.

The following day he became rather delirious, and the vomiting continued unabated; the pulse remaining as irregular and intermittent as before.

In a few days the vomiting became less urgent, and the pain in the epigastrium less severe; but in other respects he continued in a most precarious condition. A strong mustard poultice was then continuously applied to the foot in which he had been accustomed to suffer from gout, and in a day or two afterwards a sharp attack of that disease appeared in the toe. From this time he rapidly recovered; the vomiting ceased, the delirium disappeared, the appetite rallied, and the pulse became regular. He afterwards suffered from œdema of both legs, but he gradually regained his former health.

I subsequently learned from him that he had been twice previously affected in a similar manner. On the first occasion, when in America, he was attacked with severe vomiting and pain in the epigastrium, followed in a few days by delirium. He was ill for about two weeks, and recovered without any gout making its appearance. The physicians who attended him expressed much doubt as to what had been the exact nature of his case. On the second seizure the symptoms and the course of the disease

were precisely similar to those of the first, except that they suddenly ceased on gout appearing in the feet. I have since attended him for a severe fit of gout, during which he had no gastric symptoms; but the pains in the joints were preceded by the passing of albuminous urine, which disappeared after the cessation of the gouty action.

The symptoms in this case were so urgent that I should have suspected poisoning, had not the patient been from the first under the observation of a very careful and intelligent practitioner. There can be no doubt that it was an instance of acute gastritis; and the rapid disappearance of the malady after the invasion of the gout points to a connection between the inflammation of the stomach and the affection of the joints. It was in reality a case of poisoning; the irritating material being lithic acid in the blood, instead of arsenic or antimony directly applied to the mucous membrane.

In all probability much of the scepticism which prevails respecting acute gastritis as a product of gout has arisen from confounding it with another affection which is not infrequent in gouty subjects. In this the disorder can be generally traced to some error in diet; and although the symptoms are often very alarming, they usually yield quickly to medical treatment. I have added the next case to illustrate this form of dyspepsia, and it is scarcely necessary to point out the differences between it and that which precedes it.

Case 5.—An old gentleman was suddenly attacked during the night with intense pain in the left side

which obliged him to sit upright. There was no vomiting or tenderness of the epigastrium. His face was very pale and anxious, the pulse feeble, the respiration quick and constrained. He had been for many years a martyr to gout, but for some time previously had escaped its accustomed visitations. A mustard blister was applied to the epigastrium, and a dose of ether and brandy was given. A large amount of flatulence was removed with immediate relief to the oppressed heart, and a stimulating purgative next day completed the cure.

It will be observed that all the above instances of acute gastritis occurred in persons who were suffering from diseases which rendered them liable to subacute or chronic inflammation of the gastric mucous membrane; such as scarlatina, gout, affections of the heart or kidneys.

Some authors have related cases in which acute gastritis has attacked individuals in perfect health, but no such instance has fallen under my notice. The symptoms of acute gastritis are as follows:—

Severe pain at the epigastrium; in some patients, extending up the chest and between the shoulders. The pain is sometimes sharp, in others it is described as a scalding or burning sensation. The suffering is immediately increased by either food or drink. Warm liquids and stimulants generally appear to aggravate it; frequently there is a craving for cold or iced liquids.

Tenderness at the epigastrium is always present; but it is not so severe, nor is the pain produced by so slight a pressure as in peritonitis.

Vomiting is as generally complained of as pain. At the commencement of the attack this symptom is very distressing, occurring every few minutes, even when no food has been taken. The ejection of a little glairy or bloody mucus seems to give temporary relief; but the retching is renewed as soon as a fresh quantity of secretion has been formed. Both food and drink are returned directly they are swallowed; but as the disease progresses the frequency of the vomiting usually decreases.

Hiccough is in some cases a very distressing and dangerous symptom; but patients may recover even after it has been almost incessant for many days.

Thirst is present in all cases, and is often productive of much suffering. The appetite is always bad, and a loathing of food is not unfrequently manifested.

The pulse is usually quick, feeble, and sometimes intermittent; the skin is hot, the bowels are generally confined, and the urine is scanty and high coloured.

In all the cases that have come under my observation I have been particularly struck with the great prostration of the patient. The face has been pale, the countenance pinched and anxious, and the spirits exceedingly desponding. The mental faculties usually remain clear to the last.

After death from acute gastritis, the stomach is generally found contracted, and the surface of its lining membrane is more or less injected and covered with mucus. In some cases there are small ulcerations scattered over the surface; in others sloughs may be present. In two cases which were examined at St. George's Hospital "there were flakes of fibrin

and fluid, with some recent adhesions in the peritoneums of both. There were spots of effused blood and brown patches on the internal surface of the viscus; the mucous membrane was very much thickened and pulpy; the cellular tissue too of the walls was thickened, in one being nearly one-third of an inch thick, and containing a deposit of fibrin of recent appearance in its substance." [1]

When examined by the microscope the gastric tubes are obscurely seen, on account of the granular matter effused upon and between them. Their cells are either broken up, or they seem fused together into a mass with granular and fatty matters. In some cases blood is met with within and between the tubes, and is also intermixed with their cells. The subtubular spaces are loaded with granular matter and blood globules.

The diagnosis of acute gastritis is, in most cases, sufficiently easy. The severe pain at the stomach, the tenderness on pressure of the epigastrium, the urgent vomiting, and the great depression of the vascular and nervous systems will at once arrest the attention of the practitioner. It may, however, be confounded with peritonitis, with which disease it is sometimes associated.

When this complication is not present, it will be observed that the tenderness is much less marked; it is confined to the epigastrium, and is not present in other parts of the abdomen. In peritonitis, again, the vomiting is less urgent, the matters ejected are not accompanied by blood, and when examined by the microscope are found to be free from casts

[1] Digestion and its Derangement, by Dr. Chambers, p. 347.

of the secreting tubes of the stomach. The pulse, moreover, is less depressed in peritonitis, unless the complaint has been produced by perforation of some part of the digestive tube.

Sometimes, in persons much reduced by chronic disorders, we have symptoms indicating an affection of the stomach, which must not be confounded with acute gastritis, as it arises from a different cause and requires a very different treatment. The following case is an illustration of this form of disease.

Case 6.—A young lady, about eighteen years of age, had been ill for nine months before I saw her, complaining of constant and severe pain on the left side of the abdomen. She was exceedingly emaciated, but had neither cough nor expectoration. Her illness had commenced with sudden pain in the abdomen; this was followed by diarrhœa and vomiting, which subsided after one month's duration.

On examination of the chest, signs of the existence of tubercular deposit were discovered in the apex of one lung. The part of the abdomen in which the pain was situated was rather duller on percussion than the adjoining regions, and was tender on pressure.

A day or two after I first saw her she was attacked by severe vomiting, followed by purging of blood, which subsided under treatment, but returned in a few days with increased severity. The vomiting became very urgent, even when no food had been taken, and the fluid rejected from the stomach was thick and ropy. Under the microscope it was proved to consist of mucus, loaded with torulæ.

All nourishment was forbidden except beef-tea; and a single pill of creosote and opium sufficed to stop the vomiting, although I had previously to the microscopical examination prescribed hydrocyanic acid and other remedies without effect.

She sank a few days afterwards from exhaustion, and no *post-mortem* examination was obtained.

I have little doubt that this was a case of chronic tubercular peritonitis, attended by ulceration of the intestines, and probably also by chronic gastritis. The formation of torulæ, as will be afterwards shown, is very apt to occur whenever the digestive process is enfeebled, and their presence often produces much irritation of the mucous membrane of the stomach. Cases of this kind are much more common than those of acute gastritis; and a microscopical examination of the vomited matters will at once enable the practitioner to diagnose them, and to prescribe the appropriate treatment.

The cases most likely to be confounded with acute gastritis are those in which irritant poisons have been administered for a criminal purpose, in small and regular doses.

The rarity of acute gastritis, except as the result of poisons, should be borne in mind, and it ought also to be remembered that when it does occur it is almost always as a complication of some other disease. If, therefore, the practitioner should ascertain, in any case presenting the symptoms of this complaint, that there was neither disease of the heart or kidneys, pyæmia, nor a history of gout, he would be justified in *suspecting* the administration of an irritant poison.

Under such circumstances, he ought most carefully to examine all the excretions, and particularly the vomited matters. He will in this way not only have the best opportunity of ascertaining the presence of any poison, but the vigilance he exercises will probably at the same time prevent the accomplishment of the crime.

The older writers recommend venesection as the most appropriate treatment for acute gastritis. In the instances of this disease which have fallen under my notice, the pulse has been so feeble and the strength so depressed, that I have not ventured upon bleeding.

In some cases, the application of leeches to the epigastrium may be required; but I have never had occasion to use them. This part should be constantly covered with hot bran poultices, renewed as often as they become cool.

The bowels should be relieved by the use of purgative enemata, and, where the tongue is very foul, a dose of calomel in the form of powder should be given.

As soon as the violence of the symptoms has abated, a mixture containing nitrate of potass and hydrocyanic acid will be found useful in lessening the vomiting and thirst.

Obviously, the primary indication is to relieve the embarrassed organ of its functions, and we should therefore, generally, give no food by the mouth, but trust to enemata of milk or beef-tea. As soon as the vomiting and pain subside, we may prescribe barley-water, thin arrow-root, or milk and water. These liquids should be given in very small

quantities at a time; a tablespoonful being often the utmost that can be borne by the stomach. Ice is invaluable; and if, as is usually the case, the depression be very great, brandy may be mixed with it.

Acute inflammation of the duodenum will, I believe, be usually found associated with acute gastritis. The only case I have seen, in which the inflammation appeared to be confined to this part of the small intestine, was the following, which I am unable to describe minutely, in consequence of having mislaid my notes of the symptoms and *post-mortem* appearances.

Case 7.—The patient was a lady upwards of fifty years of age, who had been ill about ten days before I saw her. She suffered from vomiting and general fever. The epigastrium was very tender, and the skin jaundiced. She died a few days afterwards, and her medical attendant requested me to be present at the *post-mortem* examination of the body. We could find no disease in any organ, with the exception of the duodenum, which was intensely congested and covered with a thick layer of tenacious mucus.

Such cases as I have described in this chapter have probably occurred to many practitioners, and it is, therefore, only as regards their nature that there can be much dispute. Generally, they are looked upon as the results of nervous irritation; whereas I view them as indications of secondary disease affecting the mucous membranes, just as we see the serous membranes take on inflammatory action in the course

of various other maladies. From the former point of view they are regarded as only an accompaniment of the general exhaustion; from the latter, as the cause of a sudden depression of power, under which the patient sinks.

I have great pleasure in adding the following note from Dr. Marston, Royal Artillery, as his observations respecting acute gastritis confirm the opinions I have expressed.

"Cases of acute gastro-duodenitis depending on a blood poison are not ordinarily described in books: yet they can scarcely be so very rare, for I have witnessed some half-dozen instances in which inflammation of the stomach and duodenum was apparently the effect and expression of a pyœmic, malarial, or urœmic poisoning."

"The symptoms observed during life were sufficiently characteristic for diagnosis:—Fever, a foul tongue with red periphery; very quick, compressible, intermittent pulse; an icteroid hue of the conjunctivæ; constipation, or colicky diarrhœa, with very disordered secretions; urgent vomiting, the vomited matters being sometimes so dark as to resemble black vomit; epigastric tenderness, great præcordial anxiety, an anxious expression of face, and marked asthenia."

"The *post-mortem* appearances are those of inflammation of the gastro-duodenal mucous membrane; the smaller end of the stomach is covered with a thick mucus, the lining membrane is softened and blood-stained, the veins full, and the small vessels injected in an arborescent form. The duodenum is distended; its coats are swollen, its mucous surface crimson from

blood-staining, and the vessels much injected. This blood-staining is sometimes diffused over such an extent of surface that the membrane looks as if it had been in contact with a blood clot: sometimes it exists in patches, so as to resemble blotches of purpura. The villi and valvulæ conniventes are swollen and softened, and the epithelium separates very readily, owing to the swollen state of the lining membrane; the openings of Brunner's glands, the crypts of Lieberkühn, and the solitary glands are obscured, and it is not easy to trace the opening of the common and pancreatic duct from the same cause. On minuter examination, the chief changes are found in the increased vascularity of the membrane, the granular state of the cylindrical epithelium, and in the presence of much granular material immediately beneath the epithelial layer. The glands and their orifices are either unaffected, or, at any rate, are not affected in an equal degree, although the small orifices of the ducts are choked with epithelial products."

"There need be no pathological changes in other organs, but there generally is some concomitant affection of the liver and spleen, either vascular hypertrophy of these organs, or some morbid alterations of their minute structure."

CHAPTER III.

SUBACUTE GASTRITIS.

It has been seen that acute inflammation of the stomach is a disease of rare occurrence, and attended with imminent danger; on the other hand, chronic gastritis is one of the most common complaints we are called upon to treat, and one that seldom produces fatal effects. There is a condition intermediate in degree between these affections, which may be distinguished by the name of subacute gastritis.

Acute gastritis is usually preceded by the subacute form of inflammation; and this, as it subsides, generally leaves behind it the state we recognise as chronic gastritis.

Although, like the disease already described, this form of inflammation is often only an expression of a blood poison, we find there are other cases produced by causes directly affecting the mucous membrane.

The symptoms of subacute gastritis, particularly when this complaint accompanies other and general diseases, are sometimes so little pronounced during life, that we only ascertain its existence on *post-mortem* examination; but as the general health is always apt to suffer from it, it is of importance to

determine the circumstances under which it is liable to occur.

Subacute gastritis, like all other disorders affecting the digestive organs, is apt to be accompanied by a great number of symptoms which vary with the disease with which it is associated, or according to the affection of other organs that may be deranged in sympathy with it. The only symptoms which may be expected to be generally present are:—pain or tenderness of the stomach, nausea or vomiting, loss of appetite, derangement of the digestive process, and a very slight degree of general fever.

These symptoms will be found to vary very much in degree according to the causes producing the gastritis, and it will be therefore advisable to consider the complaint under its different forms.

The most common variety of this disorder is popularly known as a "bilious attack." Under this head we find three different kinds of disease; but they all agree in being accompanied by violent vomiting, in their tendency to subside gradually without treatment, in the short duration of their more urgent symptoms, and in their liability to frequent recurrence.

In the first form, which is often named catarrh of the stomach, the symptoms are preceded by languor and debility, and are usually ushered in by vomiting. At first, only the undigested contents of the stomach are rejected, but afterwards the vomited matters consist of slimy mucus or of bile. The vomiting often becomes urgent, and it is aggravated by all food, whether in a solid or liquid form.

There is seldom any complaint of pain, but the

epigastrium is usually somewhat tender on pressure. The tongue is foul; the bowels are generally confined; but, in some cases, the complaint is accompanied from the first by diarrhœa. There is violent headache, and inability for any exertion, either mental or bodily; the face is sallow, the pulse slow and feeble.

When the mucus which is vomited in these cases is examined microscopically, it will be generally found to contain only mucous corpuscles; but in one instance—that of a lady who suffered severely from attacks of this kind—I found casts of the gastric tubes, composed apparently of mucus.

The observations of Dr. Beaumont upon Alexis St. Martin, who had a gastric fistula from the effects of a gun-shot wound, show us what is the actual condition of the mucous membrane of the stomach in the slighter attacks of this nature. When his patient was suffering from gastric derangement, he says: "The tongue was furred with a thin, yellowish coat, and inclined to dryness. The mucous membrane of the stomach very much resembled the appearance of the tongue, with small aphthous patches in several places, but quite irritable and tender."

On another occasion, when St. Martin had been drinking ardent spirits pretty freely for eight or ten days, the protruded portions of the mucous membrane of the stomach were examined before eating, and found to be in the following condition:—"The inner membrane morbid; considerable erythema, and some aphthous patches on the exposed surface; secretions vitiated. Extracted about half an ounce of gastric juice; not clear and pure, as in health; quite viscid."

The next morning, "Extracted one ounce of gastric fluid, consisting of unusual proportions of vitiated mucus, saliva, and some bile tinged slightly with blood, appearing to exude from the surface of the erythema and aphthous patches, which were tenderer and more irritable than usual."

On the following morning, Dr. Beaumont reports: "The inner membrane of stomach unusually morbid; the erythematous appearance more extensive, and spots more livid than usual, from the surface of which exuded small drops of grumous blood; the aphthous patches larger and more numerous; the mucous covering thicker than common, and the gastric secretions much more vitiated. The gastric fluids extracted this morning were mixed with a large proportion of thick ropy mucus, and considerable muco-purulent matter, and slightly tinged with blood resembling the discharge from the bowels in some cases of chronic dysentery."

We can readily believe that the condition of the mucous membrane of the stomach thus described is usually present in the ordinary forms of bilious attacks; but, in the more severe cases, the inflammatory action may extend beyond the surface, since, as before stated, I have found casts of the gastric tubes in the vomited matters.

The exciting causes of these attacks of subacute gastritis are usually to be traced either to some indigestible articles of diet, or to an excess of food taken whilst the powers of the stomach are enfeebled. In either case, the undigested food irritates the mucous membrane, and inflammation is the result.

In other instances, the drinking of ardent spirits originates the attack, especially if the stimulant is taken when the stomach is empty.

But it will be almost always found, that for some time before the appearance of the symptoms of subacute inflammation, those of chronic gastritis had been present. Each seizure seems to leave the mucous membrane inflamed, so that after the complaint has continued for some time the general health becomes affected. The appetite fails or becomes capricious, and there is more or less thirst, especially at meals. Nausea is often present, attended by acid or acrid eructations after food; the bowels are confined, and the urine is loaded with lithates; the complexion becomes sallow, the energy is greatly impaired, and often the gradual loss of flesh and strength makes the practitioner suspicious of the presence of some organic mischief in the digestive organs. There is almost always tenderness at the epigastrium, although there is seldom any complaint of pain after eating.

The treatment of this form of gastritis must be conducted differently during and between the attacks of the vomiting. The quickest method of giving relief whilst the subacute gastritis is present is, to apply a mustard poultice to the epigastrium, and to administer a dose of blue pill, or calomel and colocynth, followed by a purgative draught as soon as the state of the stomach will allow.

After the violence of the attack has subsided, a mixture composed of nitrate of potass, hydrocyanic acid, and cinnamon water, repeated every two or three hours, removes the uncomfortable feelings in

the head, which often remain for a day or two after the vomiting has ceased.

During the intervals between the seizures, the bowels should be carefully regulated by medicines calculated to act without producing irritation. A long-continued course of liq. potassæ, in combination with a bitter infusion, such as that of calumba or chirata, I have found very useful. Where there is anœmia, iron and aloes are advantageous; but, even in these cases, it is better to commence the treatment with alkalies.

The diet requires careful regulation. As a general rule, it will be found that the patients amongst the wealthier classes of society are in the habit of taking animal food too freely, and a diminution in the amount of this is sometimes alone sufficient to prevent the attacks. In other instances, it is necessary to forbid all stimulants; as in persons predisposed to this complaint, even small quantities of beer or wine often suffice to bring on the complaint.

In the cases just considered, we have no evidence that the biliary organs are affected; but there is another class, in which the derangement of the stomach seems to originate from an affection of the liver.

In these the patient, generally on awakening from his sleep, is attacked by severe vomiting, attended by violent headache. At first, the matters rejected from the stomach consist of undigested food mixed with bile; but afterwards, a bilious-looking fluid is alone vomited. After the vomiting has lasted for some hours the symptoms gradually subside, and the patient recovers his ordinary health.

These "bilious attacks" are commonly preceded by

the passing of a large quantity of clear urine; and in some a deep, unrefreshing sleep ushers in the more urgent symptoms. They are usually not followed by chronic gastritis, as are those before described; the patient feeling not unfrequently more active and energetic for a short time after each attack.

Between the seizures the bowels are usually much confined; and on examining the abdomen it is not uncommon to find a moveable tumour formed by the impaction of fæces in the large intestines. It is most easily felt by causing the patient to draw a full breath; and it is commonly situated just below the liver.

There has been considerable difference of opinion amongst authors as to the cause of these "bilious attacks;" and as to whether the bile is increased in quantity, or is merely regurgitated into the stomach. In one case which was under my care I procured the bile vomited at the commencement of the attack. It was free from particles of food, and smelt strongly of sulphuretted hydrogen. When placed under the exhausted receiver of an air-pump, sulphuretted hydrogen gas was evolved, and the fluid exhibited the usual reactions of the bile acids. When examined microscopically, branching casts were discovered in it, which I believed to have originated in the smaller biliary ducts. They were probably formed of albumen and not of mucus, for when boiled in a weak solution of cyanide of potassium they were not dissolved. In this case, the bowels were obstinately confined, and the attacks did not occur when their free action was maintained by medicines.

Imperfect action of the bowels will not, however,

explain all the cases of this kind; for we often find them in those who are not liable to constipation.

It will be afterwards shown that persons who become affected with phthisis are peculiarly subject to these attacks; and I have often observed them to cease before the symptoms of the disease of the lung manifested themselves. The tendency to them is more frequently inherited than to any other form of dyspepsia; for whilst 42 per cent. of persons affected with weak digestion were born of parents liable to stomach complaints, 64 per cent. of the sufferers from bilious attacks were children of those subject to indigestion.[1]

It is, I think, therefore probable that the bilious attacks are often "efforts of nature" to relieve the system of effete materials which have accumulated in the blood from the imperfect action of some of the eliminating organs.

The success of our treatment will depend on our discovering the cause of the complaint. When it results from constipation, and a tumour exists in the large intestine, stimulating frictions to the abdomen are of great service. The bowels may be regulated by an electuary of sulphur and guaiacum, or a dinner pill of aloes or rhubarb will be found efficacious. Where anœmia or debility is present the purgatives should be combined with iron, quinine, or other tonics. When the digestion is feeble, the mineral acids are often extremely useful, in invigorating it.

If we have reason from the family history to

[1] See Note B, Appendix

suspect that gout or rheumatism is connected with the complaint, a long-continued course of colchicum in small doses is extremely valuable.

As regards diet, the plainest and most digestible food should be used; fat should be sparingly employed, and wine and malt liquors should be avoided.

Regular exercise in the open air is of great importance; and the functions of the skin must be carefully attended to.

I have described these forms of disease as entirely different; and no doubt they are so; but very often we meet with mixed cases, in which chronic gastritis is associated with the affection of the liver. Under such circumstances the treatment must of course be determined by the nature of the case.

There is a third species of "bilious attack," which arises from fermentation of the food. This may take place either from inflammation of the mucous membrane of the stomach, or it may occur where the digestive organs are enfeebled from other causes. The symptoms of this form of the disease will be seen in the following case.

Case 8.—A woman about thirty-five years of age was attacked by severe vomiting and diarrhœa. These symptoms persisted for some days in spite of treatment. When the vomited matters were examined they were found to be of a dark-green colour, thick and ropy, as if from admixture of mucus, and sinking to the bottom of the vessel when mixed with water. Under the microscope the sediment was found to consist almost entirely of torulæ; many of the cells

budding, but generally not so far developed as to form the long strings common in the later stages of the growth of this fungus. She was treated with creasote, and rapidly recovered.

The green colour of the fluid vomited by this patient was very striking, and I have remarked the same circumstance in other cases where vegetable growths were present. Dr. Beigel reports a somewhat similar instance, and states "that the dark-green colour depends partly upon colouring matter of the bile and partly upon the presence of innumerable sporules of a vegetable growth, of the nature of which I am ignorant. Leptothrix, vibriolæ, and other fungi, are likewise present in vast numbers."[1]

It is not at all improbable that fermentation in the stomach is a much more general cause of these attacks than is usually supposed. A woman at present under my care, and who has long suffered from "bilious attacks," vomited in the morning about half a pint of a clear liquid, before taking any food. When this was placed in a glass a substance was deposited, which, when examined with the microscope, presented the appearance of a vegetable growth. (See plate 7.)

The diagnosis of such cases is easy, if the microscope be employed. The torulæ are readily recog nised, either by the small cells which project from those that are more mature, or by their forming rows like beads. The green colour of the vomited matters will often at once attract the attention of

[1] Transactions of the Pathological Society of London, vol. 18.

the practitioner, and lead to the detection of the real nature of the disease.

It is by no means difficult to account for the presence of torulæ in the stomach during or after a bilious attack. Dr. Beaumont, in his experiments on St. Martin, remarks that when the stomach was inflamed it secreted very little proper gastric juice, but a considerable quantity of ropy mucus, which became yellowish or muco-purulent, when the inflammation was more than usually severe. Normal gastric juice prevents fermentation; whilst the mucus, so plentifully secreted by an inflamed mucous membrane, appears to act as a ferment. We can consequently easily comprehend that if the secretion of gastric juice be suspended and its place be supplied by mucus, fermentative action will be set up, and torulæ and other vegetable forms will make their appearance.

In cases of fermentation the diet should be carefully regulated. Tea, coffee, milk, arrow-root, rice, and similar fluids, so often forced upon the patient during a "bilious attack," should be forbidden; and iced water, soda water, Seltzer water, and beef-tea should be substituted.

As regards remedies, I have generally prescribed creasote in doses of one drop, combined with magnesia; but if there be much subacute inflammation of the mucous membrane the hyposulphite of soda will be found more useful. For some time after the attack has subsided, vegetable tonics in combination with acids or alkalies are required.

In the forms of subacute gastritis described as "bilious attacks," the symptoms appear suddenly,

and disappear after a few hours' or days' duration; but in another class of cases they may continue without abatement for weeks, or even for months. The effects of this more chronic form of disease upon the general health are necessarily more severe, and the complaint is often very difficult to treat.

In addition to the morbid changes in the lining membrane of the stomach before mentioned as occuring in "bilious attacks," we often discover in the more chronic variety of the disease numerous small ulcerations scattered over the gastric mucous membrane. These are also found in the stomachs of the lower animals when gastritis has been present in them; so that there can be no doubt they are frequent results of this morbid condition.

Vomiting is generally present in this variety of gastritis, and from its being often the most prominent symptom, many writers have considered cases of this kind to depend rather upon an irritable state of the stomach than upon inflammation. The vomiting occurs shortly after taking food, and the matters rejected are sometimes very acid; at other times they seem to consist chiefly of mucus and undigested food. Occasionally the vomiting is so frequent that scarcely anything is retained, and we are surprised that the life of the patient can be preserved.

Pain is as generally present as vomiting, and is increased by all food immediately it is swallowed. The pain is usually felt in the epigastrium and between the shoulders; but in other cases it is referred to the sternum and the neighbouring parts. Sometimes it is described as "sharp," or "cutting;" in other instances as a "scalding" sensation. There is gene-

rally some tenderness at the epigastrium upon deep pressure.

The appetite for food is almost always decreased, and is often replaced by loathing. Thirst in a greater or less degree is generally present.

The tongue affords no certain indication of the state of the stomach, but usually it is red at the tip and edges; and the lips are dry and cracked.

The pulse is feeble, and more rapid than in health, and there is ordinarily considerable loss of flesh and strength.

It must be remembered that every case does not present all these symptoms; nor are they in all equally severe. The more acute forms are commonly met with in young women suffering from anæmia, and in these there is often considerable difficulty in the treatment.

In most of the instances of subacute gastritis occuring in the female, it will be found that the catamenia are deficient. In various affections of the uterus we meet with subacute inflammation of the stomach, but the most marked cases are seen in persons in whom narrowing of the canal of the cervix uteri prevents the free excretion of the catamenial discharge. An instance of this is shown in the following case.

Case 9.—A young married lady consulted me, on account of pain at the epigastrium, vomiting of all food, and other symptoms of severe subacute gastritis. She was exceedingly weak and emaciated. The symptoms were aggravated during the catamenial period, and the menstruation was very slow and painful. On

examination, the os. uteri was found to be so narrow, that a fine probe could with difficulty be passed through it. The canal of the cervix was freely incised, and with scarcely any other treatment the gastric disorder ceased, and the patient regained her health and strength.

Care must be taken that the gastritis is really dependent upon the uterine affection, for these diseases may co-exist without there being any connection between them.

We should therefore ascertain before commencing the treatment whether the gastric symptoms are greatly aggravated during the catamenial period, and whether there be really such a condition of the uterus as to require surgical interference.

Subacute gastritis is one of the most common accompaniments of ulceration of the stomach, and to it are usually due the aggravations of pain to which those affected with that complaint are liable.

In other instances it results from causes preventing the ready exit of the food from the stomach, such as thickening of the pylorus. I have seen it also connected with enlargement of the liver, and suspect that the inflammation was kept up partly by the congestion of the portal system and partly by the pressure of the diseased organ upon the stomach.

The diagnosis of subacute gastritis, though in general sufficiently easy, is sometimes attended with considerable difficulty.

In cases of phthisis, even in the earlier stages, there is often vomiting after food; and, as in subacute inflammation of the mucous membrane of the stomach,

a troublesome cough is not unfrequently present, the one complaint may be mistaken for the other. In phthisis, however, the vomiting is usually preceded by severe coughing; the pulse is quicker, the heat of skin greater, and the emaciation more rapid than in gastritis. Any doubt as to the real nature of the disease ought to lead to a careful exploration of the chest, and the fluid rejected from the stomach should be examined with the microscope.

The incessant vomiting that accompanies certain forms of disease of the brain, may give rise to a suspicion of the existence of gastritis. Dr. Habershon mentions a case in which the vomiting was so severe that food was immediately rejected with great violence; and after death disease was discovered at the origin of the pneumo-gastric nerves. We must be chiefly guided, in forming our opinion as to the seat of the malady, by the history, and by the other symptoms manifested during the progress of the disease.

There is often difficulty in distinguishing between affections of the brain and those attacks of gastro-enteritis which in children are termed "remittent fever." In brain disease, however, there is more heat of the head, the pulse is quicker, and the remissions are less distinctly marked than in the fever. The vomiting is more apt to occur when the stomach is empty, and it follows more immediately after the food is swallowed than in gastritis. Again, the bowels are generally confined in brain disease, and relaxed in remittent fever; and in the former the abdomen is generally contracted while in the latter it is distended with flatus.

Fermentation of the contents of the stomach often produces symptoms resembling those of subacute gastritis. The mucous membrane is in a state of irritation, excited by the prolonged contact of the decomposing food. It is important, in a practical point of view, to recognize the value of the microscope as a means of diagnosis in such cases.

Case 10.—A very anæmic girl, about twenty-one years of age, was admitted under my care at the Victoria Park Hospital. She complained of severe pain and vomiting about two hours after she had taken food. These symptoms had existed without intermission for nearly six months; but in the earlier period of the complaint the pain and vomiting had occurred directly after eating. She had twice suffered from profuse hæmatemesis. On examination the stomach was not found to be enlarged. I directed her to excite vomiting in the morning before breakfast, and to bring me the fluid rejected. She took on the first occasion some broth and rice at nine p.m., and vomited the following morning at seven a.m. Although no food had been taken for ten hours, about four ounces of fluid were rejected from the stomach. It was of a dark colour, slightly acid, and deposited a sediment of mucus. When examined by the microscope, it was found to contain mucous cells, no casts of the tubes, but numerous pieces of branching fungi like the vinegar-plant. A few days afterwards she took some soup at night, and the next morning vomited about six ounces of brown thick liquid, which deposited, on standing, a considerable sediment. This consisted of fragments of animal and vegetable

structures, and a large quantity of sarcinæ. The pain and vomiting soon disappeared under treatment; but she has since applied at the hospital with a return of her former symptoms.

In this case there can be little doubt that the complaint commenced as subacute gastritis, probably attended, as she had suffered from hæmatemesis, with ulceration. At the time I saw her, as the pain and vomiting came on two hours after food, and the fluid vomited in the mornings was loaded with sarcinæ, it is probable that the symptoms depended only upon fermentation; and the rapid recovery of the patient seems to confirm this view. The only certain method of diagnosing these cases is by an examination of the contents of the stomach with the microscope.

There is another form of disordered digestion which may be confounded with subacute gastritis. This occurs chiefly amongst young persons, and especially females. It is sometimes preceded by gastritis; at others, it comes on gradually, without any apparent cause.

The most prominent symptom is the vomiting of all food, often immediately after it has been swallowed. There is seldom much pain, but, when present, it is referred to the chest. There is little or no tenderness at the epigastrium. The tongue is not red at the point, the pulse is not quickened, there is no thirst, and little or no emaciation. In one case, in which I carefully examined some water that had been vomited after having been drunk before breakfast, I found very little mucus and no casts or torulæ in it.

This complaint is probably analogous to the irritable condition of the eye, which so often remains after an attack of ophthalmia in young persons.

Tonics are the best remedies. Iron, either in the form of carbonate or of sulphate, is the most suitable. Strychnine, in some cases, allays the vomiting; in others, quinine or zinc is more efficacious.

The diet should consist of mutton, bread, beef-tea, and other digestible forms of nourishment. I have known the symptoms to be immediately aggravated by restricting the patient to farinaceous food. Tea and coffee should be forbidden. Wine and other stimulants are generally requisite.

Change of air, shower-baths, and, above all, sea-bathing, will often effect a cure where medicines have been used unavailingly.

In the treatment of subacute gastritis the first and great point is strict attention to the diet of the patient. Solids, as a rule, produce more excitement to the gastric mucous membrane than fluids, and nourishment should therefore be given in a liquid form.

The frequency with which food should be given depends upon the nature of the case. Generally, a teacupful may be allowed every three or four hours; but in some a single tablespoonful, every quarter or half hour, is as much as can be borne by the stomach.

Milk is, in most cases, the least irritating kind of food; but it should be mixed with lime water if there be any acidity. Substances composed chiefly of starch, such as arrow-root and sago, are useful, as they do not require much digestion by the stomach.

Beef or mutton tea seems to agree best with some patients, and particularly when there is a tendency to fermentation. Tea and coffee should be avoided, from their tendency to derange the digestion.

But we sometimes find the stomach so excessively irritable that even a spoonful of food brings on the pain and vomiting. Under such circumstances we must leave it entirely at rest for two or three days, and give nourishment by enemata. In this way very obstinate cases may be often relieved, and the digestive organs afterwards regain their power. As the patient improves the amount of food should be gradually increased, but all change must be made very cautiously; and for some time after the pain and vomiting have disappeared, the greatest care should be taken to avoid any indiscretion as regards diet.

Leeches to the epigastrium are often of great service. As the patients are generally reduced in strength by the complaint it is advisable to order only two or three leeches at a time, and to repeat their application once or twice a week, rather than remove a large quantity of blood at once.

Fomentations and poultices to the epigastrium are also useful; blisters or croton oil liniment are of value as soon as the more acute symptoms have subsided.

When the complexion is sallow, or the alvine evacuations are deficient in bile, a few doses of calomel or blue pill may be prescribed, but generally the bowels should be irritated as little as possible by purgative medicines. If constipation be present, enemata, or some gentle aperient electuary are the best means of relieving the bowels.

Sedatives are commonly required on account of the pain. Morphia and hydrocyanic acid are by far the most useful of this class of remedies, and should be given in small and frequently-repeated doses. When the stomach will bear other medicines, small doses of the nitrate or of citrate of potass seem to soothe the mucous membrane and hasten the cure of the complaint.

As soon as the acute symptoms have been subdued, it is necessary that the cause of the complaint should be discovered, and if possible removed, for in no disease is there a greater tendency to relapse. If the gastritis should be connected with some affection of the uterus, the treatment should be directed to relieve it. If anæmia be the cause, a course of iron should be prescribed, along with a nutritious and digestible diet. One of the best forms in which steel can be given is in the form of a pill containing sulphate of iron with extract of aloes and extract of gentian. With others, a mixture composed of compound decoction of aloes and compound steel mixture, grees better.

CHAPTER IV.

THE CONDITION OF THE STOMACH IN FEVERS.

The symptoms which attend the origin and progress of the eruptive fevers are sufficient to give rise to the suspicion that the mucous membranes of the digestive tract may be as generally affected as the skin. Thus, inflammation of the throat is the first evidence of scarlatina, and this part is liable to be affected with greater intensity than the external surface of the body; measles is ushered in with signs of irritation of the mucous membranes of the nose, eyes, and throat; the eruption of small-pox is often preceded by distressing vomiting; and in typhoid fever, diarrhœa is rarely absent.

We have lately had the opportunity of studying the state of the mucous membranes in the epidemic which has proved so fatal to the cattle of this and other countries. There are advantages in investigating such affections in the inferior animals which we do not possess where disease attacks the human subject. The parts can be inspected immediately after death, before either decomposition or *post-mortem* digestion has had time to alter the morbid appearances. In addition to this, we are not liable to

PLATE II.

THE APPEARANCES OF THE STOMACH TUBES IN CATTLE-PLAGUE.

FIG. 1. The normal appearance of the stomach tubes in the cow.

t. Tubes lined superiorly by conical cells.

g. Gastric cells.

m. The muscular layer.

FIG. 2. The appearances presented in the earlier stages of cattle-plague.

t. The tubes much narrowed.

g. The gastric or glandular cells scattered irregularly through the whole length of the tubes. The conical cells have disappeared.

gr. Granular matter effused between and below the tubes.

m. The muscular layer.

FIG. 3. The appearances presented in the later stages of cattle-plague.

t. The tubes reduced in size, and containing only a few altered cells.

p. The pits into which the tubes open on the surface of the mucous membrane.

r. The ridges separating the pits.

The tissue was so soft that the tubes are curved instead of straight.

Plate 2.

Fig 1

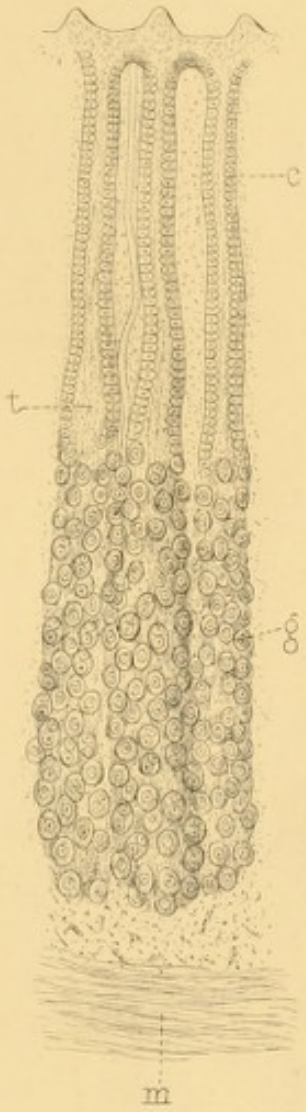


Fig 2

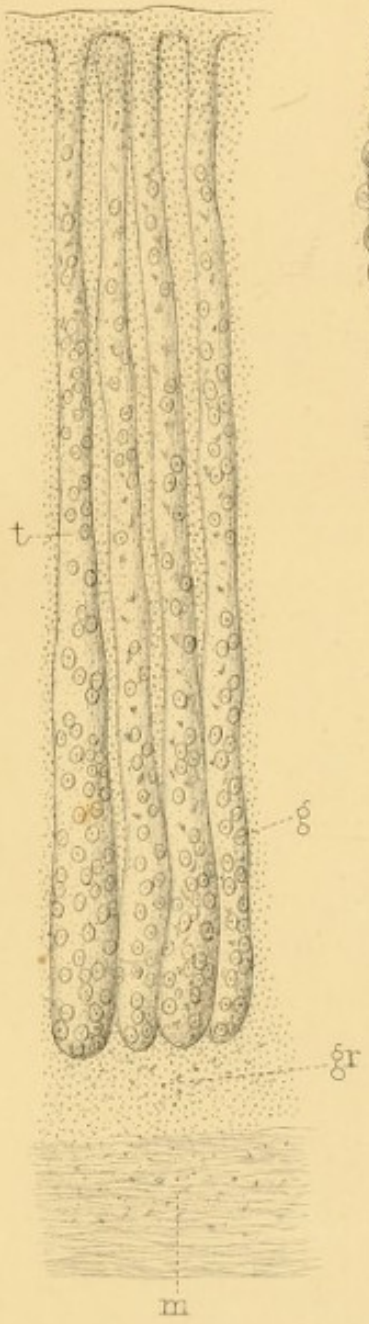
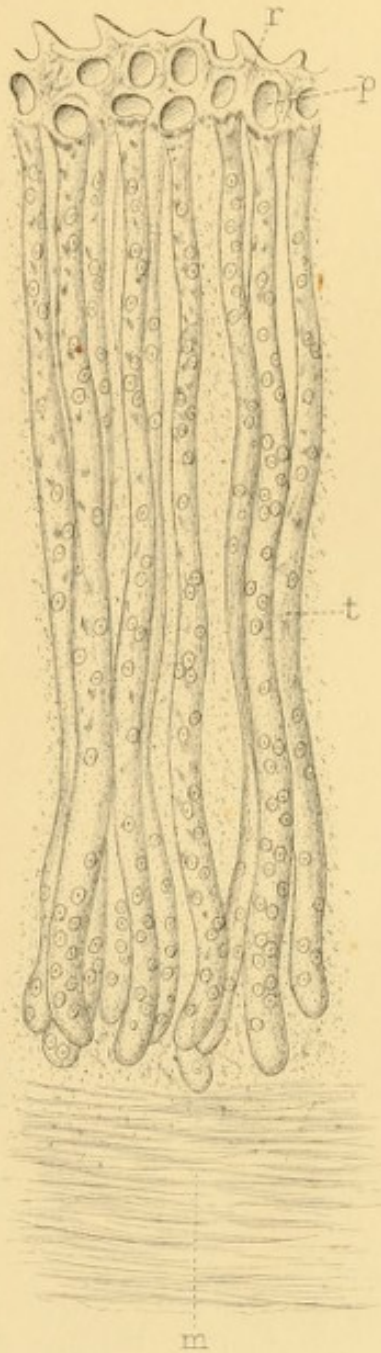


Fig 3



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mistake the effects of medicines for the evidences of disease; and the previously perfect state of health and the slaughter of the animal remove all chance of the structural alterations being the results of former maladies, or of the languid circulation consequent on a lingering death.

Where the animals had been slaughtered within a few hours of their being attacked by cattle-plague, the morbid appearances in the mucous membrane of the stomach were limited to great congestion of the blood-vessels, and to the stripping off of the conical epithelium, which in a normal state covers the upper ends of the gastric tubes. In place of this epithelium there was an exudation of granular matter, and, in consequence of the bare condition of the ends of the tubes, their openings on the surface were unusually large and prominent. The stomach always contained some mucus, in which were masses of epithelium presenting the shape and appearance of the tubes from which they had been removed.

When the disease had existed a little longer, the round gastric cells were affected, in addition to these changes. They seemed to have been loosened from the basement membrane, and were irregularly scattered through the whole length of the tubes, as though in process of expulsion; whilst between them was a deposit of granular material, showing that the inflammation had now reached the lower ends of the tubes.

Where death had been deferred until the second or third day of the disease, all the normal gastric cells had disappeared, and the tubes only contained granular matter with a few thin, flat, and

very transparent cells. The tubes were consequently much smaller, and were so soft that sections through their whole length were obtained with difficulty. But in addition to these changes the tubes, which in the earlier stages could be readily separated from each other by gentle pressure, were now found to be closely united together, and cells and nuclei could be observed between them. The blood-vessels were everywhere much injected, and ulcerations were observable on the surface of the membrane.

The morbid appearances were not confined to the stomach; the mucous membrane of the intestines was similarly affected. Effusions of blood or of granular matters were observed in the intestinal villi and glands, and in the later stages of the disease ulcerations of the mucous membrane had taken place in various parts.

The affection of the skin was less evident than in the eruptive fevers of the human subject, in consequence of this part being so much less vascular, and its physiological action so much less important, in cattle than in man. Nevertheless it did take place, for I frequently found the basement membrane of the hair bulbs stained with blood, and the secretions of the oil glands much increased; but I was unable to discover any alterations in the epithelium lining the sweat glands.

In all probability changes take place in the gastro-enteric mucous membrane in many of the epidemics affecting man, analogous to those we have traced in cattle-plague. Thus, the most prominent symptoms of cholera are those affecting the stomach and bowels; and after death morbid appearances are presented by

the digestive canal. The gastric tubes are loaded with granular matter; extravasations of blood are sometimes discovered in the stomach, and the intestinal villi are stripped of their epithelial covering,[1] The "black vomit" shows how seriously the stomach is implicated in yellow fever, and the disorganization of the colon produced by dysentery is often associated with malarial poisoning.

The question naturally arises, how is it that the violence of these epidemics so generally seems to fall on the digestive tube?

If we inoculate a healthy cow with the smallest portion of the secretion taken from the mouth of a beast suffering from cattle-plague, disease is produced. The pulse becomes quickened, the heat of the body increases, inflammation of the whole of the digestive tract is set up, and a fluid is poured out possessing properties similar to that which gave rise to the disorder.

The mucous membrane has, in this instance acted as the eliminator of the animal poison, and the gastro-enteritis has been excited by a natural effort, in order to get rid of it.

The anatomical changes induced by this class of disorders are often productive of serious effects, even to those who may recover from them. Every practitioner must have seen persons who, although they have been cured of cholera or dysentery, had received an injury to the digestive organs which neither time nor treatment was able to repair.

It might be objected that although the mucous

[1] Dr. Fox. Pathological Transactions, 1867.

membrane of the stomach and bowels may be affected in the severe and rapid epidemics of hot climates, we cannot suppose that a similar action will occur in the eruptive fevers with which we are so familiar, and in which the skin seems to act as an eliminator of the animal poison. In order to test the truth of this objection, let us examine the state of the digestive canal in scarlatina and other fevers of this class; and I trust that, on account of the importance of the inquiry, I may claim the forbearance of the reader while I go somewhat into details.

I shall attempt to prove that in scarlatina the mucous membrane of the stomach and bowels is inflamed; that desquamation occurs on this membrane as it does on the skin; and that the form of inflammation is analogous to that which we observe on the external surface of the body.

I.—IN SCARLATINA THE MUCOUS MEMBRANE OF THE STOMACH AND BOWELS IS INFLAMED.

Observation 1.—A child, two years old, was suddenly attacked by vomiting and diarrhœa. After a few hours a slight scarlet rash appeared on the body; five hours from the commencement of the illness convulsions came on, and the child died fourteen hours afterwards.

Post-mortem Examination.—The mucous membrane of the stomach was in one part much congested, but did not present to the naked eye any other appearance of disease. Its tubes could be separated with greater ease than usual. When examined by the

microscope they appeared large and much distended at their closed ends, only a few scattered cells being visible in them, and their basement membrane seemed everywhere lined by a false membrane. (See plate 3, fig. 1.) After the stomach had been soaked in spirit for six months a considerable change took place. The tubes then seemed filled with cells and with granular matter agglutinated into masses; but the cells were very much less numerous than in the natural condition. Each cell seemed covered with a thin membrane, which could be seen to pass from one to another. The villi of the duodenum were stripped of epithelium, and although there was no trace of food in the intestines the villi were distended with oily and granular matters. The lacteals were empty.

Observation 2.—The stomach of a female child, aged twelve years, who had died of scarlatina, was sent to me for examination. The tubes were greatly distended, and were easily separated from each other. In many places they were stripped of their cells, and contained only granular matter; but in other parts there were large and very thin cells in the tubes. The connection between the tubes and their contents was much less firm than usual; for when sections were made obliquely the tubes were generally found empty. When the cells were removed from the tubes they appeared fringed with pieces of very fine membrane.

Observation 3.—The stomach of a female child, who had died of scarlatina at the age of two years, was sent to me for examination. The tubes were

easily separated from each other, and were greatly distended by granular and fatty matters. There were but few gastric cells visible, and in other respects the appearances were the same as in the preceding case.

Observation 4.—A boy died of scarlatina, in the Middlesex Hospital.

Post-mortem Examination.—The pharynx and œsophagus were red, and the epithelium was absent. The stomach was covered by a thick tenacious mucus, and when this was removed the mucous membrane was found greatly congested, and in many places presented a blood-stained surface. The intestines were in a similar condition. Peyer's patches were large and congested, and the glands of the mesentery enlarged and of a deep red colour as in typhoid fever. The tubes of the stomach were greatly distended, and their closed ends curved and distorted. After being soaked in alcohol there were spaces left between the basement membrane and its contents. The membrane seemed much thickened, and the tubes were gorged with a confused mass of cells and granular matters. Scattered everywhere in apposition with the inner surface of the tubes were small round cells $\frac{1}{4000}$ part of an inch in diameter. There were also a few larger cells, $\frac{1}{1100}$ of an inch, very thin and flat, and agglutinated to the rest of the contents. In other specimens no large cells were to be discovered; but in another part the tubes themselves were found united together, the intertubular spaces being loaded with cells and nuclei. The intestinal villi were also loaded with

fatty and granular matters, although the lacteals were not distended.

Observation 5.—A girl, aged fourteen, was admitted into the Middlesex Hospital. She had been affected the night before with sore throat, followed by a slight rash upon the skin. She walked to the hospital in the morning, but was attacked by diarrhœa and died the same evening.

Post-mortem Examination.—The œsophagus immediately above the stomach was very red. The stomach was much injected in the cardiac region, and for some distance from it. There were two or three ulcerations in the solitary glands of the intestines. The muscular coat and the subtubular and intertubular spaces of the stomach were in many parts infiltrated with blood. The tubes were distended, and the edges of the cells ill-defined, from being overlaid with granular matter. In the pyloric region there were deposits of nuclei encroaching on the tubes.

Observation 6.—A youth, aged seventeen, died of scarlatina at the Middlesex Hospital after a few days' illness.

Post-mortem Examination.—The stomach was congested at the pyloric region, but there was no unusual redness in other parts of the organ. In the cardiac and middle regions the tubes were distended with round or oval nucleated cells about $\frac{1}{4000}$ of an inch in diameter, intermixed with granules and a few gastric cells, some of these being granular and larger than usual. Between and below the tubes were numerous cells and nuclei. In the pyloric region the tubes

were greatly distended, and masses of granules and small epithelial cells projected from their free ends. They did not appear to contain any normal gastric cells.

Observation 7.—A man was admitted into the Middlesex Hospital, and died a few days afterwards from scarlatina.

Post-mortem Examination.—The cardiac region of the stomach was greatly congested, the mucous membrane being spotted all over with blood. The lining membrane of the intestines was intensely red. The gastric tubes were very much distended with granular matter, and small nucleated cells, about $\frac{1}{4000}$ part of an inch in diameter, but no normal cells could be discovered. Between some of the tubes there were also elongated nuclei, and a few small cells. The mucous membrane of the duodenum and ileum was everywhere loaded with small cells and granular matters. The villi were very erect, exceedingly large, and deeply coloured by blood, which seemed to have been extravasated into their texture, especially at their free ends. They were loaded with small cells and granular matters. The tubes of Lieberkühn were distended with cells and granules. The pancreas was loaded with similar products.

Although there was redness of the stomach after death in all the above cases, the amount of disease actually existing in the mucous membrane could not have been suspected had it not been for the microscopic examination. In the next cases, however, the morbid appearances were sufficient to show the nature

of the complaint, without the necessity of a more minute investigation.

Observation 8. — See the case of scarlatina at page 50.

Observation 9. — The stomach and duodenum of a child who had died of scarlatina were kindly sent to me by Dr. B. W. Richardson. They were intensely inflamed; indeed, excepting the greater brightness of the colour, the mucous membrane presented more the appearance of a case of catarrh arising from heart disease than that of scarlatina. On account of the parts having been preserved in ammonia I was unable to make any microscopic examination.

Observation 10.—The small intestine of a child who died of scarlatina is preserved in the museum of the Middlesex Hospital, and there are in it numerous ulcerations, which seem to have arisen in the solitary glands.

In all the above cases death took place within a few days after the attack of the fever, and in Observation 1, the vomiting and diarrhœa preceded the rash. In Dr. Beale's case the vomiting and sore throat are mentioned as occurring on the same day as the rash, but I have generally observed symptoms of gastric disorder before the throat has been complained of. It is, therefore, probable that the inflammation of the digestive tube takes place before or at the same time as that of the throat, and that it is, therefore, prior to the eruption. The next cases not only strengthen the general conclusion as to the existence of inflam-

mation of the stomach and intestines in scarlatina, but also show the changes which the mucous membrane undergoes in the later stages of the illness.

Observation 11.—A female child, aged nine, was admitted into the Middlesex Hospital. Two or three weeks previously she had been affected with scarlatina. She died of diseased kidneys, with fluid in the chest. The lining membrane of the stomach was not injected, but was covered by a thick gelatinous mucus. The tubes were easily separated from each other, and were not thickened. At their closed ends the gastric cells were obscured by a large amount of granular matter, but towards their free extremities the cells were plainly seen, about $\frac{1}{1200}$ of an inch in diameter, round and nucleated, and very much fewer in number than in the natural state.

Observation 12.—A child two years of age, passed through the first stage of scarlatina, but died a fortnight afterwards.

Post-mortem Examination.—The mucous membrane of the stomach was of a pale colour, and seemed thin and wasted, but in no part did it present any appearance of *post-mortem* solution. The tubes of the stomach were smaller than usual, and were not distended as is observed in cases where death takes place earlier in the disease. They were lined by a membrane, but many normal cells were visible. After long maceration in spirit, the tubes assumed a more natural appearance, and a larger number of cells became visible, although their outlines remained indistinct. In some sections the blood-vessels situated

between the tubes were evidently enlarged, but this was by no means general.

Observation 13.—A man, twenty years of age, was attacked by scarlatina. He was admitted into the Middlesex Hospital suffering from dropsy, and died about three weeks after the commencement of his illness.

Post-mortem Examination.—The stomach was covered by a thick gelatinous mucus. It was not much congested, although the blood-vessels seemed large. At the commencement of the pyloric region the lining membrane was thick, red, and softer than elsewhere. The tubes were loaded with granular matter, but also contained cells, although these were much fewer than usual. There was less than the usual adhesion between the tubes and their contents; for the cutting of the tubes obliquely generally caused them to appear empty.

Observation 14.—A boy was admitted into the Middlesex Hospital. When first attacked he suffered from repeated vomiting; but neither sore throat nor eruption on the skin had been observed. He died in two or three weeks after the commencement of his illness.

Post-mortem Examination.—The back of the tongue and arches of the palate were stripped of epithelium, but there was no desquamation of the cuticle. In some parts the tubes of the stomach were greatly distended with granular matters, in others the cells were apparent, but seemed matted together, and their edges obscured. In other places the tubes

were united together, and the spaces below them were loaded with nuclei and small cells, about $\frac{1}{5000}$ of an inch in diameter.

Observation 15.—A man was admitted into the Middlesex Hospital, suffering from scarlatina, which was followed by peritonitis, bloody and albuminous urine, and constant vomiting. Death took place about three weeks after the invasion of the disease.

Post-mortem Examination.—The stomach was covered by a thick tenacious mucus, and the lining membrane was in some places very dark in colour, almost black; in other parts red, greatly congested, and looking as if blood had been sprinkled upon it; in the middle region it was pale. The tubes were easily separated from each other, and greatly distended by granular and fatty matters. At the closed ends of the tubes the cells were scarcely visible, but were more readily seen when their free ends were examined. The cells seemed cemented together, and covered with fatty granules, and their edges were very indistinct.

Observation 16.—A girl, aged seventeen, was attacked by scarlatina, and died upon the tenth day. The tubes of the stomach were very much distended by granular matter, and also contained cells which were larger and more granular than natural. In about two feet of the small intestines which I had the opportunity of examining, the mucous membrane was covered with a thick tenacious mucus, and only fragments of villi could be discovered, the greater part being quite denuded.

Under the microscope it presented the appearance of a sieve, being everywhere perforated by the enlarged and thickened openings of Lieberkühn's follicles. (See plate 4, fig. 1.)

The first effects of the scarlatina poison upon the stomach seem to be to congest the blood-vessels and to strip the epithelium from the tubes and the surface of the organ, at the same time that the tissues are softened. The tubes are greatly distended with granular and fatty matters, or with cells intermixed with granules; whilst in other cases they are lined by a newly-formed membrane. Sometimes no normal cells can be distinguished; in other cases they are present, but are scattered irregularly. After the second or third week the tubes are found less distended, their closed ends are still loaded with granular matters, which greatly obscure the gastric cells, but these become more evident towards the free surface of the mucous membrane. The cells at this period are sometimes very large, sometimes loaded with fat, or coated with granules, and seem still to have but little adhesion to the basement membrane, as they readily separate from the tubes, although they adhere closely to each other.

The effects of inflammation upon the intestine seem, in slighter cases, to consist in the effusion of granular and fatty matters into the mucous membrane; but in more severe cases the tubes of Lieberkühn are often choked with epithelial cells, whilst extravasation of blood takes place in the villi; and these, with the rest of the mucous membrane, are loaded with small cells and granules. In one case the villi were completely destroyed, and the tubes of Lieberkühn were

greatly enlarged and distended by cells and granular matter. In some instances in which the pancreas has been examined, appearances of inflammatory action have been remarked in it.

As the preceding sixteen observations are, with one exception, all the *post-mortem* examinations I have been able to obtain of persons who have died of scarlatina, and, as in all of them the mucous membrane of the digestive tube was more or less inflamed, I think it probable that this condition is a general accompaniment of the fever. Since, however, the inflammation varied greatly in degree in different persons, and also in different organs in the same individual, it will, I think, be found that the intensity with which the mucous membranes are attacked varies according to the type of the epidemic, and the age and constitutional peculiarities of the person suffering from the disease. The severity of the affection of the stomach and intestines is not necessarily in proportion to that of the skin and throat; for in some of the above cases little redness was observed in the latter, when the former were intensely inflamed.

II.—DESQUAMATION OF THE EPITHELIUM OF THE STOMACH AND INTESTINES TAKES PLACE IN SCARLATINA.

It is somewhat difficult to prove, that after scarlatina desquamation takes place in the digestive tube as it does on the skin; for in the majority of cases, vomiting only occurs at the outset of the disorder, and I have not had the opportunity of examining the

matters ejected from the stomach in this stage of the disease. In Observation 15 I found casts of the tubes in the fluid vomited, and from this I anticipated the appearances presented on *post-mortem* examination. The chief reason upon which I ground the opinion that desquamation of the epithelium is of common occurrence, is derived from the microscopic examination of the contents of the stomachs of those who have died of the fever, and the following are examples of the forms of casts of the gastric tubes as they appear under these circumstances.

In Observation 1, there were in the stomach a few ounces of a brown-coloured turbid fluid which had an alkaline reaction. The thicker portion of the contents, when placed under the microscope, was found to consist of pieces of fine membrane, of cells, granules, and shreds of membrane. The pieces of membrane were everywhere dotted over with granules, some of which were of fat. They varied very much in size; some of them were $\frac{1}{500}$ part of an inch by $\frac{1}{3800}$ of an inch, and in many cases a few cells were attached to their surfaces. The cells of which the contents mainly consisted were very similar to those found in a healthy stomach. They varied in size from $\frac{1}{1200}$ to $\frac{1}{2200}$ of an inch, but were more generally about $\frac{1}{1500}$ of an inch in diameter; they were oval or circular in form, and flattened at the sides. They generally contained a nucleus and numerous granules, and were usually attached to fine shreds of membrane. After the addition of acetic acid the membrane became very transparent. (See plate 3, fig. 2.)

PLATE III.

FIG. 1 shows the appearances presented by the gastric tubes in the earlier stages of scarlatina.

t. The tubes greatly distended with fatty and granular matters.

g. A few glandular cells still visible.

m. The muscular coat.

co. Connective tissue between the muscular and peritoneal coats.

FIG. 2. Casts of the gastric tubes found in the stomach after death from scarlatina.

g. Appearance of glandular cells surrounded by granular matter.

c. Conical-shaped cells.

FIG. 3. The appearance of the gastric tubes after death from measles.

t. The tubes bulging in their outlines.

g. Glandular cells united together into masses.

n. Cells and nuclei in the inter- and subtubular spaces.

m. The muscular layer.

In this drawing neither the tubes nor the spaces below them are sufficiently filled with cells.

Plate 3.

Fig 1.

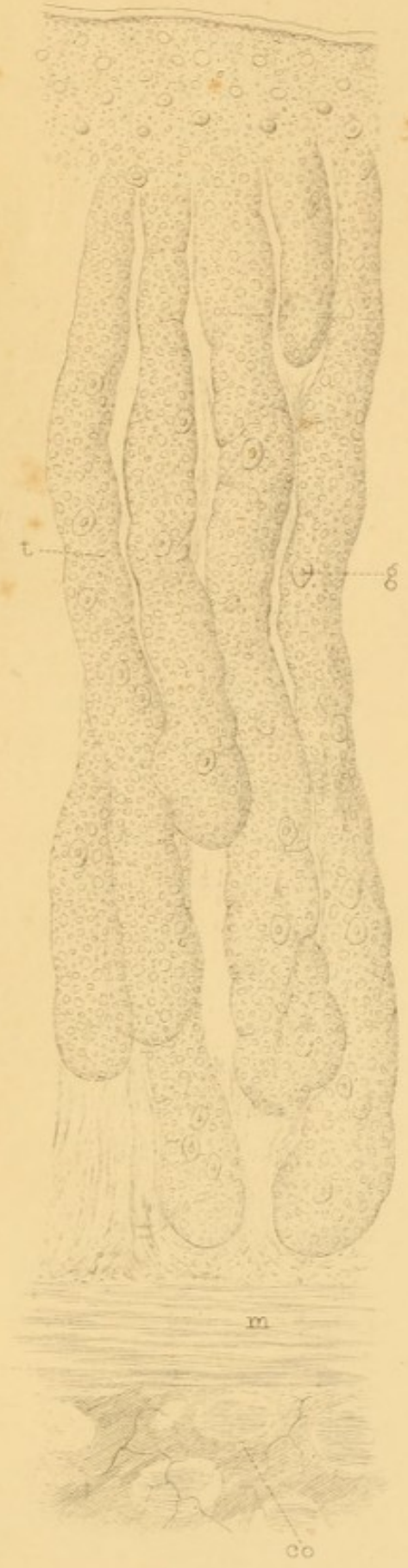

Fig 3.

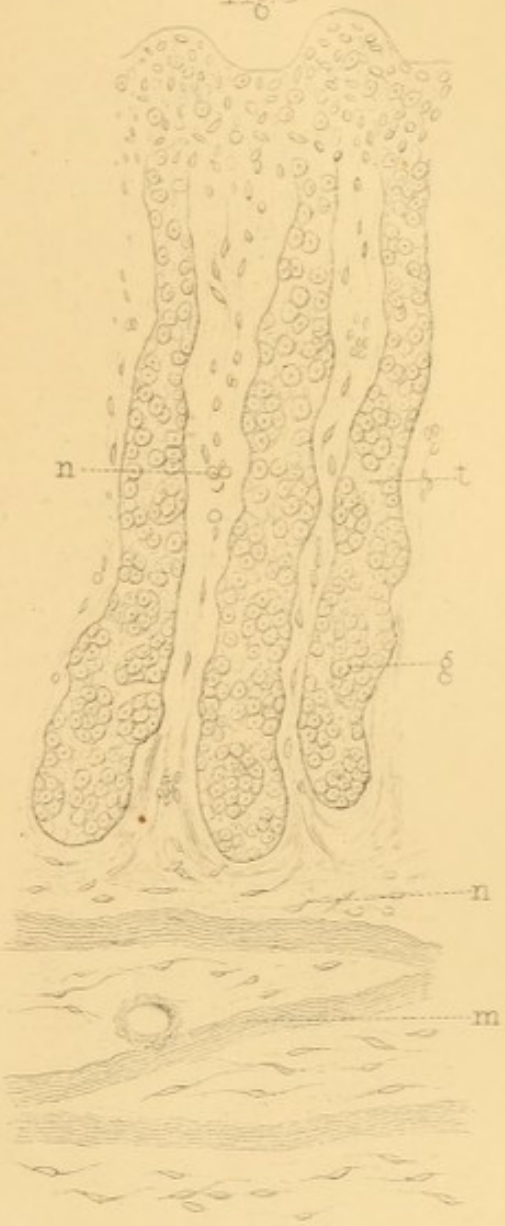

Fig 2.

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In Observation 12, the stomach contained a small quantity of turbid fluid like gruel. When examined by the microscope, this presented numerous pieces of membrane covered with cells, and separate cells with ragged pieces of membrane hanging to them. The pieces of membrane were of different kinds; some thin, and presenting no appearance of structure, but covered with granules and with a few nuclei adhering to them, whilst others seemed to consist wholly of cells bound together. In some cases it appeared as if the cells had been stripped from the tubes in a mass, the upper, wider, and flatter part being covered with conical, and the lower, longer, narrower, and more tubular portion being composed of round or oval cells. The length of these casts varied greatly, and the width was from $\frac{1}{600}$ to $\frac{1}{1000}$ part of an inch; but when their folds were flattened out by a compressor they were much broader. The free cells were like those of a healthy stomach, and varied in size from $\frac{1}{1000}$ to $\frac{1}{2000}$ part of an inch, but usually were $\frac{1}{1000}$ of an inch in diameter. Very few of them had a clear edge, but they seemed attached to ragged pieces of membrane, and thus two or three cells were often joined together.

In Observation 5, the contents were found to consist chiefly of masses of conical epithelium, stripped off from the mucous membrane in large flakes. The epithelial cells were overlaid with fine granular matter. There were also numerous casts of the tubes, composed of fine membrane.

PLATE IV.

FIG. 1 shows the appearance of the intestine in a case of scarlatina.

l. The enlarged openings of the follicles of Lieberkühn surrounded by cells.

The villi have been destroyed by the inflammation.

FIG. 2. Hæmorrhage into a sweat gland in a recent case of scarlatina.

The section is made in a slanting direction.

t. A section of the coiled tube of which the sweat gland is composed.

x. A tube greatly distended, and altered in shape.

c. The opening of a tube. The opening is irregular in shape.

Plate 4

Fig 1

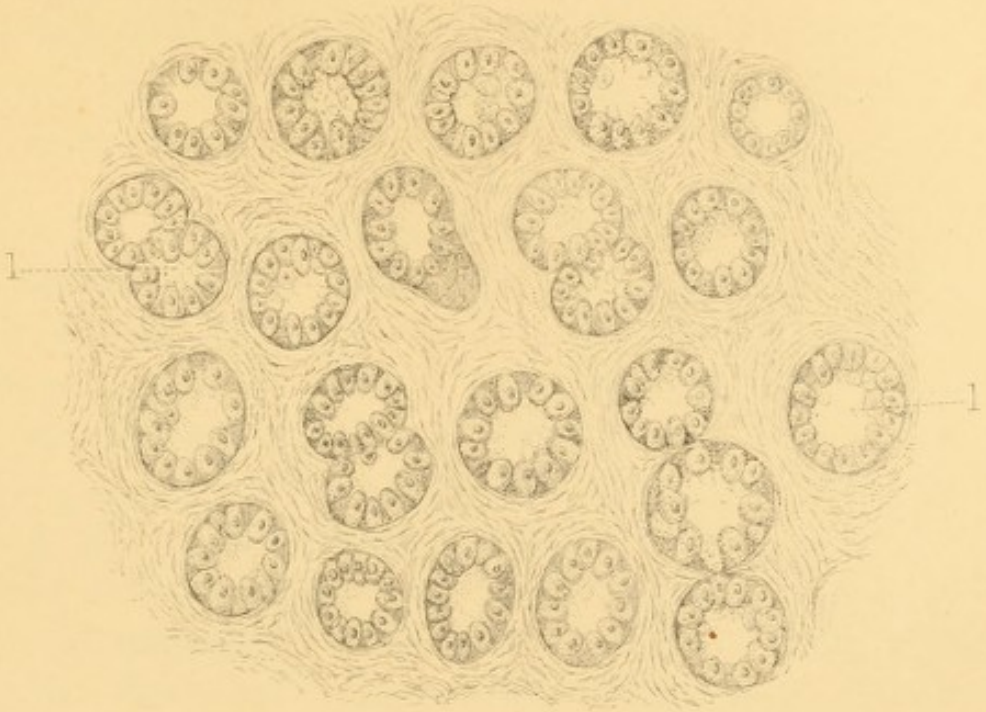
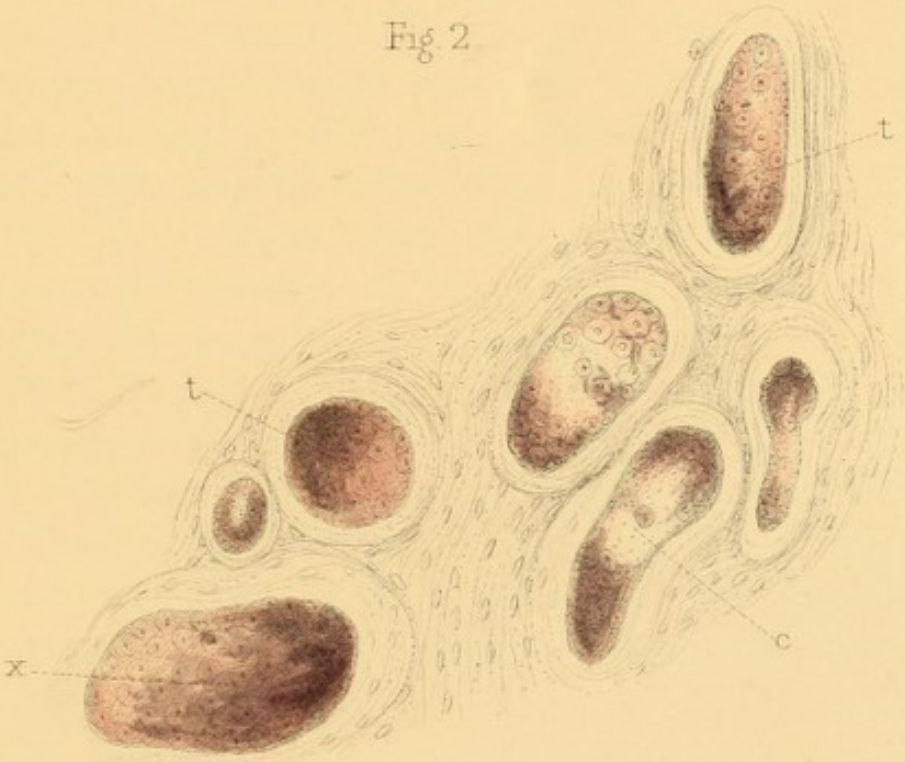


Fig 2



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III.—THE CONDITION OF THE SKIN IS SIMILAR TO THAT OF THE MUCOUS MEMBRANE OF THE STOMACH IN SCARLATINA.

I have only examined the skin in three cases of scarlatina. In the first, death took place after a few days' illness, and the morbid appearances in the cutis consisted of slight extravasations of blood in the neighbourhood of the sudoriferous ducts. The rete mucosum was greatly thickened, and numerous round cells with large nuclei were everywhere visible, intermixed with the natural cells. The basement membrane of the sweat glands was thickened, and the epithelial lining so much increased, that in most cases it obstructed their channels. In some of the sweat glands, the coils composing them were loaded with coagulated blood, and were greatly and irregularly distended. (See plate 4, fig. 2.)

In the other recent case the appearances were similar, excepting that the external layers of the cuticle were stained with blood in minute patches, and the sweat ducts were also reddened; but there was no extravasation of blood either in the glands or cutis. In some of the ducts the epithelium was detached from the basement membrane.

In the case of a man who died in the third week of the disease the sudoriferous tubes were still choked up; but in the glands the epithelium seemed in many places detached, the basement membrane being bare, or covered only with ragged particles.

It will be remembered that the morbid condition in these specimens is similar to what has been before described as existing in the mucous membrane of the stomach, viz., an increase in the vascularity of the part, effusion of fatty and granular matters, and alterations in the epithelium, with but little affection of the other structures.

It is evident from the foregoing facts that in scarlatina the mucous membrane of the digestive tube is as generally inflamed as the skin. As we know that the particles thrown off from the skin are capable of reproducing the disease, and that the external surface of the body is therefore an eliminator of the poison, we are justified in looking upon the mucous membrane as performing a similar office.

The process of elimination in scarlatina differs from that in cattle-plague, inasmuch as in the former the gastric tubes continue loaded with granular matters for some time after the cessation of the fever. It is probable, therefore, that the poison is in the first instance deposited in the outer and inner surfaces of the body, and afterwards only gradually removed from the system.

But the question arises, how is this removal effected? No doubt, in part by means of desquamation, the old cells carrying away a certain amount of the effused material. This is not, however, sufficient altogether to account for its disappearance, as will be seen in the following experiment. Some sections were made of the mucous membrane of the stomach of a person who had died of scarlatina in the second week of the disease. When examined microscopi-

cally, the tubes were observed to be distended, and the cells very obscure; but, after digesting the sections in a weak solution of nitrate of potash at blood heat for some hours, a complete change in the appearance was produced. The granular matter was entirely removed, and a cavity could be seen in the closed ends of the tubes bounded on all sides by the cells with which the basement membrane was lined.

If, then, the granular material remains at the closed ends of the tubes after the layers of cells at their upper and free ends have come into contact, it is evident that desquamation alone is not sufficient to account for its ultimate removal. Its ready solubility in the saline solution naturally excites the suspicion that it may be resorbed into the circulation, and that in this way the mucous membrane is gradually restored to its normal condition.

We know that albumen in a state of solution, when injected into the veins of an animal, is eliminated by the kidneys; and, as in scarlatina, the urine becomes albuminous in the majority of cases in the second or third week,—the very time at which the skin and mucous membrane begin to lose the material deposited in them,—we may conclude, that in this fact we see an explanation of the method which nature takes to repair the injury inflicted upon the tissues by the disease.

The view generally taken is, that the albuminous urine results from congestion of the kidneys produced by the application of cold to the surface of the body, whilst the functions of the skin are enfeebled by the fever. But this seems contradicted by the well-known fact that, in many of the worst cases of albuminuria following scarlatina, the rash had been scarcely

observed, and that consequently the skin had been but little affected. In one epidemic in which dropsy was an unusually common sequence of the disease I paid especial attention to protecting every patient most carefully from cold, and yet the albumen appeared in the urine of numbers of those who had been thus vigilantly watched.

We must remember that we have not merely to account for the presence of albumen in the urine, as in cattle plague, cholera, typhus, and other blood disorders; but we have in scarlatina an accompanying irritation of the kidney, which is one of the principal causes of death. On dissection of a fatal case, we find general swelling of this organ from congestion of its vessels, and alterations of the epithelium of its secreting tubes, exactly analogous to what we have proved to take place in the skin and mucous membrane whilst the poison is being deposited in them. This is precisely what we might expect according to the view I have advocated; for if the poison is accompanied by acute inflammation of the tubes of the skin and mucous membrane in which it is first deposited, we might conclude that similar effects would be produced in the structures of any other organ which it may traverse in its elimination from the body.

It is generally remarked that the kidney is seldom implicated in cases of malignant scarlatina, and the following case may tend to explain the reason of this.

Observation 17.—A boy, aged eighteen, died on the fourth day of malignant scarlatina. The blood

seemed very fluid; the skin and even the cartilages of the trachea were deeply stained with it. But I could find no anatomical alterations either in the glands of the skin or in the tubes of the stomach excepting the dark-red colour of these structures.

This is the only case of scarlatina in which I have failed to discover structural changes in the skin and digestive canal; and if further observation should show that this is usual in the malignant form of the disease, it will serve to explain how it is so rare to find in it the subsequent affection of the kidneys.

I have entered upon this point at some length because it is one of practical importance, and not of merely theoretical interest. It is above all things necessary that we should in the treatment of disease distinguish between our friends and our foes; between those phenomena that tend to restore the structures of the body to their normal condition and those that only produce disorganization of the tissues. To the former I believe we must refer albuminuria after scarlatina; and the small amount of mortality that accompanies this condition, the comparative rarity with which serious kidney disease follows it, and the limited period during which it is liable to occur, all tend to favour the opinion I have advanced. Dr. Dickenson has recommended the free internal use of water as the best treatment for this complication of scarlatina, and from the results of my own practice I believe that all that is necessary in the majority of these cases is to guard the patient from cold and improper food, and to leave the kidney alone to free the system from the deposited material.

These anatomical changes in the mucous mem-

brane of the digestive tube are necessarily connected with alterations in the functions of the parts affected. In the earlier stages of the disease the stomach seldom shows any signs of *post-mortem* solution, and in one case in which I tested the contents they were alkaline and albuminous.

There is not, as might have been expected, any deficiency in the amount of the characteristic secretion of the stomach. I mixed two drachms of the gastric mucous membrane of a patient who had died of scarlatina with one ounce of distilled water, and after allowing it to stand for twelve hours at the ordinary temperature strained off the solid particles. The fluid thus obtained was acidulated with hydrochloric acid, and a cube of coagulated albumen, 10 grains in weight, was placed in it. This was digested for twelve hours at a temperature of 98° F., when only $7\frac{1}{2}$ grains remained, much softened and translucent at the edges. In a second case, $3\frac{1}{2}$ grains; and in a third, 5 grains of albumen were dissolved. The average amount of albumen digested was therefore $3\frac{2}{3}$ grains. But as in similar experiments with the mucous membrane of the stomach of eleven persons dying of other diseases there were on the average 4 grains of albumen dissolved, it is evident that in this form of eruptive fever there is but little deficiency in the secretion of pepsin.

We must therefore refer the impaired functional activity of the stomach not so much to any change in its powers of secretion, as to the inability of the tubes to discharge the gastric juice, on account of their being blocked up with cells and granular matters. The mucous membrane is no doubt in a

similar state of functional inactivity to the skin, in which the perspiration only gradually returns as the sweat glands become relieved of the materials obstructing their canals.

We can scarcely estimate the injury inflicted upon the pancreas and the glandular structures of the intestine, as we are not fully aware of the functions which these organs perform in a state of health.

As regards the absorbent power of the mucous membrane, I can only state that I have not as yet found the villi distended with fat in any case in which death had taken place in the earlier stages of the disease. In most dissections they appear to contain some fatty matters, but in a state of very minute division, and not in the form which is usually presented when the intestine is examined whilst digestion has been going on.

When we regard the number of organs affected by scarlatina, and the severity of the injury inflicted upon them, we shall have no difficulty in explaining why so many patients date the commencement of their complaints from an attack of this disorder. I know no other disease excepting cholera in which the after effects are so severe, or of such lengthened duration.

I have quoted the two following cases at present under my care, to show how long the injury to the digestive organs may endure.

Case 11.—A lady was attacked by scarlatina in 1863. There was sore throat with but little eruption on the skin. The fever was followed by diarrhœa,

which persisted when I was consulted two months afterwards. She was then exceedingly feeble, and unable to take much exertion, either bodily or mental. The tongue was white, and the appetite bad. The descending colon felt large, and was very tender on pressure. In spite of all treatment she remained subject to diarrhœa until the autumn of 1865, when it gradually subsided.

The digestion still, however, continues very feeble, and she has never recovered the strength and flesh she had before the fever.

Case 12.—A child, five years of age, suffered at the same time as the previous patient from scarlatina.

When I saw her she was exceedingly weak and anœmic. The tongue was white, and the appetite very bad. She had frequent attacks of vomiting and pain after food, and the epigastrium was very tender upon pressure. The bowels were much confined. These symptoms, although relieved by treatment, frequently returned for twelve months after the fever, and it was only very gradually that she regained her former state of health.

Here were two patients attacked by scarlatina at the same time; in the former the colon seemed chiefly to suffer, and in the latter the stomach; but in both it was long before the injured parts recovered the power of properly performing their functions.

I have shown that, even where there is but little eruption on the skin, there may be considerable inflammation of the mucous membrane, and when this occurs it is often difficult to diagnose the disease.

It is only by taking into consideration all the circumstances of the case that we can arrive at a satisfactory conclusion.

Case 13.—A young lady, about ten years of age, was affected with sore throat. I saw her on the second or third day after her attack, and found the tonsils much swollen, red and ulcerated, but I could discover no eruption on the skin.

In a few days the sore throat disappeared. A week afterwards she began to complain of severe rheumatism in the hips and knees, which prevented her moving about. About six weeks after the commencement of her illness I was again requested to visit her. I found that after the cessation of the rheumatism she had been attacked with violent pain in the abdomen. The cæcum and ascending colon, to which parts the pain was referred, were very tender on pressure. The pulse was rapid, the tongue brown and dry, there was intense thirst, and no appetite for food. The urine was high coloured, but contained no albumen. Under the remedies employed the pain and tenderness gradually subsided, and the fever disappeared; but many months elapsed before she regained her former state of health.

In this case the affection of the throat, followed by rheumatism of the joints, induced me to believe the case to be one of scarlatina, an opinion which was strengthened by the circumstance that this disease was at the time prevalent in the neighbourhood. The subsequent affection of the large intestine was an additional confirmation of the truth of the diagnosis.

I believe that as soon as practitioners realize the fact that the kidneys are not the only internal organs implicated in this disorder, they will be able to explain numerous cases which at present appear to be anomalous.

I have had, unfortunately, only one case of measles in which I had the opportunity of examining the mucous membrane of the stomach with the microscope.

Case 14.—A child, after the usual premonitory symptoms, presented the ordinary rash of measles. On the first day of the eruption it was attacked by convulsions and died within twenty-four hours. The gastric tubes were filled with epithelial cells agglutinated into masses. The cells were more obscure in their outline than in the natural condition. The tubes were less readily moved upon each other than is usual, and between and below them were numbers of nuclei. (See plate 3, fig. 3.) The intestines were not examined.

In this case, therefore, the inflammation was not confined to the skin and mucous membrane of the respiratory organs, but the digestive tube was also affected. The appearances differed from those observed in scarlatina, inasmuch as the secreting tubes were not distended by albuminous material, and the normal epithelium was not removed by desquamation. But there were traces of inflammation between the tubes, and besides the purely tubular gastritis of scarlatina, there was also intertubular inflammation of the membrane.

I have had no opportunity of examining the condition of the skin in measles, but from the appearance of the rash in elevated patches, I should conclude that the morbid changes would be presented between the sudoriferous glands and ducts; whilst from the small amount of desquamation, and the early resumption of the functions of the skin, I should expect that there would be but little alteration in the basement membrane and an absence of granular deposit in the sudoriferous tubes.

If the secreting tubes of the stomach and skin are not blocked up with albuminous matter we cannot expect to find albumen in the urine; and we do not therefore usually meet with it in measles. But I have frequently observed about the disappearance of the rash a very peculiar smell in the urine, and I therefore suspect that the poison of the disease may be of a volatile nature.

It may be supposed that the lungs, whose office it is to eliminate gases from the system, would free the body from any abnormal volatile substance produced during the fever; and in the passage of this through these organs, inflammation would be liable to be excited in them. Now, we find in measles that pneumonia is the chief cause of death, just as congestion of the kidney is in scarlatina; and consequently we might conjecture that in the former disease the irritating material is of a volatile nature, and that the organs of respiration are the outlets by which its escape from the system is effected.

Further observations are much required as to the state of the bones and glands in measles. The frequency with which these parts are affected after

this disease would seem to show that deposits may occasionally occur in them as well as on the surface of the body and the mucous membranes.

This idea is strengthened by what we observe after other epidemics.

For instance, it not unfrequently happens that tubercular disease of the lungs appears in persons previously healthy, so immediately after an attack of small-pox or typhoid fever, we are led to refer it to morbid matter deposited during the progress of the fever. It may be urged that the tubercle results either from the weakness of the general health, or from the injury inflicted upon the digestive organs. But against this stands the fact that some structures are more liable than others to be affected after different eruptive fevers. Thus scarlatina is not so often followed by pulmonary phthisis as typhoid fever is; and yet in the former the whole digestive canal is inflamed, whereas in the latter the morbid action is chiefly limited to the lymphatic system.

The injury inflicted upon the digestive canal by measles is often of a serious nature. I have frequently met with cases of obstinate dyspepsia in which the first symptoms had succeeded this disorder; and much of the debility and ill-health that so often follow it are, I believe, to be attributed to chronic gastritis set up by it.

The existence of the ulcerations of the intestines so generally met with in typhoid fever would naturally lead us to expect important inflammatory affections in the other parts of the digestive canal. Such is by no means the case, for of nine dissections in which

I have examined the stomach with the microscope, only two presented serious anatomical changes in that organ. The morbid appearances are described in the following observations.

Observation 18.—A man, aged thirty-six, died of typhoid fever. The stomach was large, and much congested in the cardiac region. The gastric tubes were loaded with a confused mass of granular matter and cells. The cells varied from $\frac{1}{3000}$ to $\frac{1}{2000}$ part of an inch in diameter. The tubes seemed united together, and the spaces between and below them were occupied by cells and nuclei. The basement membrane of the tubes was greatly thickened.

The tubes of Lieberkühn were also filled with cells of the same size and appearance as those in the gastric tubes, and the intestinal villi were unusually crowded with nuclei.

In a second case similar appearances were observed, but in a less degree. In the remaining seven cases the gastric tubes were readily separated from each other, and there was no collection of cells or nuclei between or below them. The tubes were filled with granular matter and cells, but they were not distended with their contents. The cells were generally of large size, and there were none of the small cells that usually accompany tubular gastritis. The blood-vessels were large, and filled with blood. I was struck with the presence of an unusually large amount of fat; it seemed to be intermixed with the granular matter, and in some cases the cells were covered with it.

In the cases in which I examined the pancreas I

found its cells of normal appearance, but soft and easily broken up.

The only morbid change in the intestinal villi was in the presence of dark-coloured matter in their free ends, but this was only occasionally observed. In one instance I found the villi corrugated and shrunk. They often contained fat, and in two cases I found crystals adhering to them. The preparations had been mounted in glycerine, and the crystals were very minute and flat. When viewed by transmitted light they looked like needles, but when "Wenham's Condenser" was employed their flat surfaces were readily detected.[1]

I carefully examined the skin from different parts of the body, with the view of detecting alterations in its secreting glands. The sudoriferous ducts seemed to be more open than usual, but in the mucous membrane of the sweat glands the nucleated cells were normal in size and shape. In one case I had the opportunity of investigating the state of the skin at a typhoid spot, but I failed to discover in it any structural change. The spot appeared to be formed by the staining of the part with blood pigment.

But it may be asked whether the large amount of granular matters found in the gastric tubes is not a proof of the previous existence of inflammation. I think not; for in all recent inflammations we find enlargement of the part affected. In four of the cases of typhoid fever I carefully scraped off the whole mucous membrane of the stomach; and on the average its weight was only 580 grains.

[1] These crystals were probably leucine. Frerichs mentions this substance as occasionally present in the bile in fevers. Vol. I. page 175 (Sydenham Society's Edit.)

As the average weight of the gastric mucous membrane in seventeen males who had died of other complaints (exclusive of cancer) was 1035 grains, it is evident that in typhoid fever the mucous membrane loses nearly half its bulk. The greatest weight of the mucous membrane of the stomach in any of the four cases of typhoid fever was 630 grains; and the smallest amongst those who had died from other diseases was 900 grains. The diminished weight of the cases of fever had not, therefore, arisen from the inclusion of any unusual case, but would seem to be a phenomenon connected with the disease.

Taking into consideration this loss of bulk with the unusual amount of oily matter in the tubes, I am inclined to attribute the granular matter to disintegration of many of the gastric cells that were in an active state when the patients were attacked by the disorder.

Not only is the gastric mucous membrane diminished, its activity is also impaired in typhoid fever. I performed in seven cases the same experiment before described, in order to test the amount of pepsin. In three of these the albumen was not affected, but had rather gained weight by absorption of the fluid in which it was placed; in two a small quantity was dissolved; in the remaining two an ordinary amount of digestive power was observed. The average loss of weight of the albumen was 1 grain. As the average amount dissolved in other cases (exclusive of cancer) is 4 grains, we see that the functional activity of the stomach is much impaired in this disorder. Of the two cases in which a normal amount of digestive power was present, one died from perforation of the intestine, and the

patient may have been, therefore, convalescent from the fever at the time of death; in the other I was told there was a good deal of purple rash on the face and chest, the tonsils were both enlarged, and there was inflammation of the pharynx. As I did not see this second case during life, nor the *post-mortem* examination, there may have perhaps been a mistake in classing it as typhoid fever, especially as the mucous membrane furnished one of the exceptions to the ordinary appearances.

From the remarks just made we see that the actions excited in the human system by typhoid fever are in some respects the reverse of those produced by scarlatina. In the former there is a deficiency of cell formation; the latter is characterised by increased growth on all the mucous surfaces; in typhoid fever, judging from the condition of the stomach, functional disturbances arise from diminished formation of the secretions of the glands; in scarlet fever from obstructions to their outlets.

In the description of the appearances in the mucous membrane of the intestines in typhoid fever, I have purposely confined my observations to what may be remarked in the upper portion of the canal. But we must remember that in nearly every case a deposit of what is termed "typhous matter" takes place in Peyer's patches, or in the solitary glands of the lower part of the small intestine; that after a time softening and ulceration of the membrane occur; and that, either in this way or by resorption into the circulation, the deposit is eliminated, and health in the more fortunate cases is restored.

I have had no opportunity of examining with the

microscope the alimentary canal in persons who have died of small-pox, but there seems little doubt that the stomach and intestines generally present signs of inflammation. Cases are mentioned by Dr. Fox, in which the gastric tubes were found greatly altered in their structure. Gastro-enteritis is mentioned by Andral and many others[1] as frequently occurring in this disease.

It is unnecessary to point out that the poison of small-pox is, after its deposit in the skin, removed partly by ulceration, and probably also, as seen in the "secondary fever," by absorption into the system.

The foregoing facts seem to me to justify the opinion that the digestive canal acts as an eliminator of the poison of eruptive fevers, as well as of those that give rise to the more formidable epidemics we before considered.

In the eruptive fevers the morbid material is not removed at once from the system, but is deposited along with fat and albumen, in the skin and mucous membranes. It is probable that at first it is in an immature state, for when we have, as in small-pox, an opportunity of testing its action, we find it to be incapable of reproducing the disease. The structure in which the deposit takes place varies in different fevers; in scarlatina, the basement membrane of the gastric and intestinal glands is the part selected; in typhoid fever, the lymphatic system is chiefly attacked.

[1] Dr. Murchison On the Resemblance between Cattle Plague and Small-pox. *Lancet*, Jan. 13, 1866.

It may be assumed that the intention of nature, in temporarily withdrawing the poison, is to prevent the dangerous effects which its accumulation in the blood would be apt to produce. Consequently it is not sufficient that it should be only determined to the surfaces of the body, but it must also be deposited in such a condition that its immediate resorption should not take place. Thus, if the blood be incapable of proper coagulation either in scarlatina or small-pox, although the eruption may appear on the skin, the poison is not deposited in a solid form, and, from its immediate resorption, the dangerous symptoms associated with the malignant forms of these diseases are produced.

After the cessation of the fever, the poison is gradually removed from the system along with the coagulated albumen with which it is deposited. This is chiefly effected by ulceration or the analogous process of desquamation, but in most cases a portion is also resorbed and removed by some of the emunctories of the body.

The inflammation set up by the poison is apt to give rise to serious structural changes, both in the parts in which it is deposited, and also in the organs through which it is eliminated. This is more especially observed in the digestive canal, and numerous long-standing and obscure cases of deficient nutrition may be traced to the eruptive fevers. It is, I think, probable that many of the sequelæ of these diseases may arise, not only from the dyspepsia produced by them, but also from the deposition of the poison in unusual places.

The principles here laid down may be applied to

other diseases than those we term fevers. In pyœmia, erysipelas, diphtheria, and a number of other disorders, the stomach and intestines have been frequently described as inflamed. In what other way can we explain the fact that, after the injection of putrid substances into the veins of animals, the intestinal canal has generally been found inflamed? Or how can we account for the circumstance that every one who has investigated the stomach microscopically has discovered it to be affected in so many of the acute diseases of other organs?

The animal body, besides being exposed to receive poisons from without, possesses such a complex chemical apparatus in its various glands, that injurious materials must be very liable to be produced by their derangement. It seems, therefore, a necessity that some part should be endowed with the power of eliminating materials that may be incapable of expulsion by the ordinary emunctories. The design in selecting the digestive canal for such a purpose is sufficiently apparent. The activity of its glands supplies a sufficient amount of fluid to carry off, and its position affords a ready exit for any noxious matter. In addition to this, we have already seen that the stomach exercises chemical powers over substances submitted to its action, and thus renders them capable of elimination through organs which would be otherwise incapable of removing them.[1] Above all, the inflammation of the mucous membrane tends to stop the introduction into the blood of fresh material, at a time when the decompositions set up by the fever are going on within the system.

[1] See page 39.

CHAPTER V.

CHRONIC GASTRITIS.

The most common disease to which the stomach is liable is chronic gastritis, and it is one which lays the foundation of many of the other affections of this organ. In addition to this, we shall find that it is as generally an accompaniment of chronic diseases in other important viscera, as we before found subacute gastritis to be in fevers. There can be no doubt that it often results from the same causes as the other affections it accompanies, and that, by impeding nutrition, it hinders or protracts the recovery of those cases in which it may be present.

There are various morbid changes produced by chronic inflammation in the gastric mucous membrane, the exact nature of which has produced much discussion. We may, however, generally refer the differences of opinion upon this as on other diseases of the stomach, either to the fact that the microscope has not been employed in their investigation, or to the use of imperfect methods of preparing the specimen for examination.

The morbid appearances visible to the naked eye in the mucous membrane of the stomach are, an increased quantity of mucus, congestion of the blood-

vessels, changes of colour, thickening, and an uneven appearance of the surface, termed "mammillation."

We often find the lining membrane of a stomach affected with chronic gastritis studded with minute holes, and, on employing the microscope, we perceive that these are due to enlargement of the little pits into which the secreting tubes open, and that each pit is surrounded by a zone of congested blood-vessels. On making sections of the membrane, the blood-vessels between and below the tubes are also found to be increased in size, and not unfrequently in a thickened or fatty condition. In some cases the smaller arteries are chiefly affected, but where long-continued congestion has been kept up, the veins are usually thickened and their calibre increased.

The changes in colour are mostly connected with the deposition of a black or grey pigment, between and within the gastric tubes. This pigment is chiefly observed in the shape of granular matter, and there can be no doubt, as stated by Dr. H. Jones, that it arises from altered *hæmatine*.

We can with the microscope trace two kinds of morbid changes affecting the secreting tubes; one of which may be named *chronic intertubular*, and the other *chronic tubular gastritis*. Both forms may be accompanied by increased thickness of the basement membrane.

The amount of thickness varies much in different cases, but in all it is greatest at the closed ends of the tubes.

In *chronic intertubular gastritis* the tubes are firmly adherent to each other, the spaces between and below

PLATE V.

THE APPEARANCES PRESENTED IN CHRONIC GASTRITIS.

FIG. 1. Chronic intertubular gastritis.

t. The tubes filled with cells and granular matter.

co. Increased connective tissue between and below the tubes.

FIG. 2. First stage of chronic tubular gastritis.

t. The tubes irregularly filled with cells and granular matters.

v. Enlarged and thickened blood-vessels.

FIG. 3. Second stage of chronic tubular gastritis.

t. The remains of the tubes wrinkled and almost empty.

d. Dark cells scattered here and there between the tubes.

v. Enlarged and thickened blood-vessels.

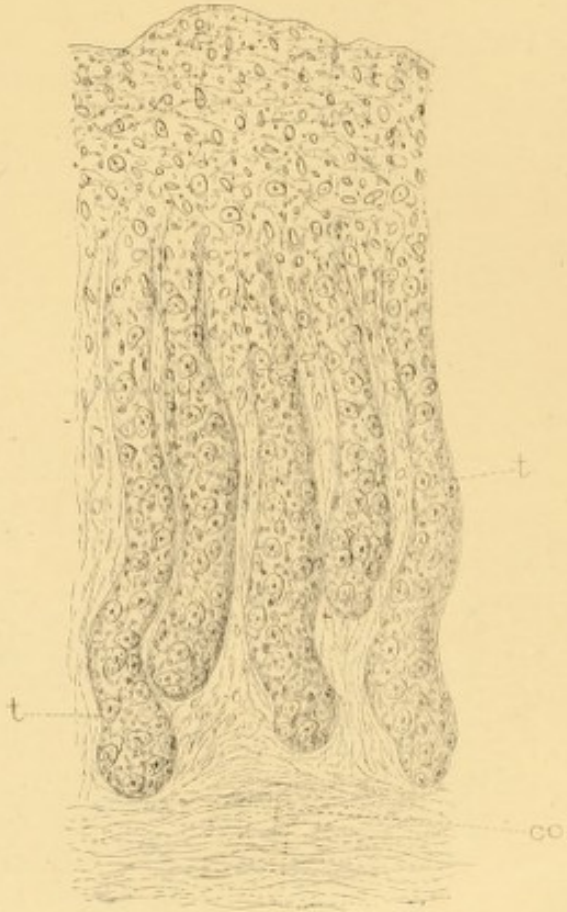
Figs. 2 and 3 were drawn from specimens taken from near the edges of chronic ulcerations of the stomach.

Plate 5.

Fig 2

Fig 3

Fig 1



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them being occupied either by an increased amount of connective tissue, or by nuclei, cells, and fibres. The tubes themselves, in the earliest stage, are in some cases distended by a confused mass of cells and molecular matters, and their contents, more especially in the pyloric region, often project from their open ends, giving them the appearance of dark granular villi. At a later period of the disease, either the distinction between the tubes is lost, and a line of fatty cells alone remains to point out their original position; or the mucous membrane presents a series of flask-shaped bodies loaded with cells, fatty and granular matters in the site of the bases of the tubes; the rest of the mucous membrane being reduced to a tissue, in which no vestige of glandular structure can be recognised. (See plate 5, fig. 1.)

Chronic tubular gastritis is a less frequent form of the disease. In this the tubes remain separate from each other, but they are generally found more or less empty; a few cells, or a little granular matter, alone occupying their interior. At a later period the tubes are lessened in calibre, the basement membrane often appearing wrinkled; and in other cases their distinctness disappears, and a few scattered cells are alone visible. (See plate 5, figs. 2 and 3.)

These alterations produced by chronic gastritis are most frequently met with in the pyloric region; indeed, in the bodies of few persons above the age of forty who have died in our London hospitals, can the mucous membrane at this part be said to be in a perfectly healthy condition.

In the pyloric region we also frequently meet with another morbid appearance, first described by Dr. H.

Jones, viz., an enlargement of the solitary glands of the stomach. These form round or oval masses of small cells and nuclei, surrounded by a distinct membrane. They are usually situated between the secreting tubes and the muscular coat. Occasionally they present a cavity, bounded by a thick layer of cells and nuclei; and the secreting tubes in their neighbourhood are very frequently pushed aside and atrophied. (See plate 8, fig. 1.)

Cysts are also of very frequent occurrence in the pyloric region, and are to be referred to chronic inflammation of the mucous membrane. Two varieties of these formations may be recognised: one appears to be produced by the evacuation of the contents of an enlarged solitary gland, the opening through which it had been emptied having subsequently closed; the other seems to arise from the distension of a tube, the outlet of which has been obstructed. The latter may be distinguished by its being lined with epithelium, and being generally surrounded by the remains of glandular structure.

In the forms of disease just described, the inflammation is confined to the mucous membrane; but it is not uncommon to find the subjacent coats of the stomach also affected. This generally occurs near the pylorus, and along the smaller curvature. Sometimes the whole of the pyloric region is diseased, at other times the morbid changes are limited to a patch one or two inches in diameter. In these places the coats of the stomach feel hard, tough, and leathery, and the mucous membrane does not retract when divided. The connective tissue below

the mucous membrane is much thickened, and the muscular structure is often fibrous. The peritoneal coat and its subjacent connective tissue are also much increased in thickness. The mucous membrane is usually diseased over the parts affected.

I have inserted the next case to show that this condition may affect the whole of the organ, and that it may arise from an injury to the epigastrium.

Case 15.—A gentleman, who had for some years been subject to bronchitis, fell overboard whilst superintending the repairs of a ship. He was swept away by a strong tide, until he grasped the paddle-wheel of a steamboat lying at anchor. On this he rested himself, bearing his whole weight upon the epigastrium. He remained in this position for about half an hour, and was much exhausted when rescued. On being carried home, he complained of pain in the region of the stomach; but I could discover nothing abnormal on examination. I attended him for many months, and, erroneously supposing that the pain in the epigastrium was caused by the liver being pushed downwards by an emphysematous state of the lungs, I directed all my attention to the relief of the chest.

Within nine months after the accident he died, gradually losing flesh and strength. He complained to the last of the pain in the stomach, and for a few weeks before death he vomited all his food. On *post-mortem* examination, the stomach was found like a cricket-ball, round and hard. It did not collapse when cut into, from the great thickening of its coats. The mucous membrane appeared healthy to the naked eye.

Morbid changes are also very frequent in the duodenum. We often find the upper part of the intestine studded with the enlarged openings of Brunner's glands. These are in some cases greatly increased in size, and on microscopic examination their acini are seen to be distended with epithelium, which is often in a state of fatty degeneration. In others the fibrous tissue between the acini is increased, and the glandular structure is in a state of atrophy.

The villi present various alterations in chronic duodenitis. Sometimes the basement membrane is thickened, and the villi are loaded with nuclei; in other cases they are thin and transparent, as if wasted.

As we know so little about the functions of this part of the intestinal canal, it is useless to speculate upon the effects which such alterations in structure may produce upon nutrition; but there can be no doubt that they are of an important nature.

Since chronic gastritis is apt to accompany a number of the diseases of other organs, it is no wonder that a great variety of symptoms should have been attributed to it. I purpose, however, to mention only those that seem to arise more directly from the gastric affection.

In the more severe cases of this complaint pain is seldom absent, but in the slighter there is only uneasiness. When pain is present, it is chiefly felt at the epigastrium; sometimes it affects the back or right hypochondriac region. It is increased by food, and generally also by stimulants and hot liquids. As soon as the organ is empty the pain subsides, but is often followed by a craving, or sinking sensation

at the pit of the stomach, which induces the patient again to have recourse to food.

There is almost always a certain amount of tenderness at the epigastrium on deep pressure, and this will be found to be present even when no actual pain is experienced during digestion. In using this as a test for chronic gastritis, care must be taken not to confound this tenderness with the increased sensation of the skin so common in nervous and hysterical subjects.

Vomiting is seldom a prominent symptom, but nausea is very general. It is not uncommon for violent retching to take place in the morning, and for a quantity of mucus to be then rejected. I have very frequently examined this mucus with the microscope, and have usually found particles of food, along with torulæ or other forms of vegetable fungi entangled in it. When there is no vomiting it is common for the patient to complain of mucus at the back of the throat, which produces a difficulty of swallowing and a choking sensation. This symptom is generally associated with acidity, and seems to arise from irritation of the pharynx by the acrid eructations.

Waterbrash has been referred by authors to different causes. Two forms of it may be recognised. In one the patient states that the mouth is suddenly filled with water, but the epigastric pain, if it exists, is not relieved by the discharge. When examined microscopically, the fluid will be found to contain only the epithelial cells of the mouth. It is, in fact, only an increased flow of saliva, produced by gastric irritation.

The second form is preceded by violent pain in the epigastrium, or in some other part of the abdomen, and is immediately relieved when the fluid is rejected. In a case of this kind I examined the liquid with the microscope, and found small epithelial cells, which, from their shape, and from their being united into small casts, I believed to have come from the little pits on the surface of the stomach. In another instance the fluid was faintly acid, and contained a small amount of albumen. When mixed with baryta, it afforded a bulky precipitate soluble in acetic acid. It also gave a precipitate with nitrate of silver, the greater part of which was soluble in dilute acids. I was not able to carry out the experiments further; but, from the above reactions, I suspect that it contained a salt of phosphoric acid. From the relief afforded by the ejection of the liquid, and from its containing epithelial cells of the gastric tubes, I think it probable that, in this form of the disease, the symptoms are produced by the secretion of some irritating salt by the stomach.

The appetite in chronic gastritis is usually deficient and irregular. In many cases, one of the earliest symptoms is a dislike to digestible food, and a preference for inappropriate articles of diet.

Thirst is very generally complained of. It is usually felt after food, and is increased towards evening.

Most patients are troubled with acid eructations. But the question arises, are we to consider *permanent* acidity as an invariable indication of an inflammatory condition of the mucous membrane of the stomach? In order to ascertain whether this

is the case, I produced vomiting in a number of dyspeptics, and invariably found that when acidity was constant after meals, a considerable quantity of tenacious mucus was rejected, often mixed with torulæ and particles of food; but that in cases in which this symptom was only occasionally experienced, or was felt in a slight degree, the mucus obtained from the stomach was thin and small in quantity. The vomiting was excited by tickling the fauces, shortly after a tumblerful of warm water, or of infusion of chamomile, had been taken. Vomiting was easily induced in cases of acidity, but considerable difficulty was often found in exciting it in persons in whom the symptoms were only those of feeble digestion. The experiments were always conducted in the morning before breakfast. As we know that an increased secretion of mucus is due to a congested or inflammatory state of a mucous membrane, we are justified in concluding, that when acidity is constant after meals, it is usually an indication of an inflamed or congested state of the stomach.

. But in addition to this, it is probable that sometimes the gastric juice is either abnormally acid, or is secreted in increased quantity.

Thus, in some cases of gout, in which acidity is a prominent symptom before an attack, it disappears as soon as the joints become affected. In certain persons, in whom a renal calculus has acted as a cause of irritation, the acidity has been observed to disappear as soon as the stone passed from the ureter. We know that urea and other substances, when present in the blood, have been detected in

the contents of the stomach, and there is, therefore, nothing improbable in the supposition, that if the blood be charged with lactates or urates, these acids may be separated by the gastric glands.[1]

The patient is generally subject to flatulence, but not to the extent that we meet with in some other forms of dyspepsia. Distension is chiefly complained of when there is great venous congestion, and is, in all probability, due more to the derangement of the liver and intestines than to the state of the stomach.

The tongue furnishes us with no certain information as to the condition of the gastric mucous membrane. In the slighter cases it is generally furred, with red papillæ projecting through the fur, or its surface is of a bright red colour at the tip and edges.

The bowels are usually torpid, and there can be no doubt, that in many persons the affection of the stomach is a consequence of the imperfect action of the cæcum and colon. In another class of cases, diarrhœa is a common and troublesome symptom, and probably arises from the extension of the inflammatory action to the intestines, or from the irritation caused by acid chyme.

The urine is ordinarily scanty, and becomes turbid on standing, from being loaded with salts of lithic acid.

The skin is dry and harsh, and is not unfrequently covered with an eruption. In other cases the first symptom of improvement is a return of the perspi-

[1] See page 23.

ration. Affections of the skin are most frequently met with in persons liable to gout.

The pulse in severe cases is quickened, especially towards evening, but in the milder forms of the complaint, it does not rise above the normal standard. In most persons who suffer from gastritis, there are irregularities in the circulation, such as coldness of the feet and flushings of the face or ears.

Notwithstanding the great number and variety of the symptoms of chronic gastritis, the cases of this disease may be readily divided into three classes, viz., those in which the prominent symptom is pain in the epigastrium, continuing during the whole or the greater part of digestion, and relieved only by the termination of that process, or by vomiting; those in which acid eructations after food are habitually experienced; the third class comprises all in whom there exists pain in the stomach which is relieved by the rejection of a watery or mucous fluid.

In the first class are included most of the cases in which a local thickening of all the coats is produced by chronic gastritis. Many of these terminate in ulceration, and after death a sore is discovered in the stomach, surrounded by a considerable margin of condensed tissue. In others it will be found that the patient has previously suffered from "bilious attacks," or some other variety of subacute gastritis; or that he has been subject to some less severe form of dyspepsia, which has been aggravated by irregularity in diet, or improper treatment. It will be therefore necessary, not merely to relieve the symptoms of which he is complaining, but also

afterwards to overcome the disease of which they are the result.

The occasional application of a few leeches, or of a small blister to the epigastrium, is usually the most effectual treatment. If the pain be unaccompanied by acidity, the nitrate or citrate of potash, in combination with morphia and hydrocyanic acid, will soothe the irritable mucous membrane; but if acidity be usually present, it is better to combine the sedatives with magnesia, soda, or potash.

The bowels should be carefully regulated with aloes, or rhubarb.

The diet is the most important consideration. If the patient's general health permit, he should at first be confined to farinaceous food—gruel, sago, or arrow-root. These should be given in small quantities and frequently, and if the strength be reduced, beef-tea may be also allowed. As soon as the pain subsides, solid animal food with biscuit, or unfermented bread may be tried; but some time should elapse before a full and mixed diet is commenced.

Simultaneously with the improvement in the diet, bitter infusions in combination with alkalies may be prescribed, followed by some of the milder preparations of iron.

The treatment of the second class of cases, viz., where acidity is the prominent symptom, is much more difficult; both because the inflammation is of a more chronic character, and also from the fact of the patient's sufferings being less severe, he is not so much inclined to follow the instructions of his medical adviser, with the exactness and perseverance

required. The chief point in the treatment is to ascertain the cause of the complaint; for unless this be removed, all our endeavours to restore the gastric mucous membrane to a healthy condition must be fruitless.

It has been supposed by some writers, that persons affected with acidity have alway previously suffered from feeble digestion; and consequently, chronic gastritis has been described as a second stage of dyspepsia. Such is not, however, the case; for in the majority of cases, the disorder of the digestion commences with some form of inflammation of the gastric mucous membrane.[1]

The variety of gastritis we are now considering is comparatively rare below twenty, or in old age; it is commonly found between twenty and forty in the male, and between forty and fifty in the female. It is therefore most frequent in males at the period of their greatest vigour, and in females, when, from the cessation of the menstruation, the system is most liable to a state of plethora.

The connection between this form of dyspepsia and plethora is further shown by its chiefly affecting persons of a stout habit of body. Thus, whilst of dyspeptics of a spare form, 30 per cent. suffered from acidity, 40 per cent. of those moderately stout, and 51 per cent. of those decidedly fat, complained of it.[2]

In like manner, a full supply of animal food appears to favour its production. Thus, of those who only occasionally took animal food, only 26

[1] Note A, Appendix. [2] Note D, Appendix.

per cent. were affected with it; amongst persons using meat regularly once a day, the proportion amounted to 42 per cent.; and in those eating it more than once a day it reached 45 per cent.[1]

Of dyspeptics who were total abstainers, and of those who took malt liquors in moderation, the proportions of cases of acidity and of feeble digestion were nearly the same, viz., 38 and 37 per cent.; but where both ale and spirits were used in moderation, the proportion of acidity rose to 56 per cent.; and when spirits alone were taken, although in moderation, the number amounted to 67 per cent.[2]

I have been thus particular in pointing out the general connection between acidity and plethora, because the patient usually complains of debility, and tonics and stimulants are frequently resorted to in order to overcome this feeling. In many cases little more is required to relieve the disease, than to diminish the amount of animal food, and to withdraw all stimulants, or at any rate to increase out-door exercise; and without such measures medical treatment is often fruitless.

A very common cause of this complaint is the too frequent repetition of meals. The patient feels faint from the irritation of the mucous membrane, and forces down a further supply of food; which, although it affords temporary relief, only adds to the mischief. In such cases it is better to remove the craving by a dose of soda and ammonia, instead of still further adding to the mass of partially digested nutriment.

[1] Note H, Appendix.

[2] Note G, Appendix.

Imperfect mastication of the food is another very general cause of acidity, as well as of all other forms of indigestion. Thus, out of 100 healthy persons, only 19 were quick eaters; whilst of those affected with indigestion, 51 per cent. were in the habit of imperfect mastication.[1]

With regard to the nature of the diet, mutton and chicken are in bad cases the only kinds of animal food that can be digested without uneasiness; as the patient improves, tender beef may be tried; veal and pork are quite inadmissible. All sauces and condiments should be avoided. There is a general belief that fish is easily digested; when used, it should be boiled and taken without sauces; the richer kinds, such as salmon, always disagree. When the complaint is severe, unfermented bread or biscuit is the best addition to the animal food; but as the inflammation lessens, potato and beet-root may be used; and after the acidity has subsided, the patient should accustom himself to a diet composed more of vegetables than of meat. All pastry, soups, or made dishes, are improper.

Farinaceous food should in the majority of cases, and in the more active forms of the disease, form the greater part of the patient's diet. At first it generally increases the acidity, but this symptom will soon be found to subside, as the stomach is relieved of the task of digesting the large quantity of stimulating material to which it has been accustomed.

The main difficulty in diet is in respect to stimu-

[1] Note E, Appendix.

lants. Many persons have been so long accustomed to their use, that they cannot or will not abandon them; and under such circumstances, a small quantity of brandy, well diluted with water, is most suitable. Malt liquors and wines of all kinds almost invariably disagree, except perhaps light claret or Burgundy.

Coffee and tea usually increase the complaint. In most cases coffee produces so much discomfort, that the patient gives up its use of his own accord. If tea be taken, it should be mixed with as little milk and sugar as possible. I have often recommended a decoction of taraxicum for the morning meal, in cases where the actions of the liver and kidneys are defective, and have found it answer remarkably well. The root of the plant should be sliced, dried, slightly roasted and ground, and afterwards mixed with about one-sixth part of its weight of the best coffee. In many cases the patient must substitute water, barley water, or milk mixed with lime water for tea and coffee.

Want of exercise has a most important influence in the production of this, as well as of the other forms of indigestion. Amongst healthy persons, 75 per cent. were found to be much out of doors; but of the dyspeptics, only 50 per cent. enjoyed a similar advantage. In the treatment of acidity, therefore, no amount of drugs, and no attention to diet, will restore the gastric mucous membrane to a state of health, if the patient persists in habits of inactivity.[1]

What is popularly termed "a cold" is a very

[1] Note K, Appendix.

frequent exciting cause of acidity. A slight wetting, the exposure to a draught, or a sudden change of temperature, which would produce rheumatism or bronchitis in persons predisposed to these complaints, sets up in others catarrh of the mucous membrane of the stomach. Strict attention to the skin is the best means of preventing such attacks. Cold or tepid sponging, and frictions with a brush or coarse towel should be used daily, and an even temperature should be maintained by warm clothing. When it can be borne, there is no remedy so useful as the Turkish bath; the large amount of acid which is removed from the system by its means tending materially to relieve the inflammation of the gastric mucous membrane.

In the treatment of acidity it must be remembered, that as the complaint subsides, a gradual change occurs in the state of the stomach. The mucous membrane ceases to be congested, but is still covered with the tenacious mucus it pours out. Consequently, although acidity is still experienced after food, it is less constant and also less in degree. At the same time the epigastric tenderness and the thirst diminish. The tongue is large, flabby and pale, and flatulence and distension after meals are more complained of than before. The urine, in place of being loaded with lithates, deposits phosphates or oxalate of lime. The surface of the body is cold and chilly, instead of being subject to attacks of burning heat. The management of this stage will be considered under the head of feeble digestion, and the remarks I have made upon diet, and those following upon the medical treatment of acidity, must be understood to refer

not to this stage of transition to feeble digestion, but only to the condition in which the symptoms of gastritis predominate.

Leeches and blistering to the epigastrium are seldom required in the treatment of acidity, as the free secretion of mucus tends of itself to prevent the more active forms of inflammatory action. The application of a counter-irritant like croton oil liniment, or of a stimulating plaster to the epigastrium is, however, almost always of service. In many cases a bandage of silk or flannel to the abdomen is of great value. This is especially the case with females; and I have known dyspepsia which had resisted medical and dietetic treatment disappear after the simple expedient of maintaining an even temperature over the abdomen had been resorted to.

Purgatives are the remedies most generally employed in this form of indigestion. The choice of the particular drug must chiefly depend on whether the symptoms seem to indicate that the gastric inflammation is associated with a similar affection of the duodenum, and consequently with congestion of the liver, or with an imperfect action of the colon.

If the upper part of the intestinal canal be chiefly in fault, the purgative salts are beneficial, especially when exhibited in the form of some of the natural waters; at other times, rhubarb or senna is more efficacious. Croton oil in minute doses has been highly recommended where the duodenum is affected, but the results of my experience are not in favour of its employment. I have generally found it better to keep up a gentle and continuous action

on the intestinal canal, than to attempt to relieve the portal congestion by violent purgation.

Affections of the colon seem to give rise to gastric disorders, partly by lessening the muscular motion in the upper part of the intestinal canal, and partly by producing impurity of the blood through imperfect excretion. When the constipation arises from want of action in this part of the intestine, preparations of aloes, or repeated and small doses of castor oil, are most suitable as aperients.

Next to purgatives, alkaline remedies are most useful. When the urine is loaded with lithates and the bowels are confined, the carbonates of soda or potash should be preferred. In some cases the extrication of the carbonic acid contained in these salts gives rise to troublesome flatulence and giddiness, and under such circumstances, either the liquor potassæ may be substituted, or the discomfort arising from their use may be prevented by the addition of ammonia. Preparations of lime are valuable when there is a tendency to diarrhœa, or when the presence of mucus in the alvine evacuations shows that the lining membrane of the intestines is affected.

As the active stage of the complaint subsides, the mineral acids will be found more efficacious in removing the acidity than alkalies, and in other cases bismuth better answers this purpose.

Tonics are almost always prescribed in cases of acidity, but in the earlier stages they seem to do but little good. In the decline of the disease, bitter infusions are useful, by improving the appetite and giving tone to the mucous membrane.

The cases included under the third class, viz., those in which pain behind the sternum or in the epigastrium is relieved by the ejection of mucus or of a watery fluid, are often very rebellious to treatment. When the liquid is rejected during digestion and consists of mucus, the throat and pharynx, which will be generally found inflamed, should be occasionally sponged with a solution of nitrate of silver or perchloride of iron, and the mineral acids or preparations of iron should be prescribed at the same time that the bowels are carefully regulated.

In the form of waterbrash in which the pain occurs when the stomach is empty, astringents are chiefly to be relied on. Kino, alum, logwood, and bismuth may be prescribed, with or without opium; but there is no remedy so generally successful as the nitrate or oxide of silver. One of these salts, in the form of a pill, should be taken at the time of the day at which the attack is most liable to occur. All irritating articles of diet, such as oatmeal, brown bread, &c., should be carefully avoided.

CHAPTER VI.

ON THE CONDITION OF THE STOMACH IN DISEASES OF THE HEART.

In diseases of the heart the morbid appearances in the gastric mucous membrane are more distinct than in any other malady. We must, however, remember that we only see these changes where the venous circulation has been retarded; for in other cases of heart disease no striking alteration can be remarked.

When we open the stomach of a person who has died of a disease of the heart, of such a nature as to prevent the free return of blood through the veins, we are at once struck with the dark and almost purple colour of its mucous membrane. This, in some cases, extends to the lower end of the œsophagus, and often affects the lining membrane of the intestinal canal. There may be frequently seen round, black patches of extravasated blood, or, in place of these, superficial ulcerations are met with in all parts of the organ, but most generally towards the pylorus.

The mucous membrane is usually covered with a layer of firmly-adherent mucus, which is generally thickest where the congestion is most intense. In some cases it is spread over the whole surface; in

others it is confined to the middle, or to the pyloric region.

There is seldom any *post-mortem* digestion, and when the mucus is removed, the membrane often presents a raw, uneven surface.

The whole organ has a firm, fleshy, thickened appearance; and it is, in reality, considerably increased in bulk. I carefully scraped off the mucous membrane in three males who had died of heart disease, and found the average weight amounted to 1026 grains; in three females who had perished from the same disorder, it was 800 grains. But as its average weight in fifteen males who had died of other diseases was only 864 grains, and in thirteen females it was 530 grains, it is evident that in heart disease the gastric mucous membrane is increased to about one-fifth beyond its normal bulk.

When we examine the middle and cardiac regions with the microscope, we do not find the evidences of disease so striking, as the naked eye would lead us to expect. If there has been much congestion, the sections of the mucous membrane have a confused appearance, from the large quantity of blood and granular matters everywhere present; but after being soaked for some time in weak spirit and water, the structures become more apparent.

In one class of cases the tubes are very readily separated by pressure, can be easily torn asunder by needles, and there is only granular matters between and below them. The tubes themselves are, in almost every case, of unusually large size, and are loaded with cells and granular matters.

The blood-vessels are always enlarged and dis-

tended; and in cases where the disease of the heart has been of long standing, their coats are considerably thickened. The capillaries surrounding the openings of the tubes are gorged with dark coloured blood, and from their congestion they make the margins of the pits on the surface very prominent.

Such were the microscopic appearances observed in the splenic and middle regions of the stomach, in nine cases out of fourteen in which death had taken place from congestive disease of the heart.

In the five remaining cases, the tubes in the splenic and middle regions adhered more or less closely together, the fibrous tissue was increased, and the inter- and subtubular spaces were occupied by granular matter, cells, and nuclei. The blood-vessels were enlarged and their coats thickened.

Generally the blood-vessels of the intestinal mucous membrane were much enlarged, and congested with blood. The villi were usually opaque with granular matters, and sometimes contained oil-globules, as if digestion were going on.

In the cases in which I examined the pancreas, the amount of granular matter seemed increased, and there was a greater quantity of fat than is ordinarily observed.

In order to ascertain the effects the congestion of the blood-vessels had produced upon the functions of the organ, I performed experiments similar to those already described with the mucous membranes of the stomachs of six persons who had died of heart disease. Three of these were males, and three females.

In one of the males the amount of albumen dis-

solved was 3·4 grains, in another 4·3 grains, and in the third 1 grain; the average amount being 2·9 grains. In seventeen males who had died of other diseases, the average loss of albumen was 4 grains.

Of the females, 2 grains of albumen were dissolved in one experiment, and in the other two the albumen, although soft and translucent at the edges, had gained in weight. This want of digestive power in the last-mentioned cases did not arise from decomposition, for the *post-mortem* examinations were made in the month of January. It is worthy of remark that, with the exception of those performed with the stomachs of persons who had died of cancer and typhoid fever, these were the only three instances out of forty-nine experiments in which no albumen was dissolved.

There is no doubt, therefore, that the long-continued congestion of the gastric mucous membrane not only produces anatomical changes, but also diminishes the characteristic secretion of the organ. The deficiency of secreting power is also shown by the number of cases in which the mucous membrane was unaffected by *post-mortem* solution.

In one instance I found numerous specimens of torulæ and sarcinæ in the mucus, and in another I detected with the microscope an abundance of phosphatic salts in the contents of the stomach. In this latter case there must have been a complete cessation in the secretion of acid, and digestion in both must have been greatly impaired.

In one case of heart disease I examined the tissues of the stomach chemically, and was struck with the large amount of lime contained. Although this is but a single observation, it opens up a wide field for future

investigations. It has been the custom of late years to ascribe all changes in the tissues which could not be referred to inflammation, to an impairment of the functional power or constructive force resident in the cells. That this theory is partly correct there can be no doubt; but I think that in the greater number of cases of calcareous deposits that occur in middle life, the first cause of the disease is an abnormal condition of the blood, produced either by an alteration in its chemical constitution, or by an imperfect excretion of its lime salts. If we should find, as this and other experiments lead me to suspect we may, that where such deposits exist in the heart and arteries, there is also an increased amount of lime in the other tissues of the body, we shall be obliged to modify many of our present pathological theories.

In the later stages of heart disease, the symptoms of indigestion arising from the congested condition of the mucous membrane are generally neglected on account of the distress produced by the implication of the lungs and kidneys; but in the earlier periods they often attract the whole attention of the patient.

The digestion is usually feeble, and there is consequently a feeling of weight and oppression after food, with distension from flatulence. Acid eructations sometimes form the principal cause of complaint, and heaviness after meals, lassitude, and depression of spirits, accompany this condition.

The impairment of the digestion always aggravates the symptoms of the original disease, and palpitation and dyspnœa are, in many cases, only experienced when the functions of the stomach and liver are deranged.

The first point in the treatment of these cases is to ascertain the amount of congestion to which they are subjected. In the earlier stages the size of the liver affords us a test of the venous congestion, and in all cases the extent of dulness on percussion over this organ should be determined. When the disease has been of long duration we cannot safely trust to this, for the continued pressure produces alterations in the hepatic cells.

When the liver is not found to be much enlarged, and the urine remains sufficiently abundant, good results may be confidently expected from medical treatment; but severe symptoms, or even fatal effects may be produced by the pressure upwards of the diaphragm, consequent on the stomach and colon being distended with flatulence, in cases in which the heart is enfeebled.

Case 16.—A gentleman, upwards of seventy years of age, had for some time presented symptoms indicating disease of the heart. He had been long subject to rheumatism, and latterly œdema of the lower extremities had presented itself. I was summoned to see him early one morning, and found him suffering from excessive dyspnœa. The pulse was feeble and fluttering, the face pale, and the countenance expressive of great anxiety. The abdomen was greatly distended, and, after some brandy had been given, a little flatulence escaped, giving him partial relief. As the symptoms however continued, a large turpentine enema was administered, and an enormous quantity of gas was expelled from the bowels. The breathing immediately became relieved, the heart's action

improved, and in half an hour he had recovered from his dangerous condition.

Six months afterwards he was again attacked in a similar manner, after eating a hearty dinner; but when I reached his house he was insensible, and he expired a few minutes after my arrival.

The diet is of great importance in the earlier stages of heart disease. Cocoa or milk should be substituted for tea and coffee, which generally increase the flatulence. The bread should be unfermented, and attention to this apparently trifling matter often leads to considerable improvement in the health. Animal food rarely can be digested in any considerable quantity more than once a day; but fish, or a little bacon, may be taken at breakfast. Food should not be taken shortly before retiring to rest, for the heart is apt to be seriously embarrassed by flatulence during the recumbent position. Vegetables and soup should be sparingly employed. Wines usually disagree; claret least so. Malt liquors generally increase the distension so much complained of by persons affected with this disease. Brandy or whisky well diluted, and taken at dinner, may be generally used with benefit.

Mercury is invaluable in the dyspepsia arising from heart disease. In the earlier stages blue pill should be prescribed combined with colocynth or rhubarb, and this may be given twice or thrice a week. If the kidneys are acting imperfectly, squill and digitalis should be used along with it.

Purgatives tend to relieve the congestion of the portal system, and should be given sufficiently often to keep up a free, but not excessive evacuation

from the bowels. In case of dropsy, they should be replaced by diuretics.

In all cases of dyspepsia arising from congestive disease of the heart, the use of small doses of digitalis or hydrocyanic acid is advisable, in order to relieve the palpitation and lessen the action of the affected organ.

It must be remembered that no long-continued course of purgatives or diuretics can be borne; but as soon as the congestion of the portal system is relieved, tonics should be employed, to give strength to the muscular structures both of the heart and digestive organs. If anæmia be present, the use of iron is indicated; but if this is not the case, quinine or other bitters should be employed.

When dropsy has fairly declared itself, the treatment of the dyspepsia is necessarily secondary to the more pressing necessity of relieving the general circulation.

In the examinations I have made of the stomachs of those who have died from affections of the aortic valves, I have detected no diseased appearances. In one case the gastric cells seemed to be unusually few in number, but the tubes appeared healthy.

In the stomach of a person who had died from aneurism of the aorta I found the arteries very much enlarged and thickened, and in some places the secreting tubes were of small size, and contained chiefly granular matter; but the mucous membrane was in other respects normal. This healthy condition of the glandular structure, associated with thickening and enlargement of the smaller blood-vessels, is interesting, as a similar condition of the arteries of the

kidney has attracted the attention of pathologists, and been referred by some to the effects of obstructed circulation.

There can be no doubt that, as we have seen in the stomachs of persons affected with congestive diseases of the heart, long-continued pressure will cause thickening and dilatation of the blood-vessels. But, as in the foregoing instance, there was no obstruction to the current of blood, and as there was a diseased condition of the coats of the main artery of the body and of the smaller arteries of the mucous membrane of the stomach, there was every reason to suppose that the affection of those different parts of the vascular system resulted from a common cause.

CHAPTER VII.

ON THE STATE OF THE STOMACH IN DISEASES OF THE LIVER.

It has been affirmed by many authors that disease of the liver is often occasioned by inflammation of the stomach and duodenum, but I am not aware of any record of microscopical investigations which shows in what proportion these parts of the digestive apparatus are simultaneously affected. The results of the microscopical examination of the stomachs of seven persons who had died of hepatic disease are detailed in my notes, and in all of them the gastric mucous membrane was in an unhealthy condition. In five the gastric tubes were closely united together in the splenic and middle regions. In some parts the glandular structure was in a state of atrophy; in others, although the tubes could be distinguished, the basement membrane was thickened, and there was a great increase in the amount of connective tissue between and below them. The gastric cells were generally fatty, and in some the muscular structure was in a state of fatty degeneration. The veins in all were greatly enlarged, and all the blood-vessels occasionally exhibited the same morbid change as the

muscular layer. The presence of pigment from extravasated blood was also noticed in most of the cases in the mucous membrane.

In the two remaining cases the tubes were readily separable, but the veins were much enlarged. In one, the tubes were distended with fatty cells and granular matter; in the other, in the splenic and middle regions they were unusually empty of secreting cells.

From the above statements it is clear that affections of the liver tend to produce gastritis, even more generally than diseases of the heart. Doubtless this may be partly explained by the fact that the congestion is much greater when the portal circulation is obstructed by hepatic than by heart disease; but we must also remember that in the former life is maintained for a longer period than in the latter, and that most of the causes that produce disease of the liver have a tendency to excite inflammation of the stomach.

It is evident that if the stomach be so greatly affected in liver disease from the congestion of that organ, slighter derangements of the portal circulation will be also sufficient to alter the normal condition of the digestive tube. The increased flow of blood to the mucous membrane accompanying gastritis tends to congest the liver, and this re-acts upon the circulation of the stomach. On this account we rarely meet with a severe case of chronic gastritis which does not, at some period of its course, display indications of portal congestion.

When this complication occurs, the patient complains of a feeling of weight or dull pain in the right hypochondriac region. The conjunctivæ are

slightly yellow, the stools dark, the urine high coloured and loaded with lithates; the tongue is very foul, often red at the tip and edges; the appetite is variable, and flatulence is constant and troublesome. There is drowsiness, especially after food; and in many cases frequent and severe headache.

Sometimes the application of a few leeches to the epigastrium gives great relief; in others the abstraction of blood by the same means from the anus is more efficacious.

Small doses of calomel or blue pill should be given every second or third night, and in young persons, or where there is much tendency to diarrhœa, the hydrargyrum cum cretâ may be substituted. The evacuations should be regularly examined, and as soon as they have regained their natural appearance the mercury should be omitted.

Frictions of iodine ointment to the epigastrium are useful, and care should be taken to maintain the abdomen at an even temperature by means of flannel. A free action of the bowels should be kept up by the use of purgative salts, senna, or rhubarb. As the complaint subsides, alkaline remedies are of use, and may be combined with taraxicum, chirata, or calumba.

The diet should in the more severe cases consist chiefly of farinaceous food, but if the debility of the patient does not permit this, beef-tea may be given. All fat and rich articles of diet should be avoided, and alcoholic stimulants should be prohibited. Nothing is so useful in promoting the circulation of the liver as regular exercise. Riding generally answers best, but in all cases where it is

possible, the patient should also have recourse to walking.

But there is another functional affection of the liver very common in dyspepsia, and which seems to be connected with diminished secretion of bile. In this state the alvine evacuations are pale in colour, and generally loose and very offensive. The appetite is variable, often craving; the abdomen much distended with flatus. There is general debility, and the sleep is broken and unrefreshing.

Small doses of mercury are very valuable in cases of this kind, followed in a short time by a course of the mineral acids. The bowels should be carefully regulated, but all severe purgatives ought to be avoided. I have in some cases found cod-liver oil very useful, and I have seen the alvine evacuations assume a more healthy appearance a few hours after its use has been commenced. Iodine, iron, and other tonics are generally required in the after treatment.

In most of the cases of liver disease in which I have examined the stomach microscopically, the patients have died of chronic hepatitis. In this complaint Frerichs reports that, "Of thirty-six observations, the mucous membrane of the stomach was pale in eight, and in twenty-six it was in a state of catarrhal tumefaction, and of a more or less livid hue; hæmorrhagic erosions existed in four cases, and cicatrices in two; in six cases the stomach and intestines contained a bloody fluid."[1] If the eight cases in which the mucous membrane was pale had been

[1] Diseases of the Liver. New Sydenham Society, vol. ii. p. 45.

examined with the microscope, it is probable that in them also disease would have been discovered in the stomach.

In the later stage of chronic hepatitis, in which hospital patients generally come beneath our notice, there is not much difficulty in diagnosing the disease; but in private practice, where we meet with it in its incipient forms, the real nature of the complaint is frequently overlooked. The liver is often not much increased in size, and the symptoms appear only to indicate chronic gastritis.

The following practical hints may be useful in preventing mistakes in diagnosis in the earlier stages. If the symptoms of chronic gastritis occur frequently and yield slowly to treatment, if the patient at each attack lose flesh and colour, and complain of debility in a greater degree than the dyspepsia would appear to warrant, and if he be in the habit of spirit-drinking, there is good reason to suspect that an abnormal state of the liver is the cause of the disease. The suspicion of hepatic disorder will be strengthened, if the alvine evacuations are found to be constantly varying in colour and appearance; showing at one time an increase, at another a deficiency of bile.

There are two other circumstances which, when they occur in persons affected with chronic gastritis, should direct our attention to the liver—viz., chronic diarrhœa, and attacks of peri-hepatitis.

The diarrhœa comes on gradually, and is never severe. The stools are variable in colour, and watery. We search in vain for any indication of disease in the lungs, kidneys, or intestines; and yet the patient

complains of great debility, and gradually loses flesh. In some cases of this kind, if we succeed in checking the diarrhœa, ascites and other evidences of hepatic disease make their appearance.

The attacks, which I believe to arise from inflammation of its capsule, should at once attract the attention of the practitioner to the liver. The patient seems dull, heavy, and unwilling to answer questions. He has occasional vomiting, and an entire loss of appetite. The tongue is thickly coated, and although it is dry, there is no great complaint of thirst. The pulse is but little quickened. The bowels are confined, the stools dark, the urine scanty, high-coloured, and loaded with lithates. Notwithstanding the threatening nature of these symptoms, they soon subside under treatment, and in a few days the patient is able to resume his accustomed occupation; to be perhaps again affected in a similar manner a few weeks or months afterwards.

In all the persons whom I have been in the habit of attending for such attacks, and in whom I have afterwards had the opportunity of making *post-mortem* examinations, I have found "hob-nail liver;" the organ being united to the neighbouring parts by an unusually great amount of adhesions.

In the treatment of gastritis arising from, or complicated with chronic hepatitis, all stimulating liquors should be strictly forbidden, and the food should be of the mildest and most digestible character. Out-of-door exercise should be taken regularly and systematically. Frictions with iodine and mercurial ointments over the hepatic region are very valuable, and preparations of iodine may be given internally.

In order to obtain any benefit, even in the earliest stages, remedial measures must be perseveringly employed.

As long-continued congestion of the liver produces chronic gastritis, so a sudden and complete obstruction to the portal circulation will give rise to more serious effects. This is shown in the following case:—

Case 17.—I was requested to see a sailor who had vomited a large quantity of dark-coloured blood. He was so faint from the hæmorrhage that he was unable to give much account of his illness; but I learned from his friends, that he had been out of health for about one month with slight fever, which had obliged him to leave his ship and return home. I could not detect any increase in the size of the liver in the epigastrium, but in the back there was dulness on percussion over a large space. He died in an hour or two after my visit. On *post-mortem* examination, the liver was found to be very large posteriorly, and was divided in the greater lobe by a deep, wide scar, which extended into its substance to a considerable depth, and seemed to pucker up its anterior surface. The vena portæ and all its leading branches were plugged with a mass of fibrine that seemed to have been gradually deposited in layers. The stomach was distended with a large quantity of dark-coloured blood. On microscopical examination, the whole of its mucous membrane was found to be infiltrated with blood. The gastric tubes adhered firmly to each other, and in some places scarcely a trace of the glandular structure could be discovered.

In the above case, the plugging of the vena portæ was probably occasioned by the obstruction to the circulation through the liver; but in the following, the origin of the disease appeared to be in the spleen. I was indebted to the kindness of Dr. Peart for the opportunity of seeing the patient during life, and of being present at the *post-mortem* examination.

Case 18.—"The subject of the following narration was a servant girl, aged 19, who was reported to have suffered when young from mesenteric disease, to have been pale-faced and weak for some months, with a slight diarrhœa immediately after taking her meals, and to have presented lately a remarkable fulness of the breasts and abdomen, so as to have excited in her friends the suspicion of pregnancy. She occasionally frequented dancing saloons, but there was no reason to suspect her of drinking, and her conduct in general was opposed to that supposition.

"She awoke during the night in October last, with a desire to vomit, which she did without suspecting anything, and was surprised in the morning on looking at the vomited matter, to find it was blood. She went to her place that day, where she had a further return of the hæmorrhage, and again during the following morning while in bed, to the extent of two or three pints of bright-red, coagulable blood. She was then found almost blanched, tossing restlessly about, with an extremely rapid, feeble pulse, and an almost insatiable thirst for cold water. The bleeding then seemed stayed through the depressed state of the circulation. The liver when percussed was of natural size; the spleen did not project forward.

"There was no tenderness over the epigastrium or abdomen. The catamenia had been excessive and too frequent; they had appeared only a fortnight before, but never returned during her illness. An astringent mixture was given at first, but the hæmatemesis returned in a few hours to a further and alarming extent, and was accompanied by purging of large, dark-coloured stools. The depression becoming extremely dangerous, half an ounce of spirit of turpentine given in mucilage checked the bleeding effectually for the time, and repeated once or twice during the week on the first appearance of a return kept this well in check, so as to allow of attempts to recruit her strength by enemata of beef-tea, milk, &c., containing spirit, repeated at short intervals, the smallest quantities of fluids only being given by the mouth, as the slightest excess caused immediate vomiting, to which cause the return of the hæmatemesis seemed afterwards several times due; vomiting, however, occurred frequently without blood appearing, the turpentine itself being often rejected.

"Various sedative medicines were tried to relieve the vomiting when present, but none seemed to agree with the stomach. The enemata were kept pretty well by her, and seemed to be absorbed largely; they were continued every two hours for a week or two, the amount of food given by the mouth being gradually increased, when, apparently from incaution in this particular, the bleeding returned after an interval of a month, but was at once checked by a repetition of the turpentine. She continued so for about two months longer, with one or two

returns of the hæmorrhage, emaciation progressing steadily during that time, and was increased by an unmanageable attack of diarrhœa, which was attributed to the administration of a chalybeate mixture, but was checked by gallic acid. She had now a constant hacking cough, without dyspnœa, but with ejection of pellets of mucus, apparently from the back of the throat. At this time, after some pain in the left leg, it became œdematous, but recovered itself soon under the use of warm fomentations, friction, and the horizontal position. Ascites then appeared, and increased rapidly to a large extent, no pain attending it or other alteration in the symptoms. Towards the end of January, she sank the second day after a furious return of the hæmorrhage, no abdominal pain or hepatic enlargement having ever been present. The appetite generally continued good. The urine at first was copious and pale, latterly less in quantity, but sufficient.

"The examination was made thirty-six hours after death. There was about a pint of dark fluid in each pleura; both lungs were crepitant and healthy. the heart was healthy and its cavities filled with dark coagula. The peritoneal cavity contained several quarts of clear fluid. Its serous membrane was smooth and transparent. The spleen was rather large, and adhered to the diaphragm and contiguous walls of the abdomen. Its structure, on incision, was light-coloured, and rather denser than natural. On microscopic examination, it showed the usual cellular bodies with much granular and amorphous matter interposed. The stomach was of moderate size, and contained some pale-coloured liquid food. Its mucous

membrane was pale and partly digested on its greater curvature towards its left extremity. No ulceration existed there, or in any part of the intestinal canal; nor any congestion of the vessels, except close around the entrance of œsophagus into the stomach. The cœcum presented rather more strongly than usual the tesselated appearance often observed, and apparently due to decomposition of blood in the vessels around its follicles.

"The walls of the small intestines were œdematous, and increased to at least three times their ordinary thickness; no cellular bodies being found within them when examined by the microscope, but apparently only serous infiltration.

"The liver, on incision, was of the ordinary healthy colour and texture in every part; the hepatic venous branches were very evident, but the portal branches were exceedingly difficult to discover. On tracing the portal vein throughout its formative and distributive branches, it was found in every part completely filled by yellowish red fibrinous material; no central channel being left, but a red core being present there.

"This obstructing material on microscopic examination, showed chiefly a granular amorphous basis, with obscure fibrillation, and scarcely a trace of cellular element, even of red blood cells, although distinctly red in some parts. The coronary and mesenteric veins felt like pieces of whipcord, cracking across in some parts when bent, and by their peculiar condition at once drawing attention to the portal vascular system; the corresponding arteries were not traced, but did not attract notice by any abnormal appearance, though frequently cut across. The gall

bladder was nearly empty, but the duodenum contained a considerable quantity of bright yellow bilious matter, which was not continued beyond it.

"The kidneys and pelvic organs were healthy. The vena cava ascendens was natural in its interior; the iliac and femoral vessels were not examined."[1]

[1] Transactions of the Newcastle-upon-Tyne Pathological Society.

CHAPTER VIII.

CONDITION OF THE DIGESTIVE ORGANS IN DIABETES.

Those who have of late years investigated the cause of diabetes, have interested themselves more with the circumstances favouring the physiological production of sugar than with the morbid appearances present in the bodies of those who have died of the complaint. Every one called upon to treat the disease must have observed, that the amount of saccharine matter in the urine depends greatly upon the nature of the food; and it is, therefore, only reasonable to conclude, that a careful inquiry into the condition of the digestive canal would be likely to throw some light on its pathology. I have, unfortunately, been able to examine the stomach and intestines with the microscope in three cases only; and in one I tested the digestive power of the gastric mucous membrane.

In each case the mucous membrane of the stomach was partially dissolved by *post-mortem* digestion; although two of them were examined in the month of February.

Considering the enormous activity of the digestion in persons affected with diabetes, we might expect to find the gastric mucous membrane increased in bulk. In one case, in which the *post-mortem* solution

was least advanced, I weighed the mucous membrane, and found it amounted to 880 grains. In three persons, who had been killed by accidents, the average weight of the mucous membrane was 1283 grains; and, as in cases of sudden death, *post-mortem* solution also takes place, we must either conclude that the gastric mucous membrane in diabetes wastes along with the other parts of the body, or that *post-mortem* digestion is exceedingly active in these patients.

The former explanation is probably the correct one; for in no case was the muscular coat destroyed, and the mucous membrane, in the regions unaffected by the gastric juice, was not of unusual thickness. We are so much in the habit of taking the bulk of an organ as a measure of its functional activity, that I would suggest that those who have the opportunity should ascertain whether the large amount of food taken by persons affected with diabetes is really digested, or whether a great part of it is not passed off by the bowels in an unchanged condition.

The contents of the stomach were in one case remarked as unusually acid. This is a point worthy of further investigation, as the difficulty experienced in rendering the urine alkaline by means of medicines, has attracted the attention of physicians.[1]

The gastric tubes were readily separable from each other, and there was no increase in the connective tissue between, or below them. They were filled with cells, which were in one instance loaded with fat, and in all an unusual number of small cells was remarked. This increased quantity of small cells, I

[1] Dr. Pavy on Diabetes.

imagine points to a very rapid production of pepsin, and is connected with the great functional activity of the organ.

The large capacity of the duodenum was noticed in two of the cases, and I believe it is generally present. It no doubt arises from the quantity of food consumed.

The villi in each of these cases are mentioned as unusually large, and loaded with large and prominent nuclei. In one the tubes of Lieberkühn could not be distinguished, but in another they were readily recognised.

An experiment was tried to test the dissolving power of the mucous membrane of the middle region of the stomach. A piece of albumen was found much softened, after twelve hours' digestion, but no loss of weight was observed; and five grains of it digested in an infusion of the pyloric region was also softened, but had rather gained than lost in weight. It seems strange that so little effect had been produced upon the albumen in these experiments; still we are not justified in drawing any conclusions from a single case, as many accidental circumstances might interfere to prevent a successful result.

I was desirous of ascertaining whether the mucous membrane of the duodenum underwent any change in its physiological actions in this disorder. I therefore made a solution of grape sugar by mixing bread with saliva, and digested for twelve hours, at 98° F., equal parts of this with an infusion of the mucous membrane of the duodenum of a person who had died of diabetes, and with that of another patient who had died of another disease. In both cases the sugar seemed to remain unchanged.

The pancreas in one case is noticed as very small, but its size is not mentioned in the others. In all of them, when examined with the microscope, this gland was found to have undergone structural changes. The cells were loaded with fat, and were so soft that they broke up with the slightest pressure. The basement membrane in each was normal.

At the time I made the above observations I was not aware that the pancreas had been found affected, by other observers, in cases of diabetes. It would, however, appear that its condition in this disease has frequently attracted notice.

Dr. Bright mentions a case of diabetes, in which "the head of the pancreas formed along with the surrounding glands a hard, globular mass, round which the duodenum turned, and to which both it and the pylorus were firmly joined." "The pancreas was hard and cartilaginous to the touch, and of a bright yellow colour."[1]

Dr. Elliotson quotes a case of diabetes under his care at St. Thomas's Hospital, in which the "pancreatic duct and the larger lateral branches were crammed with white calculi."[2]

Dr. Marston reports the case of a man, in whose urine sugar was found to be present for a short period before his death. On *post-mortem* examination the head of the pancreas appeared to be converted into a hard scirrhoid tumour, whilst the body and other parts of the gland were atrophied, and its duct was found to be obliterated, and degenerated into an impervious cord.[3]

[1] Medico-Chirurgical Transactions, vol. xviii. [2] Ibid.
[3] Glasgow Medical Journal, vol. i.

Bourchardat mentions a person suffering from diabetes, in whom the pancreas was so degenerated that its functions could not possibly have been performed.[1]

Bernard states that in two cases of diabetes he had observed the pancreas atrophied, without presenting any other alteration than the diminution in size.[2]

Dr. Harley gives a case of abscess of the pancreas in which the urine was very saccharine.[3]

Frerichs, after detailing a case in which diabetes existed along with cancerous deposit in the head of the pancreas, makes the following remarks:—"The frequency with which diabetes is accompanied by diseases of the pancreas has appeared to me remarkable; out of nine cases, I have seen atrophy, or fatty degeneration of this gland in five. It is still undetermined whether these lesions are to be regarded as the exciting cause of diabetes; and, if so, in what manner they operate?"[4]

Dr. Hyde Salter has made the following observations on this subject, and from his not mentioning what had been written by others, I conclude he was not aware that it had previously attracted the notice of pathologists:—

"I have frequently met with fatty degeneration of the pancreas, and all the instances in which I have detected it have been cases of diabetes. After finding it in four successive cases of this disease, I fancied that I had hit upon its cause and the secret of its true

[1] Cruveilhier, Anat. Path., vol. iv. p. 139.

[2] Leçons de Physiol. Experiment, vol. i. p. 418.

[3] Medical Times and Gazette, Jan. 21, 1862.

[4] Frerichs On Diseases of the Liver, vol. i. p. 197 (New Sydenham Society's Edition).

pathology. Although it seemed rather a 'lucus a non lucendo' argument, to attribute an undue formation of sugar to the derangement of a sugar-forming organ, yet in a class of bodies so full of instances of isomerism as the starch and sugar series, it appeared to me possible that an imperfect or depraved pancreatic secretion might give rise to the formation of an imperfect glucose, incapable of these after changes by which it is worked out of the circulation. The meeting, however, with other cases of diabetes, in which the pancreas was not fatty, and still more, the perusal of M. Bernard's observations with regard to the part that the liver plays in the formation of sugar and the disease of diabetes, dispelled my theory, and compelled me to regard the fatty state of the pancreas as the consequence, and not the cause, of the diseased condition, undergoing this degeneration in common with other organs, for I never found fat in the pancreas without finding it in enormous quantity in the liver and kidney."[1]

If the pathological change in the pancreas had been confined to fatty degeneration, we might have supposed that it was the result of the general wasting that accompanies diabetes. But in some of the above cases the disease was of a cancerous nature,[2] and could not, therefore, be referred to that cause.

It may be objected, that many instances of pancreatic disease are mentioned in which no notice is taken of co-existing diabetes. But in Dr. Marston's

[1] Todd's Cyclopædia of Anatomy. Art. "Pancreas."

[2] From the description of the organ in many of the cases, I conjecture that the nature of the disease was not cancer, but a fibroid degeneration allied to the cirrhosis of other organs.

case, the sugar in the urine was not suspected, until its presence was shown by the use of chemical tests; and we may therefore suppose that it has escaped notice in many others. In some of the published cases of disease of the pancreas, the patient is stated to have suffered from prurigo pudendi; and as in many persons affected with this complaint I have found the urine saccharine, I suspect that sugar might probably have been discovered in such instances, if it had been sought for.

Physiologists generally attribute to the pancreatic secretion the power of converting starch into sugar, and of favouring the absorption of fat. Alteration in the sugar and fat are the most prominent changes in function observed in persons affected with diabetes.

We find that in this complaint the quantity of sugar chiefly depends on the amount of starch taken as food. We might, therefore, reasonably expect to discover the cause of the disease in the organs whose office it is to convert the starch into sugar. The saliva, the intestinal juice, and the pancreatic fluid, all seem to possess this property, and it may at first sight appear absurd to suppose that an increase in the quantity of sugar should arise from a diminution in the secretion of any of the glands concerned in the process. But I conceive this apparent paradox is susceptible of solution. We must remember that nature never confers upon different structures precisely the same duty. When various organs seem to perform the same office, it is by supplying by their union properties not possessed by any of them alone. Now, as in the digestion of starch it is requisite that the sugar should be of such a nature as to permit of

its subsequent changes, may we not conjecture that the office of the pancreas is to finish the process commenced by the other glands, and that a diminution or alteration in its secretion may allow of the absorption of a material of a character unfitted for that decomposition in the circulation which it appears normally to undergo?

In most of the cases I have before quoted, the passing of fat by stool was the chief point of interest, and the presence of sugar in the urine is only casually noticed. The analyses mentioned by Dr. Simon show us that as much as thirty-four per cent. of fat has been found in the fæces of patients affected with diabetes. That the fat is altered in its qualities, appears from the milkiness of the blood, so frequently remarked in this disorder, and from the fact that whilst some organs are loaded with it, others, such as the liver, are unusually free from its presence.[1]

It seems to me highly improbable, from the preceding observations, that the disease of the pancreas is a mere accidental accompaniment of diabetes; but at the same time, we must not expect that it will be found in all cases to be the cause of the disease. Clinical observation shows us that there are great varieties, both in the progress and symptoms, as well as in the amount of sugar excreted in different cases; and we might therefore suspect that the complaint may be produced by an affection of any of the organs concerned in the formation or decomposition of that substance. The altered state of the intestinal tubes in one of the cases just quoted is of interest, as

[1] Dr. Johnson, Diseases of the Kidney, p. 395.

[1] Frerichs, Diseases of the Liver, vol. i. p. 298.

showing how minutely, and yet how widely, we should conduct our examinations.

In examining the pancreas with the microscope, care should be taken not to mistake *post-mortem* changes for the products of disease. I examined this organ in a large number of animals that had died of various disorders, and found the presence of crystals in it of frequent occurrence. These I considered as evidence of a morbid state; but I afterwards discovered that Bernard had stated, that if the pancreatic juice be kept for a short time, crystals of sulphate of lime (which present the same appearance as those I observed), are deposited. Again, it has been shown that this organ is capable of dissolving albumen; may not, therefore, some of the alterations we meet with after death be the result of *post-mortem* changes, analogous to those we so frequently find in the mucous membrane of the stomach?

CHAPTER IX.

CONDITION OF THE STOMACH IN DISEASE OF THE KIDNEYS.

Disorders of the digestive tube are such common accompaniments of affections of the kidneys, that the connection has attracted the attention of all careful observers. Nor is it surprising that these organs should be simultaneously subject to morbid changes of an allied character. We know that both are apt to be influenced by general causes, and we might, therefore, anticipate that these causes would be the same or very similar, and that, in this way, alterations in the functions or structures of the one would be liable to be attended or followed by changes in the other. Moreover, in each the secreting structures are disposed in the form of tubes clothed with epithelium, and each separates from the blood a fluid having an acid reaction.

In the majority of those who have died of Bright's disease, we find evidence of gastritis on *post-mortem* examination. The blood-vessels of the mucous membrane of the stomach are more loaded with blood than in the normal condition; the gastric tubes are

readily separated from each other, but are distended with a confused mass of cells and granular matter. The basement membrane is sometimes thickened, at other times it presents no morbid change.

Such a condition is, with the exception of the eruptive fevers and phthisis, more commonly met with in Bright's disease than in any other affection, and the anatomical changes in the stomach present a very close correspondence with the state of the tubes of the kidney itself, in the more ordinary forms of this disorder.

In another, but smaller class of cases, we find evidences of a more extensive inflammation of the mucous membrane of the stomach. The tubes adhere firmly together, and present the characters already described as those of chronic intertubular gastritis.

Dr. Fox gives fourteen cases of Bright's disease, in which he had examined the mucous membrane of the stomach with the microscope, and found it to be inflamed. Ten were recent cases of renal disease, and, therefore, probably instances of tubular nephritis, and eight of these presented appearances of tubular gastritis; in the remaining two, both tubular and intertubular gastritis were present. Of the four cases of chronic or granular disease of the kidneys quoted by him, all were connected with chronic or intertubular gastritis. These facts, which agree with what I have myself remarked, seem to prove that tubular gastritis is usually present in recent cases of Bright's disease, and that the granular kidney and the other chronic forms of the complaint, are mostly associated with intertubular gastritis.

The following Observation shows that the intestinal canal is also liable to be affected in disease of the kidneys.

Observation 19.—In a man, aged fifty-seven, who had died of renal disease, the duodenum had a very granular appearance, arising from an hypertrophied condition of Brunner's glands. Numerous little pits were everywhere visible, showing the enlarged openings of these bodies. In a place about the size of a sixpence the surface of the membrane was greatly congested, and here the coats were exceedingly thin and wasted. On examination with the microscope, Brunner's glands were found greatly enlarged and loaded with epithelial cells. The basement membrane of these glands was thickened; in some places so much so, that the glandular structure was in a state of atrophy. The epithelial cells were much increased in size, dark and granular. The villi were large and loaded with nuclei, and presented in many places thickening of the basement membrane.

This condition of the basement membrane and the enlargement of Brunner's glands indicate, I believe, chronic inflammation of the duodenum; and excepting in cases of cancer of the breast, I have never met with these morbid appearances so well marked as in the foregoing case.

I have only examined the skin microscopically in one case of disease of the kidneys. The patient was a man fifty-eight years of age, and had also an affection of the bladder. The stomach was very large, and contained a few clots of blood. The gastric tubes were readily separable, but were choked with granular

matter and cells of large size. The sudoriferous glands were distended with fat and cells filled with oil. Indeed, they presented appearances precisely similar to those observed in the tubes of the stomach and kidneys when these organs are in a state of fatty degeneration.

But how can we explain the frequent occurrence of gastritis in diseases of the kidney? No doubt the similarity in the morbid changes leads to the belief that the affection in both organs has a common origin. No one can examine the secreting tubes of the stomach and kidneys, in an early stage of the disorder, without being struck with the very marked similarity in their morbid alterations.

The causes of disease of the kidneys seem to be such as are equally capable of exciting inflammation in the gastric mucous membrane. Thus, of twenty-one cases of tubular nephritis, in which Dr. Dickenson investigated the origin of the complaint, eight were attributed to scarlatina, and ten to exposure to cold. We have before shown that tubular gastritis is almost invariably found in persons who have died from scarlet fever, and we also know that the application of cold to the surface of the body is a fruitful cause of the same disease.

Again, in the majority of cases of chronic Bright's disease, the malady is found to be connected either with a tubercular or gouty constitution; and in both of these conditions, structural changes are apt to take place in the mucous membrane of the stomach.

Whether, therefore, we regard the anatomical changes in the organs affected or the causes tending

to produce them, we see reason to believe that both the disease of the kidneys and the gastritis may often have a common origin.

Still, although we may account, in many instances, for the contemporaneous occurrence of these diseases in the same individual, we can scarcely, in this way, explain all the cases that come before us. In some persons affected with Bright's disease, no morbid changes can be found in the stomach, and in others, the gastric symptoms only make their appearance when the renal affection has existed for a considerable period.

Persons suffering from renal disorders are peculiarly liable to severe attacks of local inflammation; and death is, in a great number of instances, the result of these secondary affections. Thus pleurisy is found in 60 per cent.; and more than one-fourth of the whole number are attacked by pericarditis.[1] Every other important organ in the body is liable to be injured in a similar manner, and we cannot, therefore, be surprised that the mucous membrane of the stomach and intestines should be likewise implicated.

This tendency to inflammatory action in other organs is usually, and I think with justice, attributed to an impure condition of the blood, arising from the imperfect elimination of the effete materials by the kidneys; and to this cause also, I believe, we must charge no small amount of the gastritis that so frequently accompanies this disorder.

But may not a gradual failure in the activity of the skin be as potent in producing the more chronic

[1] Dr. Dickenson, Medico-Chirurgical Transactions.

affections of the stomach and kidneys, as the sudden suspension of its action is in giving rise to the acute form of these disorders? I think this is probable; and it was on this account that I mentioned the abnormal condition of the sweat glands found in a case of diseased bladder and kidneys. It may seem absurd to assert that we know but little of the part that disorders of the skin play in the production of maladies, when so much attention has been bestowed upon them; but it must be remembered, that the various eruptions so minutely described are usually the result of over-action. The skin is employed in eliminating materials retained in the circulation in consequence of the imperfect activity of other organs; and hence the various forms of inflammation to which it is subject. The question to be solved is — What are the effects produced by a gradual diminution in, or total cessation of, the excreting powers of the surface of the body? The presence of moisture on the skin is not sufficient to prove that its functions are properly performed; for in diseases of other organs the secretions are often found altered in quality, although not lessened in quantity.

As we have not yet determined the exact nature of the substances eliminated by the skin in a state of health, we cannot by chemical tests ascertain when its functions are imperfect. A microscopical examination of the sweat glands in a large number of different diseases would, however, probably afford us some trustworthy conclusions, and, perhaps, show us that many maladies take their rise from alterations in the structure of this important organ.

The phenomena presented to us by disease of the

kidneys may, I think, be sufficiently accounted for on the principles just mentioned, without having recourse to the hypotheses, that Bright's disease arises from a special degeneration of all the tissues of the body, or that albuminuria is an effect of imperfect digestion. That imperfect digestion does set up this complaint is, I believe, beyond a doubt; but it is by the production of abnormal substances which irritate the organ by which they are excreted, and not by pouring into the circulation albumen of so low an organization, that it passes through the renal blood-vessels.[1]

When we bear in mind the frequency with which the mucous membrane of the stomach is inflamed in chronic disease of the kidneys, we shall readily comprehend that the majority of persons affected with this disease will exhibit symptoms of derangement of the digestive functions. In many cases the patient first seeks medical advice on account of impaired digestion, and is not aware that he is the victim of any more serious disorder. This so often happens that practitioners should make it a rule never to commence the treatment of any severe case of dyspepsia without first carefully examining the urine for albumen.

One of the most prominent symptoms of renal disease is vomiting, which frequently occurs as soon as the patient arises from his bed, or sometimes takes place only after meals. This is usually attributed to sympathy of the stomach with the kidneys, but the more probable cause is, that the organ

1 Dr. Parkes's Clinical Lectures, *Medical Times and Gazette*, April 22, 1854.

attempts to relieve itself of the mucus, which has collected in it during the intervals of digestion.

The mucus that is vomited will be usually found to be acid, and the question arises how this occurs, when we know that what is secreted in inflammation of other mucous membranes is generally alkaline. The change, I believe, results from the fermentation of the particles of food which have remained entangled in it.

In some instances there is no vomiting, but constant nausea is complained of. The tongue is often foul, and the patient is troubled with acid eructations and pain after eating.

At other times the symptoms only indicate feebleness of digestion, and there is uneasiness and weight after food, with distension and flatulence.

The bowels are seldom much confined and diarrhœa often takes place, especially in the later stages of the disease.

When there is pain in the chest, epigastrium, or between the shoulders, coming on shortly after food, and accompanied by tenderness on pressure at the pit of the stomach, some form of counter-irritation should be employed. The bowels should be carefully regulated, and alkaline remedies, combined with hydrocyanic acid, prescribed.

Where pain and epigastric tenderness are absent, creasote is often very valuable in relieving the nausea and vomiting. It generally gives most relief when taken in the form of a pill at bed-time, or shortly after a meal.

In prescribing purgatives, the disease of the kidney should be remembered; as a general rule, mercurials

are seldom required. Podophyllin will be found the best substitute for them. It may be given in small doses in combination with aloes, or if much flatulence is experienced, with creasote or galbanum pill.

When the digestion is slow, I have seen great benefit produced by the use of pepsin with dilute hydrochloric acid. Where the vomiting of mucus is troublesome, astringents are generally required to give tone to the mucous membrane. The best of these are the oxide or nitrate of silver, alum, kino, and tannin.

In the majority of cases anæmia presents itself, and in some instances in which the amount of albumen passed off with the urine is large, this is one of the first indications of disease which attracts the notice of the patient or his friends. Tonics should be, therefore, employed, as soon as the state of the digestive organs will permit. One of the most useful of this class of remedies is the tincture of perchloride of iron combined with calumba. In other cases the acid phosphate of iron seems to agree better, or the carbonate of iron may be preferred.

It not unfrequently happens that the disease of the kidney is connected with gout, and then colchicum in small doses is invaluable, but alkaline remedies and tonics should be combined with it.

The skin is generally dry and harsh in renal disease. It is of the greatest importance to see that its functions are properly performed, and the use of hot baths is invaluable. The clothing should be warm, and care should be taken to preserve the patient from exposure to cold and damp.

Great attention should be paid to the diet. The food should be nutritious, but rather sparing in quantity at each meal.

Animal food ought to be given as freely as the state of the digestion will permit. This is required, both on account of the anæmia usually present in these cases, and also from the "fact that the albumen in the urine decreases by the use of animal food, and increases again under a vegetable diet."[1] When the stomach is unable to digest solid food, beef-tea and nutritious soups may be resorted to. As a general rule fats are apt to produce nausea, nor are they so much required as in many other complaints, as the patient usually remains tolerably stout.

Alcoholic stimulants are almost always requisite, on account of the debility accompanying the disorder. Spirits are generally injurious, and malt liquors are apt to increase the flatulence. The wines most generally useful are claret and sherry. When there is a tendency to diarrhœa, or when weakness forms the prominent symptom, port wine is to be preferred.

Where there is much acidity, tea and coffee should be avoided.

The chronic gastritis which we have seen to be so common in disease of the kidneys is liable to occasional aggravations, when it assumes the subacute form of the complaint. The patient suffers from thirst, vomiting of all food, and depression of strength; the pulse is quickened, and the epigastric tenderness increased. The treatment laid down for subacute gastritis must, under such circumstances,

[1] Dr. Basham on Dropsy, p. 217.

be applied; for these attacks greatly reduce the strength of the patient, and in many instances lead to a fatal termination.

The following case shows that the symptoms really arise from gastritis, and not from sympathetic irritation.

Case 19.—A gentleman, aged thirty-two, had been for some time under treatment for albuminuria, when he was seized with vomiting, constant thirst, and pain on pressure at the epigastrium. The tongue was red and dry, and the pulse rapid. Some of the vomited fluid was placed in a conical-shaped glass. The deposit, when examined with the microscope, was found to consist chiefly of epithelium, many of the cells being of the conical variety. There were also some casts, apparently composed of mucus. These represented groups of the circular pits of the surface of the stomach as exactly as if they had been obtained by the collodion experiment.[1] Intermixed with the mucus of the casts were numbers of the conical-shaped cells. On *post-mortem* examination, the stomach was found much inflamed, especially in the cardiac region. The liver was enlarged and fatty, and both kidneys were affected with tubercular deposit.

In this instance there were casts of the surface of the mucous membrane in the fluid vomited, whilst after death the stomach was found in such a state of inflammation as would account for the symptoms observed during life. We ought, therefore, in the

[1] See page 12.

treatment of renal disease, to watch for any sudden aggravation of the gastric disorder, and not look upon it as merely a sympathetic affection, but as the result of the same impure condition of the blood that so often gives rise to inflammation of the serous membranes.

CHAPTER X.

ON THE CONDITION OF THE STOMACH AND DUODENUM IN PHTHISIS.

THERE is no subject connected with the digestive process more important than the connection between dyspepsia and phthisis. The vast numbers annually swept off by consumption render everything connected with that disease a matter of the greatest interest, whilst the want of success that attends its treatment, under ordinary circumstances, makes it most important to ascertain, whether there may not be an earlier and more curable stage of the complaint.

The most exact statements respecting the condition of the digestive canal in phthisis, as visible to the naked eye, are those of Louis. This careful observer found the stomach to be enlarged in two-thirds of the cases of this disease; whilst of 230 persons who had died of other complaints, only two examples of this condition presented themselves. He also described softening of the gastric mucous membrane as of common occurrence; it having been present in a large proportion of his dissections of tubercular subjects.

He met with tuberculous ulceration of the small

intestine in five-sixths of his cases, and the mucous membrane of the large intestine was red, thickened and softened in half of the consumptive patients examined.

There seems little doubt that the softening of the mucous membrane of the stomach observed by Louis was produced by *post-mortem* solution, with the nature of which he was not at the time acquainted. It is not remarked in the stomachs of the inferior animals, if the examination be made shortly after death, and the softened state of the tissues in phthisis is sufficient to account for the frequency of its occurrence in the human subject.

The stomach after death from consumption is very often flaccid, but I believe this results chiefly from the exhaustion of the patient at the time of death, and, in some cases, from the fatty degeneration of the muscular coat not unfrequently present in this disease.

As regards the morbid appearances presented to the microscope in the stomachs of phthisical persons, our two chief observers have arrived at nearly opposite conclusions.

Dr. Handfield Jones says,—"Out of 100 there were 18 cases of marked scrofulous disease, not including instances of tubercular deposit which were but slight or obsolete. In four of them the gastric structures were healthy; in ten they were moderately healthy; in two there was moderate, and in two there was great destruction of the tubes. The conclusion is, that scrofulous disease, using the term in its widest sense, does not exert any marked influence in the production of organic disease of the gastric gland tissue."

On the other hand, Dr. W. Fox states,—"The disease that leads to the evolution of gastric catarrh with peculiar frequency is tuberculosis." He gives two cases of phthisis out of twenty-one cases of acute gastric catarrh; nine cases of phthisis out of nineteen cases of chronic gastric catarrh; and five cases out of seventeen, in which the morbid appearances showed the existence of both forms of the disease combined.

The difference between the statements of these two anatomists is not, however, difficult of explanation. Dr. H. Jones had not noticed the minuter changes of the gastric epithelium, but chiefly directed his attention to the general condition of the tubes; whilst Dr. Fox more carefully examined those alterations of the secreting cells which he believed to indicate the effects of inflammatory action. The former, therefore, considered tubercular disease as seldom connected with gastric disorder, because he could generally detect the secreting tubes; whilst the latter came to an opposite conclusion, inasmuch as he found the contents of the tubes in an abnormal condition.

My own observations confirm the statements of both. Out of ten cases of phthisis, in which I have minutely recorded the state of the mucous membrane of the stomach, only one showed the tubes in the middle or splenic regions united together; and in this case there was no wasting or destruction of the secreting structures. In eight the tubes were affected either with thickening of the basement membrane, or they contained an unusual quantity of fatty and granular matters, similar to what is observed in tubular gastritis occurring under other circumstances.

In two cases the solitary glands were enlarged in

the pyloric region, but not in the other parts of the organ.

In one there was a superficial ulceration in the pyloric region, about the size of a shilling.

Three cases are mentioned, in which the mucous membrane was affected with fatty degeneration; and the muscular structure is especially noted as being in this state. Minor degrees of this pathological condition may have been probably overlooked.

I have very carefully examined the upper part of the intestinal canal in a considerable number of cases of phthisis, in the hope of detecting some morbid changes in the glands, or villi, sufficient to account for the production of the disease. With the exception of those parts in which tubercular deposit had taken place, I have been unable to find any structural changes peculiar to this disorder.

I have seldom met with anatomical alterations of the stomach in the lower animals affected with tubercular disease. In a hyrax there were some superficial ulcerations; and in a leopard the gastric mucous membrane was of a dark grey colour; but on microscopic examination, the secreting tubes were neither united together, nor altered in appearance. Fatty degeneration was occasionally observed in the mucous membrane.

In two or three instances amongst the lower animals, I have found the lining membrane of the duodenum thickened and inflamed, but usually this part of the digestive canal was healthy.

Ulcerations of the small intestine seem less frequent in the inferior animals affected with phthisis than in the human subject.

The intestinal villi were, in some animals, very much wasted; and injections, when thrown into the blood-vessels, did not distend their network of capillaries; but in all these cases the mesenteric glands were enlarged, and the arteries were found to be obstructed by the growth of the tumours. The attenuation was not confined to the villi, but the neighbouring tubes of Lieberkühn were also wasted and frequently deprived of epithelium. (See plate 6, fig. 2.)

I have often observed the contents of the intestinal villi in tuberculous animals to be more granular than usual; but when death had occurred whilst digestion was going on, they always contained fatty matter. (See plate 6, fig. 1.)

It is evident, therefore, that in phthisis the mere absorption of oil is not prevented, and that on whatever alterations in the fatty materials of the body the disease may depend, it does not arise from any failure in the anatomical structure of the parts employed in conveying those materials from the intestines to the blood.

Taking into consideration all the foregoing facts, it is sufficiently plain, that neither in man nor in the lower animals are there any anatomical changes in the stomach or upper part of the intestinal canal *peculiar* to phthisis. But admitting this, are we justified in assuming that tubercle may not result from an imperfection in the action of the organs of digestion? I think not. Great attention has been bestowed by different observers upon the state of health which precedes the development of phthisis, and the majority of those who have investigated the

PLATE VI.

INTESTINAL VILLI IN DIFFERENT DISEASES.

FIG. 1. Injected villi from a monkey which had died of phthisis.

v. Blood-vessels.

gr. Very granular appearance at the end. This has not been marked in the engraving with sufficient distinctness.

o. Oil globules.

FIG. 2. Villi in a case of mesenteric disease in a monkey. The structures had a wasted, transparent appearance; and the injection only penetrated the larger blood-vessels.

v. The blood-vessels.

o. Oil globules.

FIG. 3. Intestinal villus in cancer of the breast.

b. Thickened basement membrane.

n. Nuclei and cells in the interior of the villus.

FIG. 4. Intestinal villus in a case of uterine cancer. The villus was very transparent and loaded with fat. No nuclei were visible.

o. Fat globules.

FIG. 5. Intestinal villus in a case of uterine cancer.

o. Oil globules.

p. Pigment.

Plate 6.

Fig 1.

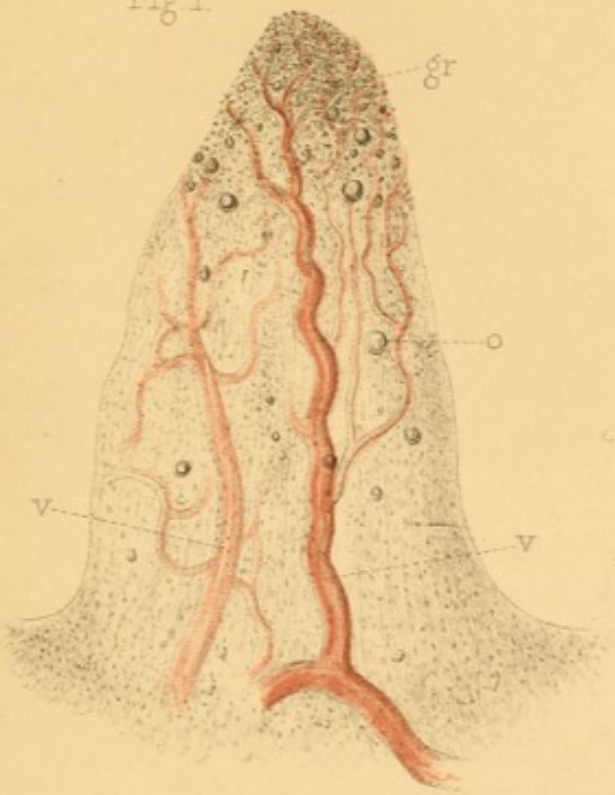


Fig 2.

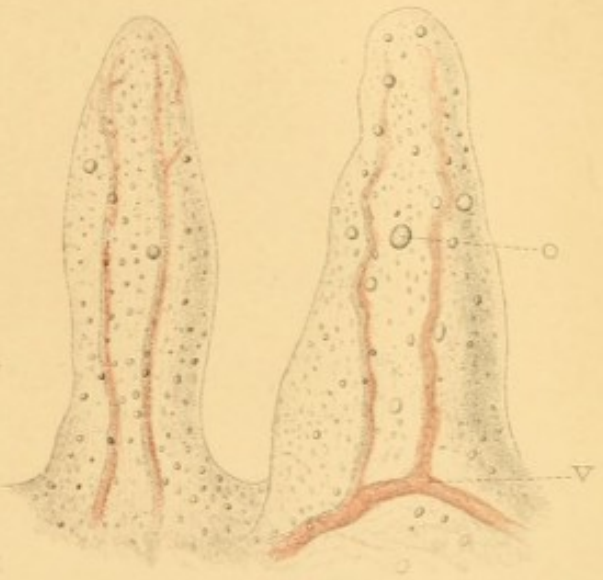


Fig 3.

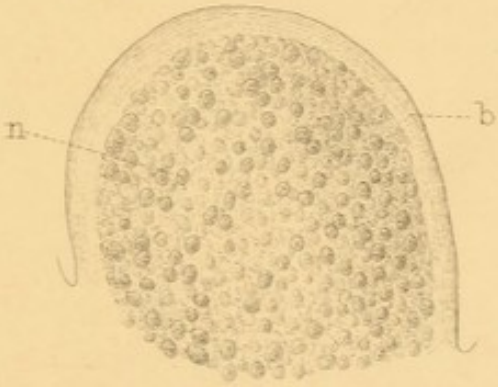


Fig 4.

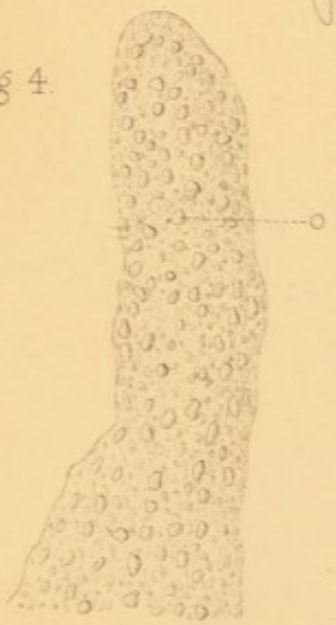
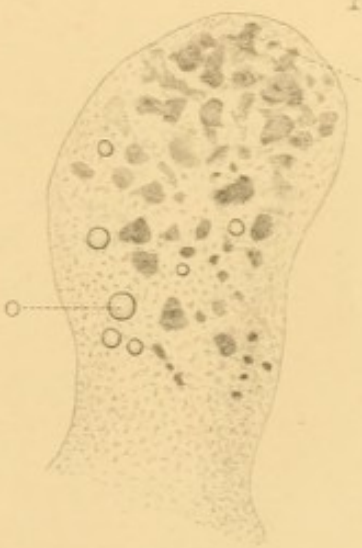


Fig 5.



Tuffen West sc.

W West imp.

subject agree, that the functions of the digestive organs are frequently deranged before any morbid change can be discovered in the lungs.

Dr. Wilson Philip, Dr. Todd, Sir James Clark, and many others, have drawn attention to the impairment of digestion as premonitory of consumption, and my own experience fully confirms many of the results at which these observers have arrived.

Mr. J. Hutchinson has carefully investigated this subject, especially pointing out that in the majority of phthisical persons there is a distaste for fat. He sums up his conclusions as follows:—

1. "In a very large majority of cases of established phthisis, a condition of well-marked dyspepsia is present as a complication. Out of fifty-six cases, it was absent in four, present mildly in twenty-one, moderately in twenty-two, and severely in nine.

2. "Of the form of dyspepsia most common in established phthisis, the prominent symptoms relate to difficulty in the assimilation of fatty matters. The patient acquires a remarkable distaste for all fats, which occasionally extends itself to sugar and even to alcohol. He suffers much from 'biliousness,' heartburn, flatulence, and above all from acid eructations after taking food. Everything he takes 'rises acid,' to use his own expression, but more particularly everything containing fat, oil, or sugar.

3. "The majority of cases of phthisis, whether hereditary or otherwise, are *preceded* by a well-marked stage of dyspeptic symptoms. By this it is meant, that symptoms referable to the stomach or liver have preceded those connected with the lungs. Out of the fifty-two cases in which, as has

been shown, dyspepsia was present, it had followed pectoral symptoms in nine, been developed about coincidently with them in ten, and preceded them in thirty-three.

4. "The symptoms of the dyspepsia premonitory of phthisis are the same in character with those which complicate it when developed. The very earliest are alterations in the tastes, and the most constant one is a disrelish for fat. Often sugar disagrees and is disliked, sometimes alcohol also.

5. "The subjects of phthisis have, in a large number of cases, had peculiarities of likes and dislikes for different articles of food, even from very early life, and whilst seemingly in perfect health. Amongst these peculiarities, the dislike of fat often amounting to extreme aversion, ranks first. Thus it might be predicated of a family in which one child distinguishes itself from its brothers and sisters by its refusal to eat fat, that that child will, *cæteris paribus*, be the most likely one to become the subject of tuberculous disease in after life."[1]

Although Dr. Dobell[2] had confirmed the truth of Mr. Hutchinson's observations, this subject seemed to me of so much importance, that I carefully inquired into the state of health preceding the appearance of phthisis, in 200 cases under my care at the Victoria Park Hospital. I took them without selection, and was careful to avoid any appearance of "leading questions."

I found that in 83 per cent. the cough was preceded either by dyspepsia, by loss of strength, or by

[1] *Medical Times*, p. 385, 1855.

[2] *Lancet*, Sep. 10, 1864.

languor; in the remainder, the chest symptoms were the first to attract notice. In 50 per cent. there had been a distate for fat previous to the commencement of the phthisis.

In 23 per cent. the patients dated their ill-health from some previous malady.

In 13 per cent. some febrile disorder appeared to have given rise to the illness. In half of this class, the cough immediately followed the cessation of the fever; all of them except two had previously suffered from dyspepsia, but only five out of the thirteen had shown any distaste for fat. In thirteen cases the general health had been injured by the febrile disorder, but some time elapsed before they showed any symptoms of consumption. Of these, seven were liable to dyspepsia previous to the fever; in five, indigestion appeared after the attack, and one remained weak and languid, but complained of no symptom of dyspepsia. Of the whole 26 cases, sixteen had suffered from "typhoid," "gastric," or "low fever;" three from small-pox; four from rheumatic fever; one from dysentery; one from scarlatina, and one from erysipelas.

The tendency of "enteric fever" to give rise to phthisis has been often noticed, and from the above figures it would appear, that those who have been previously subject to dyspepsia are most liable to suffer from this unfortunate termination.

In seven cases the cough commenced during pregnancy, and of these, five had been previously dyspeptic. In three others, the affection of the lung followed some time after the confinement, and all of these suffered from some form of indigestion

associated with weakness and languor, before the appearance of the cough.

Ten dated their failure of health to accidents or some chronic disease. Only one of these had previously suffered from dyspepsia. Six complained of feebleness, bad appetite, and other symptoms of indigestion; the others only of debility following the accident or disease, and preceding the symptoms of phthisis.

In thirty persons, or 15 per cent. of the whole number, neither dyspepsia nor languor preceded the chest symptoms. These might seem to form an exception to the rule afforded by the other classes, but we must remember that there is every reason to believe that many cases of phthisis, strictly speaking, originate, not from tubercle, but from local degeneration of the tissues. That a number of such cases are here included may be gathered from the fact, that a large proportion was above the age of forty, and that many attributed their disease to the drinking of ardent spirits, or to the dusty occupations in which they were engaged.

Of the remaining 124 cases not included in the above groups, all had experienced either languor or dyspepsia before the occurrence of any chest symptom. Amongst these we find that weakness or languor preceded phthisis in 73 per cent. In some it was only of a few weeks', in others of one or two years' duration. Some persons had been obliged to give up their occupations on account of it, in others it came on only towards evening. There was a distaste for fat in 57 per cent., and this symptom was generally observed after the lung symptoms had presented them-

selves in those who had not previously experienced it. In many the dislike to fat diminished if the health improved under treatment. Heartburn or acidity was remarked in 56 per cent. It had been in many cases complained of for years, in others only for a few months before the commencement of the cough. Few patients escaped it after the disease in the lung had become confirmed. A tendency to sweating at night, or on moderate exertion, presented itself as a precursory symptom of phthisis in 33 per cent., and a gradual loss of flesh was observed in 28 per cent. of this group. Twenty-eight per cent. had been liable to bilious attacks, which in many instances had ceased shortly before the symptoms of phthisis made their appearance. The appetite had been bad in 26 per cent., and flatulence had been a prominent symptom in 30 per cent.

From the results of the above inquiries, combined with what daily observation affords us, we have not much difficulty in sketching the main features of the form of dyspepsia that often precedes phthisis.

In children its symptoms are usually more distinct than in older persons. The face gradually loses its colour, becoming pale and pasty; the child is unwilling to play about like others, and if roused for a time into activity, it soon becomes tired; there is a gradual but steady loss of flesh; the skin is often dry, harsh, or covered with eruptions; in others it is soft and easily perspires.

These symptoms are often allowed to continue for weeks or months before medical advice is sought, or before the condition of the patient is regarded as at all dangerous.

When more minutely examined, various symptoms indicative of disordered digestion may be remarked. The lips are often dry and cracked, the tongue is furred, red at the tip and edges, or with bright red spots projecting through the fur. The hands are hot, especially towards evening, and thirst is complained of. The appetite is very variable, at times ravenous; at other times the child cannot be tempted to eat anything. The abdomen is usually tumid, sometimes tender, and the bowels are confined, with occasional attacks of diarrhœa. The alvine evacuations are invariably disordered; often of a grey colour and pasty, and almost always mixed with mucus.

As the disease progresses, the languor and loss of flesh become more manifest; a short cough comes on, pains of the chest and head are complained of, and before long either the stethoscope indicates consolidation in the lung, or inflammation takes place in the peritoneum or pia mater, from deposit of tuberculous matter.

In the case of adults the symptoms are somewhat different. In the greater number the patient has been either subject to bilious attacks for a length of time, or is affected with them shortly before the more serious indications of disease make their appearance. Vomiting of bile may take place only at intervals of a few weeks, or may occur for a short period two or three times a day. Acidity and flatulence after food are very usual symptoms, and with these there is a decided distaste for fat. A sense of languor is generally present, and in many cases it is the only

cause of complaint. The emaciation is at this stage very slow, and is generally rather observed by the friends of the patient than by himself. The skin becomes sallow and unhealthy; in some cases it is dry and harsh, in others perspirations occur after the slightest exertion. The bowels are usually confined, often obstinately so, and the alvine evacuations are unhealthy. The urine is generally scanty and loaded. Gradually a short cough makes its appearance, the languor increases, and hæmoptysis, or some other serious symptom, attracts the attention of the patient or his friends to the dangerous nature of the disease.

Whenever languor persists for any length of time in a young person without obvious cause, it indicates *something* serious, and it is therefore necessary that the medical practitioner should most carefully search for the cause of the feebleness. Such a case requires very careful attention, for we know not how soon all chance of successful treatment may be destroyed by permanent injury to some vital organ.

As regards the treatment of the precursory stage of phthisis, most writers have agreed as to the great value of mercury, and my own experience confirms the truth of their observations. It should, however, be only used as an alterative, and it acts best when given in small and repeated doses. The hydrarg. cum cretâ is the preparation best fitted for children, and the pil. hydrarg. for adults. In the treatment of both it is useful to combine the mercury with a small dose of rhubarb or of aloes. Whilst giving mercury, it is a good plan, at the same time, to exhibit an alkali along with some light

bitter, and if the state of the bowels requires it, an occasional aperient.

After a short continuance of the above treatment I have seen excellent effects produced by sarsaparilla and taraxicum. The former is chiefly useful in the cases of children, and is often borne where a more decided tonic creates irritation in the digestive organs. The taraxicum is valuable when the complexion remains sallow, the tongue foul, and the alvine evacuations disordered after mercury in alterative doses has been fairly tried. Dr. Todd strongly recommends a combination of taraxicum, nitrate of potass, and infusion of rhubarb, as a substitute for mercury in strumous subjects.

As soon as the condition of the digestive organs will permit, we must have recourse to the stronger tonics, and in the choice of them we must be guided by the circumstances of the case.

When the tongue is large and flabby, and the alvine evacuations remain of a dark colour, the mineral acids are generally useful. If the skin be soft, and the patient liable to perspirations, they should be combined with cinchona or quinine.

Steel in its various forms is invaluable in the treatment of these cases, and acts well in restoring the strength. The most useful forms are the syrups of the iodide and phosphate of iron. If there be much depression of the nervous energy, it will be found useful to combine some preparation of steel with the hypophosphite of lime or soda.

There can be no doubt that the remedy which is most generally useful in the precursory stage of phthisis is cod-liver oil. Its good effects are more

particularly seen in those cases in which emaciation is an early and prominent symptom. We cannot give it advantageously under all conditions, for it aggravates the symptoms when prescribed before the derangement of the digestion has been corrected by other means.

When the circumstances of the patient permit it, change of air will be found of the greatest service. It is in fact chiefly at this stage of phthisis that real and permanent benefit may be expected from such a measure. In the case of children, a residence at the sea-side is usually to be preferred, but adults derive more advantage from frequently changing their abode, so as to combine amusement with variety of air and scene.

It has been before mentioned that in a small number of cases of phthisis, the mucous membrane of the stomach was found to be affected either with adhesion of its secreting tubes to each other, showing the effects of chronic gastritis, or with superficial ulceration in the pyloric region. We meet with cases, probably of this kind, in which the dyspeptic symptoms are of such severity, that they mask the indications of the disease of the lungs.

There are two well-marked classes of cases, in which the predominance of the symptoms of gastric derangement is apparent.

The subjects of the first class are found in young females from thirteen to seventeen years of age. In some the earliest symptoms are those of subacute gastritis. There is a constant pain at the stomach after food, vomiting, thirst, and loss of appetite. In others the complaint commences more insidiously, and

pain is experienced in some part of the abdomen, with nausea and loss of appetite. Its ordinary situation is to the left and a little above the umbilicus; but I have known it affect the hypogastrium so severely, that the young lady in whom it occurred was treated for some obscure disease of the uterus. When the abdominal symptoms have disappeared, as they usually do under treatment, the patient still remains pale, thin, and languid. She is unable to make much exertion, and seems listless and desponding. The appetite is fickle, she is subject to flatulence and occasional vomiting after food, and the bowels are disordered. In this state she may remain for two or three years; never feeling strong, and yet unable to complain of much, beyond the dyspeptic symptoms. The catamenia are very irregular, or they never make their appearance, and to this circumstance the friends often attribute her ill-health.

But gradually the real nature of the disease begins to show itself. Cough sets in, at first only in the morning; this is frequently followed by vomiting, the appetite becomes more fickle, the pain in the epigastrium increases, and emaciation progresses more rapidly. The pulse is quickened, and the case gradually slides into well-marked phthisis.

The other class comprises men from thirty to forty-five years of age. They are usually tall, spare, of nervous temperament, and often endowed with more than the average amount of energy and mental ability. They have always been victims to indigestion, and have for years suffered from acidity, flatulence, and occasional pain after food. When they come under medical treatment it is often more

in compliance with the wishes of their friends than from any idea of their own, that they are in worse health than usual.

They experience pain in the epigastrium, and often also below the clavicles; the digestion is deranged, they have become a little thinner, and have less energy than is natural to them. These symptoms may shortly disappear, but return from time to time; the patient becomes more feeble, but in many cases so imperceptibly so, that it is only by comparing his amount of strength with what he possessed in the previous year that he can detect its decay. At last some symptom to which he has not been accustomed attracts notice; sometimes hæmoptysis calls attention to the lungs; in others slight, but obstinate diarrhœa gives rise to the suspicion of tubercular deposit on the mucous membrane of the intestines.

Even when the indications of phthisis are so evident that they cannot be mistaken by the medical practitioner, the patient often refers all his sufferings to the stomach. The pain at the epigastrium increases along with his weakness, vomiting occurs after all food, and flatulence and acidity are oftener complained of than cough or night sweats. I have known patients so affected refuse to admit that they are troubled with cough or expectoration, and to the last express their belief that, if the stomach were only relieved, they would be soon in good health.

The treatment of these cases is one of great difficulty in the earlier stages, inasmuch as whilst we have to combat the disorder of the stomach, we must also endeavour to arrest the impending formation of tubercle.

Mercury can seldom be borne, and, if it be necessary to give it, the mildest preparations should be employed.

All active purgatives should be avoided, as the strength of the patient is already lessened by the disease. The gastric irritation should be first allayed by means of bismuth, hydrocyanic acid, morphia, or nitrate of potass; the treatment being regulated by the condition of the digestive organs. These may be followed by alkaline infusion of sarsaparilla, or, if the stomach will bear them, by the mineral acids and cinchona.

Unfortunately, the patients can seldom digest cod-liver oil; but it should always be tried as soon as the state of the stomach will permit it. In the case of girls steel is invaluable; the mildest forms being those best fitted for exhibition.

From the observations above detailed we may, I think, hazard some conjectures, which, even if not altogether correct, may be useful in directing future inquiries into this important subject.

Observations seem to hint that the materials which at one time would not be absorbed, or, if taken up, would be eliminated, may at another period give rise to tubercle. Thus, a child may for a long time be affected with dyspepsia, and at last be suddenly carried off by tubercle of the brain; or an adult may suffer from indigestion and languor for months or years; and yet, without any change in these symptoms, phthisis may supervene. In either case dyspepsia has been present from the first, but some local action has been required to convert the ill-formed nutriment into tubercle.

It appears to me that the chief cause leading to the actual production of tubercle is an activity of growth in the tissues disproportioned to the amount of healthy nutriment presented to them. In the normal condition the power of the digestive organs is regulated by the requirements of the system; hence the keen appetite and the rapid absorption of the young. But if the growth of the body progresses more quickly than the digestion can supply a sufficient quantity of properly constituted material, then matter of an inferior organization will be taken up and employed in nutrition, and disease must be the result.

Youth is the period of life when growth is most rapid, when tubercle is most common, and when the symptoms of the premonitory dyspepsia are most distinctly marked.

Again, those amongst the young who have shown a sudden increase in growth are especially the victims of phthisis. In common language, they have "outgrown their strength;" according to a more scientific expression, the development of the system has been in excess of the nutriment digested and absorbed. After the cessation of fevers, nature attempts by increased activity to repair the loss of structure, and if the digestion at the same time recover its powers, it shows a corresponding vigour; but if digestion be seriously injured, the supply of normal material is insufficient for the demand, and phthisis is apt to supervene. On the same principle only can we explain the frequent occurrence of tubercle during pregnancy; for many of these cases previously exhibited no symptoms indicating any affection of the lungs. Another circumstance often giving rise to tubercle is he occurrence of an accident, or local inflammation,

in a person of a feeble habit of body. In a healthy constitution, properly organized material would supply the amount required for the rapid growth of cells, but in the case we have supposed, a sufficiency of this does not exist in the blood, and a development of tubercle results.

If this theory be correct, we ought not to find indigestion the only symptom preceding phthisis. The organization of new material is the result of a number of processes, of which digestion is only one, and we might therefore anticipate that imperfection in any of these would lead to the formation of tubercle. We have seen that languor and debility often precede the disease of the lung where there is no indigestion, and we may conclude that in such cases the disease has arisen from failure in the functions of some of the other organs that concur with the digestive tract in the elaboration of the materials required for the growth or renovation of the tissues.

I suspect that, under the head of tubercle, we comprise many substances of different chemical constitution. Thus, I found the lung of a camel, which had died of phthisis, hard and calcareous; but the calcification was not the result of the deposit of the inorganic salts of lime, for after being soaked for some months in alcohol, the organ became soft and pliable. Here was a case in which the tubercle was chiefly composed of lime united with some organic acid. On the other hand, the lung of a foreign pigeon was converted into a cheesy mass, which no one would hesitate to declare to be tubercle, but which, under the microscope, seemed to consist almost entirely of cholestrine. In this instance there seemed

an absence of lime, and it would be therefore impossible to consider the morbid deposit as alike in both of these cases.

But whatever be the exact nature of tubercle, there is little doubt that it acts as an irritant to the tissues in which it is deposited. This is well shown in the mesentery of many of the lower animals which have died of phthisis. In these a number of minute spots may be often observed, near the edge of the intestine; and if the blood-vessels have been carefully injected, small arteries can be seen by the microscope to converge to each spot from different quarters. The vessels, as soon as they enter the diseased part, become much dilated, and form a close network within it. The elevations themselves are composed of cells intermixed with fat; but after the preparation has been kept for a short time, the cellular structure disappears, and oily and granular matters are alone to be perceived.

Tubercle agrees with the animal poisons we before examined, in its power of reproducing in the system a substance possessing properties similar to its own.[1] This appears to be demonstrated by the experiments of M. Villemain, who produced phthisis in rabbits by inoculating them with tubercle taken from the human subject.

The researches of M. Villemain also seem to prove that tubercle follows the law we before observed in regard to the poison of fevers, viz., that it is deposited in certain organs, along with the new growth it excites.[2] The parts chiefly selected are the lungs and lymphatic glands.

[1] See page 91.

[2] See page 123.

After remaining for some time, its removal takes place partly by ulceration, and partly by resorption. Tubercle, however, seems to differ from the poison of fevers in the difficulty or impossibility of its elimination through the emunctories of the body. Each breaking up of its structure, and consequent resorption, leads to a fresh series of deposits in other and more distant organs, and thus the case is often hurried to a fatal termination. As regards the difficulty of its elimination, it resembles syphilis; for in this complaint the irritant matter is successively deposited in different structures, exciting in them what are termed the primary, secondary, and tertiary forms of the disease. This similarity gives us some slight grounds for hope that, with the advance of science, substances may be discovered which will act—as mercury and iodine seem to do in syphilis—in rendering the elements of tubercle capable of elimination by the excreting organs of the body.

CHAPTER XI.

WEAK DIGESTION.

Strictly speaking, every disease of the stomach might be included under this head, for in all the digestive powers are lessened. In inflammation of the gastric mucous membrane, as we have already seen, its secretion is both altered in its chemical composition and diminished in quantity; and similar changes, in all probability, occur in ulcerations and cancer of the stomach. But there is a large class of cases in which the symptoms, being unaccompanied by indications of active disease, arise simply from deficiency in the digestive powers, and I propose to consider these under the head of weak digestion.

The greater number of persons who apply for medical relief on account of disorder of the stomach are affected with this variety of dyspepsia. The predisposition to it is influenced by various circumstances: thus, the female is more liable to it than the male; below thirty years of age inflammatory dyspepsia is much more common than weak digestion; between thirty and fifty, the proportions are nearly equal; from fifty to sixty, the latter is more generally met with; and above sixty, but few instances of gastritis present themselves to our notice.[1]

[1] Appendix, Note A.

The effect of hereditary predisposition is less shown in cases of weak digestion than in any of the other classes of gastric disorder; for where the indigestion commenced with symptoms of feeble digestion, only 42 per cent. were born of persons subject to dyspepsia; where it appeared as chronic gastritis, there were 46 per cent.; when the first ailment was a tendency to "bilious attacks," there were 64 per cent.; and when the first attack was characterized by severe pain, 52 per cent. were children of persons liable to complaints of the digestive organs.[1] The predisposition to feeble digestion is also more decided in those whose general nutrition is defective; for, of dyspeptics of a spare habit of body, 60 per cent.; of those moderately stout, 53 per cent.; but of those decidedly fat, only 45 per cent. applied for medical relief on account of its symptoms.[2]

Although pain is not so common an accompaniment of feeble digestion as of many other diseases of the stomach, it is by no means unfrequently complained of. It is usually referred to the sternum and not to the epigastrium, but in some persons it extends to the hypochondriac regions and across the chest. In a certain class of cases it affects the inside of the left arm, reaching to the fingers, and the sensation is often described as a numbness rather than an actual pain. The pain of feeble digestion is usually of a dull and gnawing character, and is neither constant as in ulceration of the stomach, nor sharp and cutting as is often the case in gastritis. It is most commonly felt some time after food or

[1] Appendix, Note B. [2] Appendix, Note D.

when the stomach is empty, as in the early morning, and is often described as a faint or sinking sensation. It is generally relieved or entirely removed by food, stimulants, and hot liquids. There is no tenderness of the epigastrium in uncomplicated cases, and this is a very important distinctive mark between this and the inflammatory forms of dyspepsia.

There is usually a feeling of weight and discomfort after a meal of even moderate amount. The food is said "to lie heavy at the stomach;" a sensation arising probably from the slowness of the digestive process, and the imperfect contractile power of the muscular coat. In some cases, when the patient is laid flat upon his back shortly after food, the least motion of his body produces a splashing sound, as if the stomach only feebly grasped its contents.

Flatulence is almost always present, and causes much distress to the patient, both when the stomach is full and empty. When there is much debility of the muscular coat the diaphragm is often pushed upwards, and various sympathetic affections of the heart and lungs are produced.

Vomiting is rarely an accompaniment of feeble digestion, but nausea is often met with, and seems to arise from the irritation of the partially digested food.

The appetite is generally impaired; in some cases there is a loathing of all food, whilst in others there is a craving for various indigestible articles of diet.

Acid eructations are only occasionally experienced; when they become continuous, they mark a change from a mere state of debility of the gastric mucous membrane to one of congestion or inflammation.

The tongue is often pale, large, and flabby, and indented by the teeth; in other cases it is covered with a whitish fur, or streaked with mucus. There is seldom much thirst, but the sense of taste is often impaired.

The bowels are almost always confined, although at times this state alternates with diarrhœa. The alvine evacuations are often pale and unhealthy in appearance; at other times, pieces of undigested food may be detected in them. I have often known patients suffering from this form of indigestion assert that they were affected with worms; which when examined have proved to be pieces of muscular or vegetable tissue that had passed unaltered through the alimentary canal.

The urine is occcasionally loaded with lithates, but is more generally copious and clear, and deposits on standing phosphates or oxalates, mixed with a large quantity of mucus.

The pulse is feeble and rather slow; the skin is soft and perspires easily; the extremities are cold and the muscular power diminished; the sleep is broken and unrefreshing, or accompanied by nightmare, dreaming, and cramps of the hands or feet.

The sympathetic affections of other organs are so various that they almost defy description. There is, indeed, scarcely a disease that may not be to some extent simulated. Whenever, therefore, symptoms present themselves indicative of an affection of other organs, a careful examination of their condition should be made, lest the practitioner should be misled into believing the case to be one of greater gravity than it really is.

Headache, giddiness, loss of memory and confusion of thought, are often subjects of complaint; or the senses appear to be chiefly affected, and noises in the ears, partial deafness, dimness of vision, chiefly attract the patient's attention. In others again, cough, dyspnœa, and pain of the chest, lead to a suspicion of lung disease; or palpitation or irregular action of the heart may be complained of.

Unquestionably the most frequent cause of feeble digestion is the previous existence of inflammation of the gastric mucous membrane. The first symptoms may be produced by subacute gastritis as in cases of "bilious attacks," or they may appear in the form of chronic gastritis; but nothing is more common than the subsidence of the inflammatory action into a condition of weak digestion. The probability of its being ushered in in this manner varies very much with the sex and age of the patient. In the female, gastritis is more apt to end in weak digestion than in the male; and in both, this occurrence is more likely to take place in the old than in those of middle life. Again, subacute gastritis more commonly originates from enfeebled digestion amongst the females than in the other sex.[1]

Constipation is a very frequent cause of feeble digestion. The muscular coat of the colon acts slowly and imperfectly, and in consequence the food is delayed in the upper part of the digestive canal; and either chronic gastritis is set up, or the symptoms of atonic dyspepsia are produced. In the same way hernia seems to bring about a defective state of the digestive powers. I have seen a few

[1] Appendix, Note A.

cases of obstinate dyspepsia in which there existed a small abdominal hernia, and as soon as the intestine has been permanently kept within the abdomen, the symptoms of the disorder have disappeared.

A considerable number of the poorer classes affected with this form of indigestion have an insufficient supply of food. Of the dyspeptics who only partook of animal food occasionally, 70 per cent. were affected with feeble digestion; but amongst those more liberally supplied with nourishment, only 49 per cent. suffered from it.[1]

The abuse of alcoholic stimulants has a tendency to give rise to this disorder, probably by previously producing inflammation of the gastric mucous membrane. Of those dyspeptics who confessed to have been intemperate, 57 per cent. applied for relief on account of this form of dyspepsia, and only 36 per cent. for symptoms of chronic gastritis. But, on the other hand, there can be little doubt that amongst the poorer classes a moderate amount of fermented liquors tends to ward off indigestion; for as before stated, affections of the stomach are much more frequent amongst total abstainers than amongst those who were in the habit of taking malt liquors in small quantities.[2]

The immoderate use of tea produces all kinds of dyspepsia, more especially amongst the ill-fed classes of society. It chiefly predisposes to a feeble state of the stomach; for of those dyspeptics who were in the habit of taking it in moderation, 50 per cent., but of those who used it to excess, 58 per cent., were affected with weak digestion.[3]

[1] Appendix, Note H. [2] Appendix, Note G. [3] Appendix, Note I.

The want of sufficient muscular exercise, whilst it gives rise to other kinds of indigestion, chiefly tends to produce a feeble state of the stomach; thus of 100 males who complained of acidity, 83 had followed active employments, whilst of 100 who suffered from weak digestion, only 76 had sufficient exercise.[1]

We may see the influence of muscular exertion upon the digestive organs by looking at the effects of trades. Of persons who pursued their trades out of doors, 27 per cent. applied for medical relief on account of dyspepsia; whilst of those whose occupations confined them to the house or factory, there were 43 per cent. Again, of those whose work within doors was of a laborious character, 37 per cent. were dyspeptics; whilst of those employed in sedentary occupations, the proportion reached 46 per cent. A constrained position during work seems to neutralize the beneficial effects derived from active muscular exertion; for amongst the miners of coal and lead, 42 per cent. sought advice on account of dyspepsia. We may therefore conclude that an insufficient supply of pure air, deficiency of muscular exercise, and a constrained position of the body, tend to give rise to dyspepsia; and of the various forms of indigestion, that characterized by imperfect secretion of the gastric juice is most likely to result.[2]

Although the proportion of persons who eat quickly was found to be much greater amongst the dyspeptics

[1] Appendix, Note K.

[2] I have omitted in the Appendix the investigation into the effects of trades on digestion.

than the healthy, the relative numbers of those who masticated imperfectly, and who were affected with feeble digestion, were exactly the same as of those who suffered from chronic gastritis. It is therefore evident that the habit of imperfect mastication tends to produce that form of dyspepsia to which the individual is otherwise predisposed.[1]

Medical authors have been so generally in the habit of stating that the practice of smoking tobacco produces feebleness of digestion from waste of the saliva, that we are naturally induced to accept their conclusion. It will be seen, however, that such is not the case; and that if tobacco, when smoked in moderation, acts at all injuriously on the stomach, it is rather by producing chronic gastritis than mere weakness.[2] Smoking is a popular remedy for flatulence, and a cigar after breakfast is very effectual with many persons in producing a regular action of the bowels.

The first and main point in the management of weak digestion, as in that of all other diseases, is to ascertain, and if possible to remove, the cause from which it has arisen.

The medical treatment of this class of cases is quite different from that required in inflammatory dyspepsia. Local depletion and counter-irritation, which are of such value in many cases of chronic gastritis, are injurious in this by reducing the strength of the patient. A stimulating plaster to the epigastrium is, however, often of service; and in all cases care should be taken that the surface of the

[1] Appendix, Note E. [2] Appendix, Note F.

abdomen is maintained at an even temperature. This is especially necessary in children, and a bandage of silk or flannel round the stomach is often more valuable than any other means employed for their cure.

Nothing is more injurious in weak digestion than the indiscriminate use of purgatives. The action of a brisk aperient is generally followed by an increase of the flatulent distension, and the powers of the stomach are enfeebled by every repetition of the dose. When the functions of the liver appear to be disordered, podophyllin in small doses will be found more useful than mercurial preparations. It should be combined with creasote and rhubarb pill, or with extract of aloes. Where flatulence is a prominent symptom, assafœtida and galbanum may be employed. Powdered charcoal is a valuable remedy, but chiefly where the action of the colon is imperfect. In the majority of cases, a regular action of the bowels is best maintained by an aperient electuary of senna or sulphur. In some a pill of rhubarb or aloes combined with extract of nux vomica, gentian, or cinchona, taken shortly before dinner, relieves the bowels without irritation; in others, a small dose of castor oil every morning is found most useful. When the colon is overloaded from atony of its muscular coat, frictions of iodine or turpentine to the abdomen are often of more value than any aperient medicine.

Of the class of tonics, the mineral acids are by far the most generally useful, and the nitric and hydrochloric acids seem to answer best; they should be given shortly before the principal meals. Where the urine deposits phosphates, or oxalate of lime,

they are especially beneficial, and may be combined with calumba, cinchona, or any of the other bitter infusions. When there is general anæmia, steel is invaluable if it can be borne; and we may begin with steel wine, and afterwards try some of its salts. The sulphate and perchloride appear to act as astringents to the gastric mucous membrane. Where nervous depression is a prominent symptom, strychnia, silver, and zinc will be found most suitable.

Stimulants are almost always required at some period of the case, and whenever the skin is cold, and the patient is free from burning heat in the hands and feet, benefit may be expected from them.

Fermented liquors are generally useful, and the choice of the particular kind to be employed must be determined by the circumstances of the case. Ammonia is valuable, as it acts locally upon the stomach, by expelling flatulence and promoting digestion, whilst at the same time it stimulates the heart and nervous system. It is best given in combination with some bitter infusion. Preparations of ether answer very well in the dyspepsia of old persons, and in that form connected with nervous exhaustion. Ipecacuan and capsicum have been strongly recommended by Dr. Budd and others as stimulants to digestion. In some cases they are no doubt valuable; but the habitual use of all such remedies is apt to prove injurious, by inducing the patient to look for relief from expedients that can only produce temporary benefit, instead of seeking for a permanent cure.

Pepsin given at meals along with dilute hydrochloric acid is of service, and that made from the

stomach of the pig has proved most useful in my experience; some of the other preparations have appeared to be almost inert.

As we before found that the various substances used as food differ greatly in the readiness with which they are acted on by the gastric juice, we may conclude that their relative digestibility will depend chiefly upon the proportion of their more soluble constituents. Thus, connective tissue is more slowly dissolved than muscular fibre,[1] and therefore the flesh of beef, which contains more of it than that of mutton, is digested with greater difficulty. For the same reason, fowls and game may be often taken with advantage, where the firmer fibre of beef and mutton would produce indigestion. Those parts of the animal which contain the smallest amount of fibrous tissue, such as tripe, the loin of the sheep, or the breast of birds, are most readily digested. Certain methods of cooking, such as roasting and broiling, are useful, in rendering the muscular fibre more easily separable; whilst boiling, by removing the more soluble parts, leaves only those constituents which longer resist the action of the stomach. Some kinds of food, such as pork, salmon, and herring, are apt to disagree, on account of the quantity of oily matter they contain.

The cells and spiral vessels of vegetables are not acted upon by the gastric juice, whilst their contents —starch, sugar, gum, and vegetable albumen—are readily dissolved. As the leaves of plants, such as the cabbage, are composed chiefly of the former, they seldom agree with a dyspeptic. The roots, in which

[1] See page 21.

the greater portion consists of starch or sugar, as in the case of the potato and beetroot, are much more readily digested. All vegetables should be completely cooked, as by this process the cells are separated, and the gastric fluid gains more ready access to their contents.

Farinaceous food of all kinds generally agrees, on account of the large amount of starch it contains, and the minute division of its insoluble portion. Bread made with yeast is very apt to cause fermentation, and in all protracted cases unfermented or aërated bread should be used.

In addition to the causes of weak digestion before described, there are other circumstances which give rise to it. In order that digestion may be properly performed, it is necessary that the structure of the stomach should be in a healthy condition, and also properly supplied with blood and nervous power. The effects of inflammatory changes of the gland structure have been already discussed under the heads of gastritis, and will be further alluded to when ulceration and cancer are described. The results of a deficiency in the supply of blood and nervous energy now require our consideration.

In old age we meet with a weakened condition of all the parts, upon the due action of which the proper performance of the functions of the stomach depends.

The state of the digestion in old people is, in fact, the best test of the vigour of the whole body. It must have been generally remarked that those who have lived to an unusually old age have through life enjoyed good digestive powers, whilst dyspeptics are

often cut off at an early period by degeneration of some of the vital organs.

After forty years of age, the glandular structure of the stomach diminishes in amount and in the energy of its action. As age advances, the blood-vessels are apt to become thickened. The muscular coat undergoes fatty and other degenerative changes, and no doubt the nervous power becomes enfeebled. We consequently find that the appetite decreases, the digestion is slower, and flatulence is experienced after the middle period of life has passed.

The best treatment for the dyspepsia of old age consists in the exhibition of stimulants and tonics. Ammonia in combination with cinchona, or some other bitter, is valuable; and in some cases the preparations of iron give tone to the stomach, and increase the power of the whole system. The bowels must be regulated by means of an electuary of senna or sulphur, or by a pill consisting of aloes combined with creasote or assafœtida.

It should be always remembered that, on account of the diminished mobility of the ribs, any distension of the colon is attended with more or less difficulty in breathing in the cases of the aged, and hence the great relief experienced from the use of purgatives. In one case in which the bowels had been obstinately constipated, I found after death fatty degeneration of the muscular layer of the colon.

The attacks of dyspepsia in old people are occasionally ushered in by chronic gastritis. There is tenderness at the epigastrium, acidity after food, loss of appetite, thirst, and a foul tongue. In many of these cases, the complaint seems to arise from a deficient

action of the kidneys; and I am occasionally consulted by one old gentleman, in whom attacks of this kind are generally followed by the passage of a small lithic acid calculus from the bladder.

In the weak digestion affecting the aged, the diet requires careful regulation. Soups or beef-tea should be employed, and solid food of the most digestible character only should be chosen.

CHAPTER XII.

ON THE CONNECTION BETWEEN AFFECTIONS OF THE BRAIN AND THE DIGESTIVE ORGANS.

THERE is no truth more certain in physiology than that a healthy state of the nervous system is requisite for a proper performance of the functions of the stomach. When Dr. Beaumont applied the bulb of a thermometer to the gastric mucous membrane, he remarked that congestion of the blood-vessels of the part and secretion of gastric juice almost immediately took place. The effects of this irritation must have been produced through the medium of the nervous system, and we may therefore conclude, that any cause tending to lessen its sensibility will necessarily influence the function of the digestive organs. The effects also of strong mental emotions in arresting the sensation of hunger and impeding digestion, are matters of every-day observation. Pathological observations confirm this view. Many diseases or injuries of the brain excite vomiting; whilst headache, giddiness, and affections of the senses are amongst the commonest symptoms of disorders of the stomach.

When we examine the digestive canal after death from diseases of the brain, we may feel surprised at the small amount of structural changes usually discovered; especially when we remember the frequency with which these take place in the affections of many other organs. I have the notes of only seven cases in which a careful microscopical examination had been made; and with the exception of one to which I shall afterwards refer, there was no serious disease of the gastric mucous membrane. In one hundred microscopical examinations of the stomach, published by Dr. Handfield Jones, there is no case of brain disease, with the exception of one of epilepsy, amongst those who presented "instances of great destruction of the secreting tubes." Dr. Fox reports fifty-seven cases of "catarrh of the stomach," but in none had death occurred from cerebral disease. Therefore, out of more than three hundred cases in which microscopical examinations of the stomach had been made, there was no case of brain disease, with the above exception, in which any structural change could be detected in the mucous membrane.

Of my own cases, three died of chronic disease of the brain, and in all these, with the exception of the pyloric region, the gastric tubes were healthy and readily separable from each other. In one they seemed unusually empty of cells, but in the others they contained both cells and granular matter. It is especially noted that the whole structure of the organ was very soft, and that the gastric tubes and cells were loaded with fat in two of the cases. Is this fatty condition the result of deficient nutrition

caused by the defective function of the nervous system?

Of the remaining three cases, two died from delirium tremens, and one from an accident whilst intoxicated. We have therefore in these the opportunity of examining the effects of spirit-drinking on the mucous membrane of the stomach. In none of them was there any evidence of intertubular gastritis in the middle or splenic region. The tubes in all contained cells, but in each case the remark is made that the whole stomach was very soft, and loaded with fat. In both the examples of delirium tremens, the veins were greatly enlarged, and in all three the pyloric region was thickened.

In a case where death had occurred from delirium tremens, I found that the mucous membrane of the stomach possessed the average amount of power of dissolving albumen; but the solution obtained by the experiment gave no precipitate with bichloride of mercury or tannic acid. Without wishing to draw any conclusion from a single case, I cannot help suspecting that, in many stomach affections, the essential nature of the disease may consist, not so much in a loss of power to reduce the food to a fluid condition, as in the formation of peptones slightly differing in their chemical or physical properties from those which the organ produces when in a healthy condition.

There is no form of indigestion so distressing to the patient and so embarrassing to the practitioner as that which arises from deficient power of the nervous system. It has been described by various authors under different names, but perhaps that of "nervous dyspepsia" is the most suitable.

The approach of this disease is so insidious, and its symptoms are so gradually developed, that the patient is generally unable to fix the date at which it commenced.

A person usually of middle age, who has been long subject to indigestion, after being exposed to the operation of some cause tending to depress the power of the nervous system, becomes aware of an increased amount of sensitiveness in the digestive canal. He can perceive the passage of the food along the mucous membrane, especially if it has been taken rather warm. There is a feeling as if the digestive tube were in a constant state of motion, which is often amongst the poorer classes attributed to the presence of worms. Others describe a sensation that shows still more the excited condition of the nervous system. It is as if a "wave" passed over and obscured the mental faculties for a moment; the feeling in the head being instantaneously followed by a movement of flatus in the stomach or intestines. With these there are evidences of disordered action of the brain and nerves in the other parts of the body. The patient starts on the slightest noise; a thrilling sensation passing down to the hands and feet. Twitchings of various muscles occasionally take place; there is palpitation of the heart; and numbness of the arms and legs is apt to occur after the limbs have been kept in a constrained position even for a short time.

The tongue is usually clean; the appetite good, sometimes craving; the urine is generally clear, and after standing deposits phosphates or the oxalate of lime. The bowels are almost always confined, and in

many cases a moveable tumour can be detected in the colon, just below the liver. In females, and sometimes also in males, the abdominal aorta may be felt to pulsate violently, and this has occasionally induced a belief that abdominal aneurism was present.

As the complaint advances, the evidences of the affection of the brain are more distinct. The patient becomes irritable, quarrelsome or suspicious, and is liable to uncontrollable bursts of anger on the slightest provocation. The powers of the will and of attention are diminished; those formerly resolute become facile and fickle, and the memory for recent events is impaired.

The most characteristic symptom, however, is the great mental distress. This is generally spoken of as a sense of despair, and in many cases it is accompanied by a dread of impending insanity. It almost always seems to be occasioned by the disorder of the digestive functions. I have known a person express himself as plunged into a state of wretchedness half an hour after taking a glass of wine, and in some, the effects of a meal of indigestible food are felt for many days. The patients are sometimes distressed with vertigo. The sensation is rather one of unsteadiness than of actual giddiness; it is not increased by stooping. In some it is accompanied with the feeling of the floor being uneven, in others, as if it were requisite to balance the body by constant attention to the limbs. The hand often shakes on the least mental excitement, and this want of control occasionally becomes so great that the sufferer from it is unable to sign his name, and is in constant fear of paralysis.

Attacks of palpitation form a prominent symptom with some; the pulse is irregular and intermitting, there is much distress, and the patient believes that death is staring him in the face; and yet all these symptoms may vanish as soon as the bowels are relieved by a purgative.

At other times spasmodic affections of the gullet occur; the food is swallowed with the greatest care, and the practitioner is led to suspect some organic disease of the œsophagus; or the patient starts from his sleep with a sense of strangulation; there is a distinct crowing sound, like the false croup of infants, and the symptoms are only relieved by the evacuation of flatus from the stomach.

Of course, in no single case are all the above symptoms manifested. These differ according to the organ more particularly affected, the natural constitution of the patient, and the exciting causes of the malady. The gravity of the complaint is also regarded in various lights by different observers. Those who only estimate the severity of a malady by the amount of structural disease they can discover in the patient, are apt to regard the highly-coloured descriptions of a person affected in this way as mere exaggerations; whilst those who believe, as I do, that functional disorders of the nervous centres may lay the foundation of physical changes, will regard the increased sensibility as possibly indicating a serious and important disease. My own observation leads me to conclude that the condition of the nervous system here described is sometimes the forerunner of structural changes in the nervous centres, or of fatty degeneration of some vital organ.

As "nervous dyspepsia" is really a disordered condition of the nervous system, we find that its causes can generally be shown to be some circumstances tending to affect this part of the body.

The chief and most important of these is long-continued mental anxiety. Even amongst the poorer classes this has a vast influence in the production of indigestion; for we find that whilst 38 per cent. of those liable to dyspepsia had been subjected to excessive care, only 16 per cent. of those who were free from this disorder had endured much anxiety. Its ill-effects tell more severely on the female than on the other sex, and they are more injurious to persons of middle age than at an earlier or later period of life.[1]

The tendency of mental anxiety is to produce feeble digestion rather than gastritis; and this is more particularly the case with females and with those who are otherwise predisposed to this form of dyspepsia.

It is in the middle classes of society that we generally meet with the most severe examples of "nervous dyspepsia." The student taxing his brain beyond its powers; the man of business exposed to the vicissitudes of fortune incidental to mercantile life; or that numerous class who are always struggling to maintain a position in society with insufficient means at their disposal—such are the classes of persons whose nervous system most frequently breaks down under the mental strain to which they are subjected.

[1] Note C, Appendix.

In the treatment of this disorder the great point is to recruit the powers of the nervous system, and for this purpose a full measure of sleep is necessary. It will be found that in the majority of cases there is either sleeplessness, or the rest is broken and unrefreshing. In some it is a good plan for the patient to secure a short sleep in the afternoon, provided this can be done, without preventing rest at night.

Wakefulness is often the result of exhaustion, and it is then advisable to give some easily-digested nourishment before the patient retires to rest. Sometimes he awakes about two or three o'clock in the morning, and is unable to sleep again; and in such cases the best effects are produced by the simple expedient of having food ready by the bedside.

But in others, the sleeplessness seems to be connected with an excited condition of the brain, and it is necessary to have recourse to sedatives. Small doses of morphia answer this purpose, but if it affects the digestion or produces headache, hyoscyamus, conium, or hop may be substituted. Sometimes a combination of bromide of potassium with the tincture of Indian hemp and chloric ether is very serviceable. Very frequently, the compound tincture of camphor appears to soothe more completely than stronger sedatives.

In the slighter cases, relaxation from business is alone requisite; but in the more severe forms of the disease, mental exertion must be completely suspended. This is usually the one prescription which it is most difficult to induce the patient to employ, but it is absolutely necessary that it should be

strictly carried out, if he wishes to regain his health. At the same time, nothing is more absurd than to condemn a person of active habits to a state of listless indolence, and it is of little use only to order what is called change of air.

Travelling seems to combine what is required for a patient in this condition. He is removed from the routine of his accustomed employments, his mind is pleasantly excited by the new objects presented to his view, and he obtains all the advantages connected with complete change of air and diet. But where, as is often the case, the disease has arisen from some severe and long-continued sorrow, this means will be found ineffectual, unless the attention be diverted from the subject on which it has been accustomed to brood, by providing an occupation which will interest the mind, at the same time that it involves no strain on the intellectual faculties.

Mental relaxation is necessary for all suffering from this disease, but as regards medical and dietetic treatment, we may recognise two distinct forms of the complaint; one in which the abnormal condition of the nervous system is associated with congestion of the liver and chronic gastritis; the other and more common case, in which the dyspepsia arises from a feeble state of the stomach.

When chronic gastritis is present, the patient has a foul tongue, defective appetite, thirst, heat of the skin at nights, confined bowels, and urine loaded with lithates. In this state it is advisable to keep him in the house for a few days, and apply fomentations or mustard poultices to the epigastrium. The diet should consist either of farinaceous food or beef-tea,

given frequently and in small quantities. If not contra-indicated by other circumstances, a few grains of blue pill, followed by a small dose of castor oil, may be administered once or twice a week, and a sedative mixture should also be prescribed. When acidity forms the prominent symptom, alkalies or bismuth may be resorted to.

Very careful treatment is required where the disease of the digestive organs seems to be solely connected with increased sensitiveness of the mucous membrane. Purgatives should be used with caution, as they tend to increase the irritation. I have seen much exhaustion of both body and mind produced by a small dose of castor oil; and in one case the patient was so affected by the irritation induced by a few grains of aloes that he left his house and wandered about the streets on a winter's night, in the hope of overcoming his excitement by fatigue. When an aperient is required, an electuary of senna or sulphur will be found useful, and as the patient's strength improves, a pill of rhubarb, galbanum pill, and hyoscyamus, or an electuary of sulphur and guaiacum, may be substituted. In other cases, it is better to trust entirely to enemata to relieve the bowels. When there is a tumour in the colon, stimulating frictions are of value.

Tonics, sooner or later, constitute the chief part of the treatment, and the selection of what drug we should use must depend upon the particular features of the case.

When the affection of the digestive organs forms the most prominent symptoms, we may have recourse to bismuth, silver, or iron.

Bismuth is chiefly useful when the complaint shows a tendency to frequent slight attacks of chronic gastritis, and when acidity is often complained of. It should be given in combination with magnesia and sedatives. The preparations of silver I have found very valuable, although many of late years have denied that they possess any efficacy in this complaint. This has probably arisen from the extravagant manner in which they were praised a few years ago. They seem to me, even in small doses, to act as astringents to the mucous membrane, whilst they probably also exercise a tonic effect on the muscular coat of the stomach and intestines. I prefer the oxide combined with small doses of morphia, or with hyoscyamus. Iron is also very valuable, and is suited for all the slighter forms of the complaint. When we desire its local action on the stomach, as well as its effect on the nervous system, we should employ the sulphate or the muriate.

When the nervous system is more prominently affected than the digestive organs, we shall find iron, zinc, and strychnine the most suitable. If, as is not unfrequently the case, neuralgia, either of the head or stomach, accompanies the complaint, quinine, arsenic, and carbonate of iron are the best remedies at our disposal.

The diet requires very careful regulation, and must be varied according to the condition of the digestive organs. Practically, the best information respecting the suitability of the food may be obtained by watching the sensations of the patient. Whatever meal has been followed by an increase either of mental distress or of the sensibility of the digestive canal,

must have been unsuitable either in quantity or quality, and repeated observations will soon show in what way the diet may be improved.

As a general rule, the food should be sparing in quantity, and vegetables, soups, wines, and other articles difficult of digestion, or apt to produce acidity, should be avoided. Bread, lean meat, and farinaceous food, should form the chief articles of diet.

The highly excitable condition of the nervous system in this form of dyspepsia would lead us to expect that in some persons it might produce epilepsy. The following case is an instance of this result.

Case 20.—A gentleman, about thirty-five years of age, whose health had broken down from excessive attention to business, presented the usual symptoms of nervous dyspepsia. I was one day requested to see him, and found him in a severe epileptic fit, in which he remained about half an hour. There was no biting of the tongue; and no heavy sleep followed the attack. He informed me that he had several times been affected in a similar manner, and could always trace the fit to a meal of indigestible food. Under careful dietetic and medicinal treatment he recovered his health, and the epilepsy ceased to trouble him.

In the above case the bowels were very much constipated, and before he came under my observation he had been treated for a tumour in the stomach; a mistake which I imagine had arisen from a collection of fæces in the colon.

I have met with other epileptics, in whose cases inaction of the large intestine formed a prominent symptom, and in these a sensation ushering in the fit was often referred to the side or epigastrium. I have at present an hospital patient under my care, who is subject to epileptic seizures every few weeks. The fit always takes place during sleep, and she states, that for a day or two previous to it she is sensible of a swelling of the side, in the situation of the ascending colon.

The prognosis of epilepsy in cases of this kind is of course of a more hopeful character than where it arises from other causes. The treatment that has proved in my hands most successful has been the careful regulation of the bowels by aloes and creasote, whilst the nervous system has been strengthened with iron and hypophosphite of lime.

The following case seems to show that epilepsy may arise from injury to the digestion caused by chronic gastritis.

Case 21.—A child, about four years of age, had been for some time subject to fits, which attacked her two or three times a day. She was stout, but flabby and anæmic. The appetite was voracious, and pieces of food were observed to pass from the bowels, unaltered by the digestive process. All the remedies prescribed proved fruitless to alleviate the complaint, and the patient died in a convulsion. On examination after death, all the organs, including the brain, seemed to the naked eye in a perfectly healthy condition. The mucous membrane of the stomach was pale, and not softened by *post-mortem* digestion. On microscopic

examination the splenic and middle regions were found to be diseased; the pyloric was tolerably healthy. In some parts of the splenic region the gastric tubes and muscular layer seemed closely united together by fine membrane, intermixed with fibres, nuclei, and small cells. Many of the tubes could be traced throughout their whole length, but in other parts scarcely any appearance of them could be observed; their original positions being represented by lines of fatty cells.

Although a diseased state of the stomach in epileptics does not appear to have attracted the attention of pathologists, the following case described by Dr. H. Jones makes it probable that such a condition may be more general than is at present supposed. He remarks, "that the following case shows that considerable wasting of the glandular tissue of the stomach may take place, without any apparent symptom."

Case 22.—"E. G., female, married, æt. 52, had been subject for eight years to epileptic fits occuring very frequently. In one of these she set her clothes on fire, and was burnt severely. She lingered for rather more than a month and died. She always had good digestion; never complained of pain in the stomach. Could eat any kind of meat; was very strong, and well nourished. All the organs appeared healthy except the stomach, on the surface of which were several ecchymosed spots, and the ileum and cœcum, in which were patches of deep red congestion. Microscopic examination showed the tubes in the

splenic region tolerably healthy; those in the mid region were utterly atrophied, and replaced by a fibro-homogeneous stroma, densely loaded with nuclei and granular matter; those in the pyloric region were also extremely wasted and lost amid fibroid formation."

Affections of the digestive organs may constitute the first, and for some time the only symptoms of serious disease of the brain. A person about forty years of age consulted me on account of vomiting, which occurred every morning. He had no headache, giddiness, or other symptom of cerebral disease; and the urine was free from albumen. A short time afterwards he was attacked with hemiplegia; and after death a tumour was discovered in the brain.

There is another and very important class of cases, in which along with dyspepsia there is an unusual amount of debility, often attended by severe neuralgia. Some of these are relieved by the accession of gout, others seem to terminate in disease of the brain.

Case 23.—A gentleman, between fifty and sixty years of age, had gradually become very dyspeptic for some time before I saw him. He was exceedingly feeble and very excitable; but his chief complaint was of a pain down the left arm to the hand, as soon as he retired to rest, and which was often so severe as to prevent sleep. He seemed at first to improve under treatment, but was attacked with paralysis, followed by softening of the brain. The pain of the arm ceased immediately after the paralytic seizure.

Although cases of this kind are rare, compared with the numbers who suffer from headache, giddiness, and other head symptoms arising from affections of the digestive organs, it is necessary that the possibility of their occurrence should be borne in mind, lest their real nature should be overlooked, and an inappropriate treatment adopted.

CHAPTER XIII.

DILATATION OF THE STOMACH.

The stomach is liable to degenerative changes like the other organs of the body. The anatomical alterations produced in it by the fatty and fibroid degenerations will be described in the following chapters. I have never met with the amyloid degeneration except when other organs were at the same time affected, and as the appearances are analogous to those observed in the kidney and liver, it is unnecessary to describe them.

There is, however, a disease of the stomach which, being usually connected with degeneration of the muscular coat, it will be most convenient to discuss in the present place. It consists in a dilated condition of the organ, and is accompanied by well-marked and characteristic symptoms. This complaint has of late years attracted a considerable amount of attention, on account of sarcinæ having been chiefly found in the matters vomited by patients affected with it, and from the discussion which has taken place as to the best method of treating it.

The amount of dilatation varies greatly in different cases. In some it is but slight, whilst in others it is so great that the organ occupies nearly the whole

cavity of the abdomen, concealing the larger part of the intestines, and its greater curvature reaching to the pubis.

The coats of the stomach are generally much attenuated, and the mucous membrane is smooth and thin. In one case which I examined microscopically, the gastric tubes were plainly visible, but were unusually distant from each other, and filled with large and very fatty gastric cells. In another the greater number of the glands had disappeared, and were replaced by fibrous tissue, and the muscular coat was thin and fibrous. It is evident, therefore, that by the long-continued distension of the organ, its secreting and muscular coats are seriously altered, and the probability of any permanent good being effected by medical treatment must depend upon the extent to which the disorganization has proceeded.

From what we know of analogous changes occurring in other hollow organs, it might be surmised that the cause of this affection would be an inability in the stomach to empty itself of its contents; and we find this to be the case; but the manner in which the disorder commences is very various.

A thickened condition of the pylorus is one of the most common causes of the dilatation. The opening is found much constricted; in some cases so much so, that even a probe can with difficulty be passed through it. The narrowing is produced by a ring of thickened tissue, and the condensation often extends for some distance from the opening. If a section be made through the pylorus, we find the mucous membrane in some cases much thickened, in others very thin and wasted, and occasionally

ulcerated. Below it is a band of hard, white, opaque tissue, which is connected with the more translucent muscular structure forming the greater part of the tumour.

If examined more closely, it will be observed that the muscular coat is divided by bands passing through it from the thickened connective tissue above and below. Sometimes the tissue between the muscular and peritoneal coats is thicker than that which unites the muscular layer to the mucous membrane.

When viewed with the microscope, the muscle is seen to vary in different cases. In some its fibre cells are increased in length and width, their nuclei are very large and prominent, and the whole structure has a coarse appearance. (See plate 7, fig. 2.) In others the nucleus is less prominent, and the rest of the cell is pale, membranous, and wrinkled. We can occasionally trace in the same preparation the gradual change which occurs; at one place a few separate pale cells are apparent in a band of fibres, in another the cells have disappeared, and the fibres are the only representatives of the formerly contractile structure. (See plate 7, fig. 3.)

Not unfrequently the opening at the pylorus is found after death to be so large, that it could not have presented an impermeable obstruction to the passing onwards of the fluids vomited during life. The cause of the distension in such cases must be partly referred to the degeneration of the muscular coat, and partly to spasm of the orifice, which we may as readily suppose to be associated with a stricture in this locality, as it so often is with a similar condition of the urethra.

PLATE VII.

FIG. 1. Muscular fibre cells from the stomach of a female affected with cancer of the breast.

FIG. 2. Hypertrophy of the muscular coat at the pylorus. The cells are much increased in length, and their nuclei are unusually large and prominent.

FIG. 3. Conversion of the muscular coat into fibrous tissue in a case of thickened pylorus. The muscular fibre cells are but faintly visible, and their nuclei are not apparent.

FIG. 4. Complete conversion of muscular fibre into fibrous tissue in a case of thickened pylorus. There are no remains of fibre cells to be perceived.

FIG. 5. Torulæ in fluid vomited by a dyspeptic patient.

FIG. 6. Sarcinæ ventriculi.

FIG. 7. A form of fungus vomited by a female suffering from "bilious attacks."

a. With a moderate amplification (x 150 diameters).

b. Globular enlargement at end of a branch.

c. Four smaller terminal globular enlargements.

d. A large and a small terminal enlargement.

e. Four similar bodies in chain, progressively diminishing in size outwardly.

f. Rounded aggregation of sporules such as by many authors are called "Aspergillus," evidently merely produced like the preceding, and accidentally remaining attached.

g. Portion of the thallus, with short lateral branches (conidia), and a swollen portion.

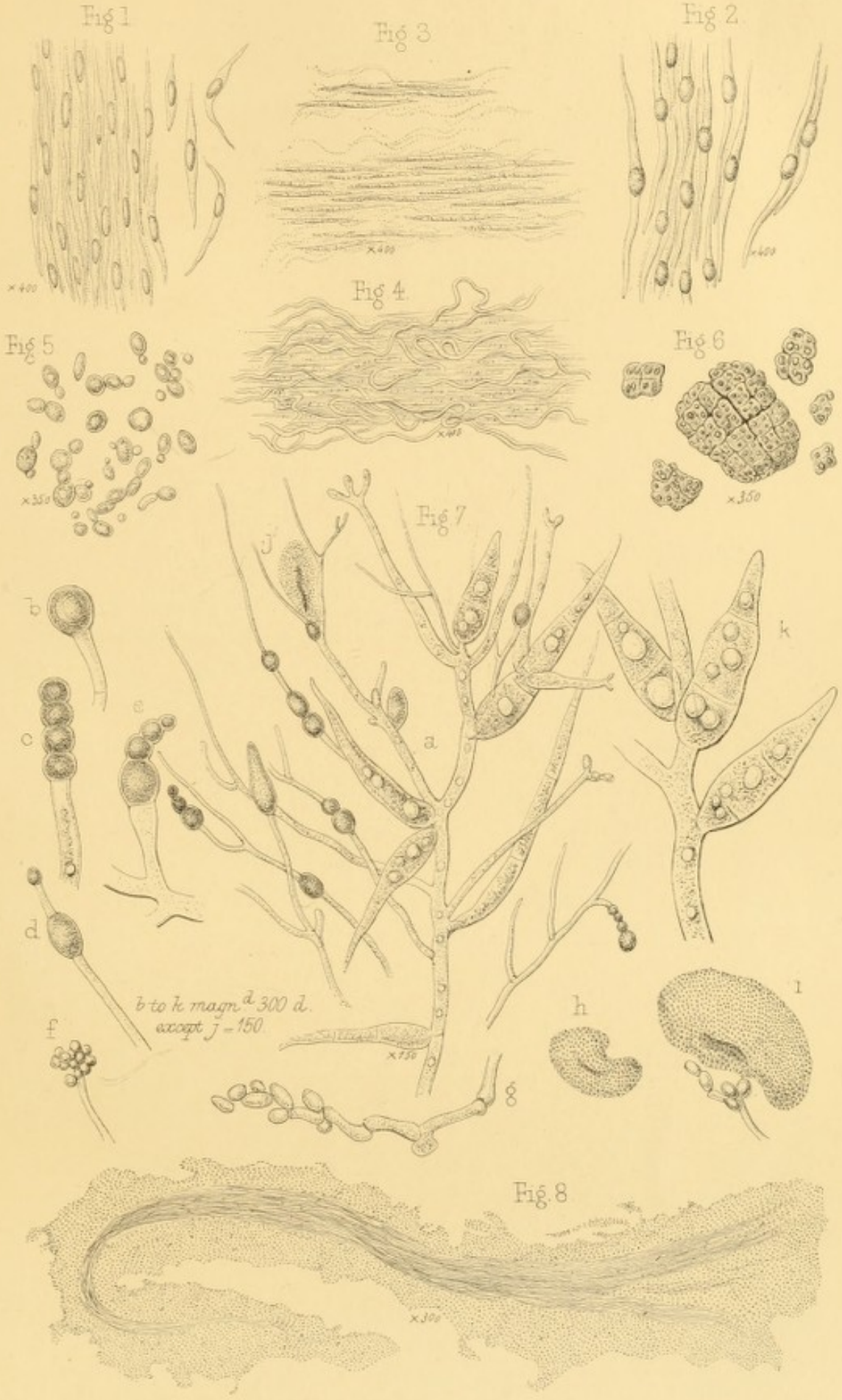
h. i. "Pyriform masses" of extremely minute sporules (?) and central rod-like portion.

j. One of the same, *apparently* in connection with a branch of *a* (x 150).

k. Supposed fructification more enlarged. *B* to *i*, and *k* magnified 300 diameters.

FIG. 8. A portion of a substance vomited by a person, which at first view seeemed of vegetable, but was probably of animal origin.

Plate 7



Tuffen West sc.

W. West imp.

But it may be asked why the muscular coat is attenuated instead of being thickened, as in the case of an obstruction at one of the orifices of the heart. Hypertrophy, as we have just seen, does take place at, and immediately behind the pylorus; and the wasting of the fibres covering the body of the stomach is probably caused by the distension being occasional and sudden, instead of being gradual and constant, as in most other hollow organs. It is occasional, inasmuch as it only takes place during digestion, and sudden, as it is produced by gas evolved by the fermentation of the food.

The thickening of the pylorus is most frequently found in males between thirty and fifty years of age, and especially in persons who have been addicted to the abuse of ardent spirits.

The vomiting of sarcinæ has been observed to follow a blow or other injury to the abdomen. Generally in such cases adhesions have been formed between the stomach and some of the neighbouring organs; its position has been altered, and dilatation has taken place from the difficulty which the muscular coat had under these circumstances in propelling its contents. An injury sometimes gives rise to chronic inflammation of the stomach or upper part of the intestinal canal. I have before shown that thickening of the stomach may follow severe pressure on the epigastrium;[1] and an instance of stricture of the upper part of the intestines came under my notice, in which the symptoms commenced shortly after a severe blow on the abdomen.

The obstruction is not unfrequently caused by

1 See page 131.

cancerous growths at or near the pyloric orifice. Under these circumstances there may be considerable difficulty in diagnosis, for the attention of the practitioner is chiefly attracted by the fermentation of the contents of the stomach. Such cases may be generally distinguished by the short duration of their symptoms, by the severe pain, often of a neuralgic character, the admixture of coffee-ground materials or of blood in the matters vomited, and by the cachectic appearance which so generally attends the growth of cancer in any of the internal organs of the body.

The narrowing of the pyloric opening is sometimes caused by the pressure of glandular or other tumours, as in the following example.

Case 24.—A sailor, about twenty years of age, came under treatment for enlarged glands of the axilla. He was much emaciated, but had neither cough nor expectoration, although on examination of his chest I found slight dulness under one clavicle and tubular breathing. He made no complaint of his digestion, but I subsequently found that for twelve months he had been liable to vomiting of large quantities of sour fluid, and that this took place every two or three days. I saw him on one occasion after his being attacked with violent vomiting, which was induced by food, but also took place without; the vomited matters were of a dark green colour, thick and ropy. Under the microscope they were seen to be filled with yeast cells. The vomiting gradually ceased, but his strength failed, and he sank from exhaustion.

Post-mortem Examination. — There was tubercular

deposit in the upper part of the lung as diagnosed during life. The stomach was dilated, but not to the extent often seen in cases of diseased pylorus. The glands near the pylorus were considerably enlarged, and by their pressure narrowed the pyloric opening. The other organs of the body were in a healthy condition.

The diagnosis of a case of this kind is generally difficult on account of the depth at which the tumour is situated, and from the symptoms being less distinctly marked than when the constriction is produced by thickening of the pylorus. It may be suspected that the dilatation arises from obstruction by enlarged glands when the patient presents evidence of tubercular disease, and when other circumstances likely to produce the complaint cannot be discovered.

Ulceration is perhaps the most frequent cause of dilatation of the stomach. The enlargement may occur when the ulcer is still in progress, either from the deformity of the organ produced by adhesions, or from the destruction of a large portion of the muscular structure preventing the due propulsion of the food.

Dilatation may take place long after the ulcer has entirely healed; the stomach being constricted or the pyloric orifice or duodenum being narrowed by the contraction of the cicatrix. The length of time at which this may occur after the ulcer has apparently healed is sometimes very remarkable. I attended a middle-aged lady affected with well-marked symptoms of ulceration of the stomach, from which she gradually recovered. She remained in good health for about ten

years, when she became subject to attacks of vomiting and other symptoms of dilated stomach. On examination, the whole abdomen seemed filled with the enlarged organ, and the matters rejected were loaded with sarcinæ.

If is of importance to ascertain whether ulceration is present along with the dilatation. We have good reason for believing such is the case if the pain be much increased during or shortly after a meal, if it be chiefly felt at some particular spot at which there is also considerable tenderness on pressure, and above all, if hæmatemesis have preceded the symptoms of enlargement.

I have met with cases of dilatation of the stomach, in which there seemed to be no mechanical obstacle to the exit of the food into the duodenum. As the muscular coat was very fibrous, I conceive that the complaint arose from atrophy of the contractile layer.

There are various other causes of dilatation, such as the pressure of an enlarged liver upon the pylorus, and the displacement produced by herniæ, but these must be diagnosed by reference to the disorders they accompany.

The earliest symptoms of this disease arise in each case from the primary malady. Thus, when the contraction of the pylorus has been caused by a cicatrix, we have the history of ulceration; when it has resulted from thickening of the mucous membrane, the patient suffers in the earlier stages from the ordinary feelings of indigestion. As soon as the enlargement has taken place, the symptoms of this morbid condition are added to those of the original disease.

One of the most general complaints of the patient is severe and distressing heartburn after food. It commences shortly after a meal, and continues as long as digestion is in progress, unless relieved by vomiting. The pain is neither sharp nor gnawing as in ulceration, but is usually described as a severe burning sensation, extending from the epigastrium to the throat. Sometimes it is felt between the shoulders, but unless ulceration be present, it is not fixed to one spot. It is relieved by the use of alkalies; and many patients are in the habit of taking chalk or soda for this purpose. The whole abdomen is sometimes rather sore, but there is no great tenderness confined to one place.

A greater or less degree of vomiting is always present. In the earlier periods of the disease this occurs only occasionally, but it may afterwards take place every day, or frequently during the twenty-four hours. Sometimes it ceases for days, or even for weeks at a time, although the disease at the pylorus may be still progressing. It seldom comes on directly after a meal, but is chiefly experienced at night or early in the morning.

The quantity rejected by the stomach at a time admits of great variety. In one case only a teacupful may be vomited, and this is chiefly in those in whom it takes place in the morning; in others it may amount to many pints of fluid, and it then seems as if all the food swallowed during the day had been retained in the stomach.

In the advanced stages of the complaint the rejection of the contents of the stomach takes place with little effort. It is in fact rather a regurgitation than

actual vomiting, and the organ is never thoroughly emptied. This can be proved by percussing the abdomen immediately after the vomiting, when a splashing sound will be elicited over the still distended stomach. The patient usually complains of fulness shortly after meals, and the vomiting is often preceded by the discharge of a quantity of gas. In other cases a feeling of motion is described, as if fermentation were going on within the abdomen.

There is always more or less, and sometimes great emaciation and feebleness. The tongue is clean, the pulse regular, and the appetite good, often craving. The bowels are generally confined, but in some cases there is troublesome diarrhœa of yeasty stools. The urine is clear, light-coloured, and often deposits phosphates or oxalate of lime. Thirst frequently distresses the patient, and the sleep is disturbed and unrefreshing.

It is of importance to recognise dilatation of the stomach in the earlier stages, before muscular degeneration has proceeded to such an extent as to render fruitless all attempts to repair the mischief. The general symptoms however, at this period, are not sufficient to indicate the nature of the complaint, and we must trust chiefly to physical signs for its detection.

On examination of the abdomen we do not meet with any great enlargement of the organ, but may find it still distended with food, at a time when it should have been empty if digestion had proceeded at the normal rate. For a few hours after a moderate meal, there is often a splashing sound when the patient moves upon his back, or in some cases even

on full inspiration. Although this symptom only shows that the stomach is not firmly grasping its contents, it is sufficient, if it be constantly present, to indicate a state of muscular debility which is often connected with the earlier stages of dilatation.

In doubtful cases I have frequently requested the patient to induce vomiting early in the morning. If we find that the vomited matters amount to a teacupful or more, and consist of fragments of the meals taken the previous day, along with a considerable quantity of sarcinæ and other forms of vegetable fungi, we may be sure that there has been some impediment to the free transmission of the food into the duodenum. It must be remembered, that for this test to be of any use there must be a considerable quantity of food in the fluid vomited. Nothing is more common in cases of chronic gastritis, than to find a few fragments of the animal or vegetable matters taken the previous day still entangled in the mucus rejected by the stomach in the early morning.

When the dilatation has proceeded to a greater extent, there is seldom much difficulty in the diagnosis. The abdomen is much distended, and the superficial veins are large and prominent. Even the movements of the organ have in some cases been observed through the thin and tightly-stretched integuments. Percussion, and still more auscultatory percussion, shows that the stomach is greatly enlarged, and, even after vomiting has taken place, we find its volume apparently unaltered.

The fluid rejected is characteristic of the complaint. It is usually of a brown colour, and, when allowed to stand for a few hours in a warm place,

it becomes covered with froth. A quantity of thick, ropy mucus mixed with the fragments of the last meal sinks to the bottom. The food seems to be rather broken up than digested. The starch is readily detected by the use of iodine, and the portions of muscular fibre seldom present that appearance of gradual solution observed in the process of normal digestion. The microscope shows innumerable specimens of sarcinæ and torulæ. Chemists have ascertained the presence of the acetic, lactic, hydrochloric, and butyric acids in the contents of the stomach in such cases.

I have so frequently mentioned the occurrence of fungi in the fluids vomited by patients affected with diseases of the stomach, that it will be necessary in this place to give a short description of the more common forms presented to our notice.

Yeast cells (*torulæ cerevisiæ*) are very readily recognised by the microscope as round or oval cells joined one to another. In the earlier stages of growth, the appearance of minute vesicles budding from the side of the parent cells, renders their detection simple and easy. (See plate 7, fig. 5.)

The *penicillium glaucum* is another species of fungus not unfrequently met with in vomited matters, and is also an evidence of diminished action of the stomach. It is composed of cells joined one to the other, and "its mycelium consists of interwoven articulated filaments most extensively ramified."[1] I have never met with it in cases in which the symptoms were of recent date; and we may therefore conclude that it indicates fermentation of a longer

[1] Micrographic Dictionary, by Griffith and Henfrey.

duration than is the case with torulæ. It does not appear capable of producing fermentation, but is only a species of mould formed in acid and albuminous liquids.

The *sarcina ventriculi* is a species of fungus found in the stomach and in vomited matters which has attracted great attention ever since its discovery by Professor Goodsir. It is composed of square cells closely connected together in groups of four. These are again connected with similar groups, so as to give the appearance of a square or oblong mass, tightly tied by lines that cross each other at right angles. Iodine renders the sarcinæ of a brown colour, and makes their detection more easy. (See plate 7, fig. 6.)

I have found sarcinæ in the stomachs of various animals, but fragments of vegetable tissue were always present at the same time. They may, I believe, be looked upon as an evidence that the food has been retained in the stomach for a lengthened period.

Considering the variety of substances that pass into the stomachs of animals, it is surprising that so few forms of vegetable growths have been observed. The following description of the fungus alluded to at page 76, and drawn in figure 7, plate 7, is from the pen of Mr. Tuffen West.

"Leptomitus. *Algæformis*, T. W. (L. uteri, Lebert.)

"Thallus of relatively thick mycelium, the filaments of which are constituted by short pieces swollen at their junction; these have usually a zigzag outline, and are closely felted: buds (conidia) are frequently given off, both laterally and at their terminations.

"Filaments sparingly septate, and frequently branched in an irregularly dichotomous manner; at the base of many of the branches a triseptate fruit-like body is borne, whence the specific name; each septum contains a large vacuole, or two (occasionally three) smaller ones.

"In addition to these, many pyriform bodies are present, which seem to belong to the fungus; they are apparently composed of masses of extremely minute sporules, each mass with a darker rod-like body in its centre. It seems probable that these pyriform bodies truly belong to the fungus, although, from the nature of the materials amongst which the latter flourishes, it is exceedingly difficult to speak positively as to the existence of any actual connection with the rest of the plant.

"Swellings are occasionally to be found in the mycelium, as well as on the branches of the filaments, the free extremities of the latter frequently giving off conidia ("sporules" or "sporidia" of many authors).

"The plant in question *may* be only one of the protean forms of Penicillium reproducing like an alga under algal conditions of growth, but it presents points of such high interest as to deserve most careful study."

The treatment of dilatation of the stomach has been of late years much discussed, and, since the discovery of the presence of sarcinæ in the matters vomited by those suffering from this complaint, the prevailing idea seems to have been to prevent the formation of the vegetable fungi. With this view the hyposulphite of soda has been prescribed by Dr.

Jenner, common salt by Dr. Budd, and large doses of alkalies by others. The diet has been recommended to consist of meat, unfermented bread, and other substances not prone to fermentation.

I am quite willing to allow that such a plan of treatment is often followed by great temporary relief, but as far as my experience goes, the disease proceeds to a fatal termination in spite of it. The vegetable fungi are the result, not the cause of the malady; and it is as reasonable to expect that we should cure an enlarged stomach by stopping the fermentation of its contents, as to cure dilatation of the bladder by preventing decomposition of the urine. The first point a surgeon aims at in the treatment of a dilated urinary bladder is to empty the organ, and to keep it so, for he knows that if he can effect these objects the formation of mucus and the decomposition of the urine will cease of themselves. In like manner, we may suppose that if we can completely empty a dilated stomach, and can prevent it from becoming again distended, the secretion of mucus and the vegetable fungi will disappear.

It may be said that we cannot relieve the stricture of the pylorus as the surgeon does that of the urethra. This is true; but we can better regulate the amount of fluid in the stomach than in the bladder; and consequently we can more readily prevent the distension of the former than of the latter.

In the earlier stages of dilated stomach I generally direct the patient to empty the organ by vomiting in the early morning, and to keep it as free from any accumulation of food as possible. With this view the diet is restricted to liquids, such as beef-

tea, milk and lime water, arrow-root, and other forms of farinaceous food. These are ordered to be given frequently, and in small quantities.

So many of the persons affected with thickened pylorus have been in the habit of spirit-drinking, that it is generally advisable to allow a small proportion of stimulants. Malt liquors and wines are to be avoided, on account of their tendency to produce acidity, and well-diluted brandy or whiskey should be preferred.

If the heartburn continue, the use of alkalies, hyposulphite of soda, or of common salt, may be tried. Pepsin and dilute hydrochloric acid are frequently of use in promoting digestion. In most cases some form of steel, strychnine, or quinine is required. The bowels should be regulated by an occasional aloetic pill, or by enemata.

There is often a craving for food, arising probably from the relaxed state of the stomach, and careful bandaging of the abdomen is of use in allaying it.

I have never employed galvanism, but I have seen it so useful in cases of dilated colon that I think it is worthy of a fair trial, in order to stimulate the enfeebled muscular coat.

If the excessive secretion of mucus should continue after the diet has been regulated, astringents, such as the oxide of silver, kino, or tannin, will be found of value.

I am far from asserting that every case of this disease will yield to this, or indeed to any form of treatment, for they often do not come under our notice until the muscular structure is hopelessly

atrophied; but I conceive that such is the only plan likely to be attended with good results. As we become more skilful in our diagnosis, and learn to detect the complaint at an earlier period, we may hope to be more successful in its management.

CHAPTER XIV.

ON THE MORBID CHANGES IN THE STOMACH AND INTESTINAL VILLI PRESENT IN PERSONS WHO HAVE DIED OF CANCER.

The difficulty of accounting for the origin of cancer, and the want of success in all our efforts to arrest its progress or effect its cure, render investigations upon it of general interest. Of late years inquiries have been chiefly directed to obtaining clearer views as regards the development and anatomical structure of the tumour itself. As far as I am aware, no attempts have been made to ascertain whether the progress of the disease is accompanied by changes in other important parts; and yet an accurate knowledge of the condition of the various organs connected with the formation of the blood must be necessary to enable us to determine whether a malady, having chiefly a local manifestation, originates in an error of local or of general nutrition. Until, therefore, we have carefully scrutinised all the glandular structures, we cannot be certain that the predisposing causes of the so-called malignant action may not lurk in the imperfect or perverted actions of some of these organs.

The microscope has hitherto shown us no local changes which *precede* the formation of cancer; consequently we are unable to foresee and powerless to prevent its invasion. If we could discover that anatomical or functional alterations take place in tissues other than those obviously affected, a careful observation of their conditions might warn us of the approach of the disease, and we might be enabled to avoid such circumstances as are likely to excite its development.

In many cases of cancer we can scarcely account for the death of the patient. There is no secondary formation in any important organ, and the failure in strength has been out of proportion to the amount of local mischief, so that we are forced to admit either that the blood has been infected, or that some fatal change of a non-cancerous nature has occurred in the viscera.

But if all the laborious investigations into the nature of cancerous tumours have left us still ignorant of their causes, and of any structural changes preceding their formation, and if in many cases the cause of death is not apparent, is it not probable that the medical practitioner will derive more advantage from a knowledge of the changes which may be found to take place in the other *organs*, than from further inquiries directed exclusively to the locally diseased tissues?

I shall in the present chapter state the results obtained from the microscopic examination of the stomach in fifty-seven, and of the intestines in twenty-three cases of cancer.

I have to regret, however, that I am unable to

give the history of each patient and a description of the peculiarities of the local disease, or to report the manner in which digestion was performed during life. I am therefore compelled to limit myself to detailing the changes I have observed in the mucous membrane of the stomach and intestines.

CANCER OF THE BREAST.

Observation 19.—A woman, æt. 62, died of cancer of the breast in the Middlesex Hospital,[1] February 7th, 1865. The mucous membrane of the stomach was everywhere thin, especially along the smaller curvature; it was smooth, but much injected in patches. Along the greater curvature it was rather thicker, adherent firmly to the subjacent coat, and mammilated. In this part the tubes were united together, and the spaces between and below them were loaded with nuclei and cells, nuclei also being everywhere visible in the muscular coat. The solitary glands were greatly enlarged, and mostly empty at the centre, but at their edges they presented thick layers of cells and nuclei. In the more wasted parts of the mucous membrane, the remains of the tubes appeared as bulbs, or as irregularly shaped masses of fat and broken-up gastric cells, or as lines of fatty matter so small as to resemble blood-vessels, whilst their interspaces were occupied by fatty and

[1] To avoid repetition, it may be stated that all the observations mentioned in this chapter, were made upon patients who died in the cancer wards of the Middlesex Hospital.

granular matters. In some places no remains of the solitary glands could be perceived; in others elongated cavities surrounded by thin layers of nuclei and cells marked their former position. The muscular coat seemed to consist of little else than fibres. The duodenum was large, but to the naked eye showed no appearance of disease. Examined microscopically, Brunner's glands were seen to be enlarged and loaded with nuclei and fatty cells. The intestinal villi were normal.

Observation 21.—A woman, æt. 37, died June, 1863. The mucous membrane of the stomach was very thin, and much congested in parts. At the cardiac end, it was everywhere sprinkled over with small white spots about the size of a pin's head, that looked but did not feel as if raised above the surface. In this portion of the organ the membrane was converted into fibrous tissue, fat, and granular matters, whilst the tubes had disappeared or their remains only could be recognised as faint lines of fatty matter. The muscular tissue was thickened and fibrous, and the blood-vessels seemed very large and in many cases thickened and opaque. In a small portion of the organ the tubes could be distinguished, but they were firmly adherent to each other, and were filled with granular matter and a few large gastric cells.

Observation 22.—A woman, æt. 43, died in July, 1863. In one part of the middle region of the stomach, the mucous membrane seemed hard and fibrous. The solitary glands were in some parts

enlarged and the tubes distorted or withered, as in Observation 20, but in other parts, although the solitary glands were not apparent, the tubes were firmly adherent to each other, their basement membrane was thickened, and the connective tissue between them and the muscular coat increased. The openings of the tubes on the free surface were larger than usual.

Observation 23.—A woman died August, 1863; no *post-mortem* digestion had taken place. In the cardiac region the tubes were greatly wasted, and for the most part their closed ends only remained. They were firmly united in every other part of the stomach, their interspaces being occupied by nuclei, as in Observation 20. The gradual conversion of tubes into bundles of fibre was observable at many points.

Observation 24.—A woman died August, 1863. In the smaller curvature of the stomach, no indication of tubes existed, excepting here and there a bulb surrounded by thick fibres; the whole of the structure being composed of cells, nuclei, and fibres. In the cardiac region the tubes were in a similar condition. The solitary glands were in many places very large, and loaded with cells and nuclei.

Observation 25.—A woman, æt. 63, died December, 1863. The stomach contained torulæ in large quantities. The mucous membrane was remarkably thin, but much congested; along the lesser curvature were patches of a white opaque appearance. The

tubes could be easily recognised, but contained only small cells; between and below the tubes the spaces were loaded with nuclei.

Observation 26.—A woman, æt. 63, died December, 1863. The stomach was extremely thin everywhere, but especially so in the cardiac region, which was not digested. A broad band of dense white tissue ran along the smaller curvature for two-thirds of its length; excepting this, the middle and pyloric regions were of a dark gray colour. The tubes could be distinguished in some parts of the cardiac region, but were united together, whilst in other places they were converted into bundles of fibres. In the white band no remains of tubes were visible, the whole tissue appearing to consist of fibres and granular and fatty matters. In the gray parts the tubes were firmly adherent, and intermixed with cells and nuclei. The solitary glands were much enlarged, and filled with cells and nuclei.

Observation 27.—A woman, æt. 60, died January, 1864. The mucous membrane of the stomach was exceedingly thin and pale, but not digested. Towards the cardiac end the remains of the tubes appeared only as confused masses of fat and granular matter, and the membrane itself seemed opaque and granular. In other parts the tubes were firmly connected together, and their basement membrane thickened, whilst within and around them were cells and nuclei from $\frac{1}{3000}$ to $\frac{1}{4000}$ of an inch in diameter. Few normal gastric cells could be seen, but the

solitary glands were greatly enlarged and filled with the same cells and nuclei.

Observation 28.—A woman, æt. 75, died July, 1865. The mucous membrane of the stomach was not atrophied; the tubes were adherent to each other, their interspaces being occupied by nuclei and cells. The tubes contained gastric cells, generally of a small size.

In all the above cases the appearances were similar. In all except one the mucous membrane was much wasted, chiefly at the smaller curvature and splenic regions; in one instance, in which I weighed the mucous membrane, it only amounted to 360 grains: it was congested in irregularly shaped patches, and the veins generally were of large size. When examined by the microscope they all presented evidences of disease, which were most perceptible where the membrane was thinnest. In the earliest stage of the disease the solitary glands were enlarged and filled with cells and nuclei; the gastric tubes and sometimes the musular fibres were displaced by these bodies, which were also scattered everywhere through the membrane; the tubes adhered firmly to each other, but still contained normal gastric cells. Later, the solitary glands appeared empty in the centre, but surrounded by thick layers of nuclei; the tubes could no longer be traced in their whole extent, but could be recognised only as bulbs filled with fatty cells, or as lines of cells, whilst the whole tissue was obscured by fatty and granular matter. In the last stage the solitary glands had disappeared, and the tubes were

replaced by fibres, the replacement of glandular structure by fibre being the ultimate metamorphosis.

These anatomical changes seem to have produced a concomitant decrease of functional power. *Post-mortem* digestion seldom occurred even in the summer, and in one case, in which I digested ten grains of albumen for eleven hours in an acidulated infusion of the mucous membrane, only six-tenths of a grain were dissolved.

In the next cases, although no nuclear deposits were present, the structure of the stomach was seriously injured by an increased formation of fibrous tissue.

Observation 29.—A woman, æt. 56, died in August, 1864. The mucous membrane of the stomach was exceedingly thin. At the greater curvature was an irregularly-shaped, puckered patch of thin membrane, about three inches long by one in width, and from this projected fibrous bands in different directions, but not so well marked as is usual in a cicatrized ulcer: there was no change in the shape of the stomach. At the puckered part the membrane was pale, but on every side it was greatly congested. Where most contracted the mucous membrane seemed to be converted into a very thin layer of fibres, intermixed with a few cells; in other places the tubes appeared to be drawn in a longitudinal direction, and were in process of conversion into fibres, the cells being absorbed and the thickened basement membrane constituting the fibrous bundles. Along the smaller curvature the tubes were easily distinguished, filled with gastric cells, but adherent to each other,

PLATE VIII.

DEGENERATIONS OF THE STOMACH IN CANCER OF THE BREAST.

FIG. 1.
- *s.* Enlarged solitary glands.
- *t.* Remains of the gastric tubes.
- *g.* A few cells still remaining.
- *m.* Muscular layer.

FIG. 2. Gastric tubes in process of being transformed into fibres.
- *t.* The tubes drawn from their natural position and altered in shape.
- *co.* Fibrous tissue between and below the tubes.
- *g.* Cells in the tubes.

FIG. 3. Gastric mucous membrane changed into fibres.
- *g.* A few scattered cells.
- *m.* Remains of the muscular layer.
- *e.* Elastic fibres.

Plate 8

Fig 2.

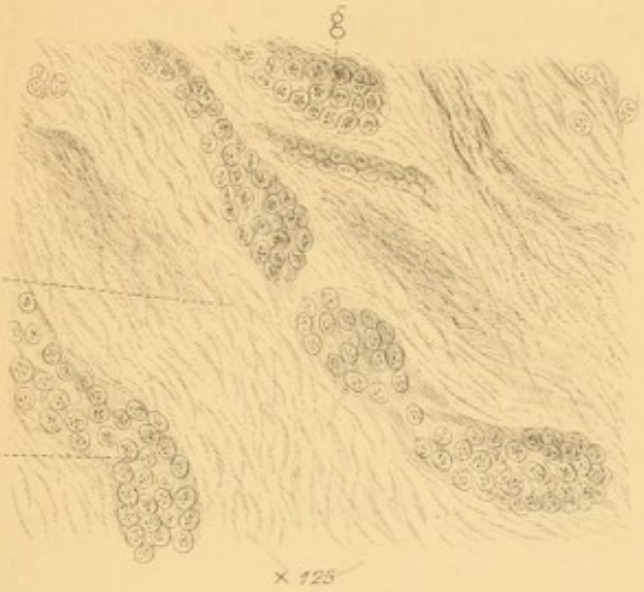
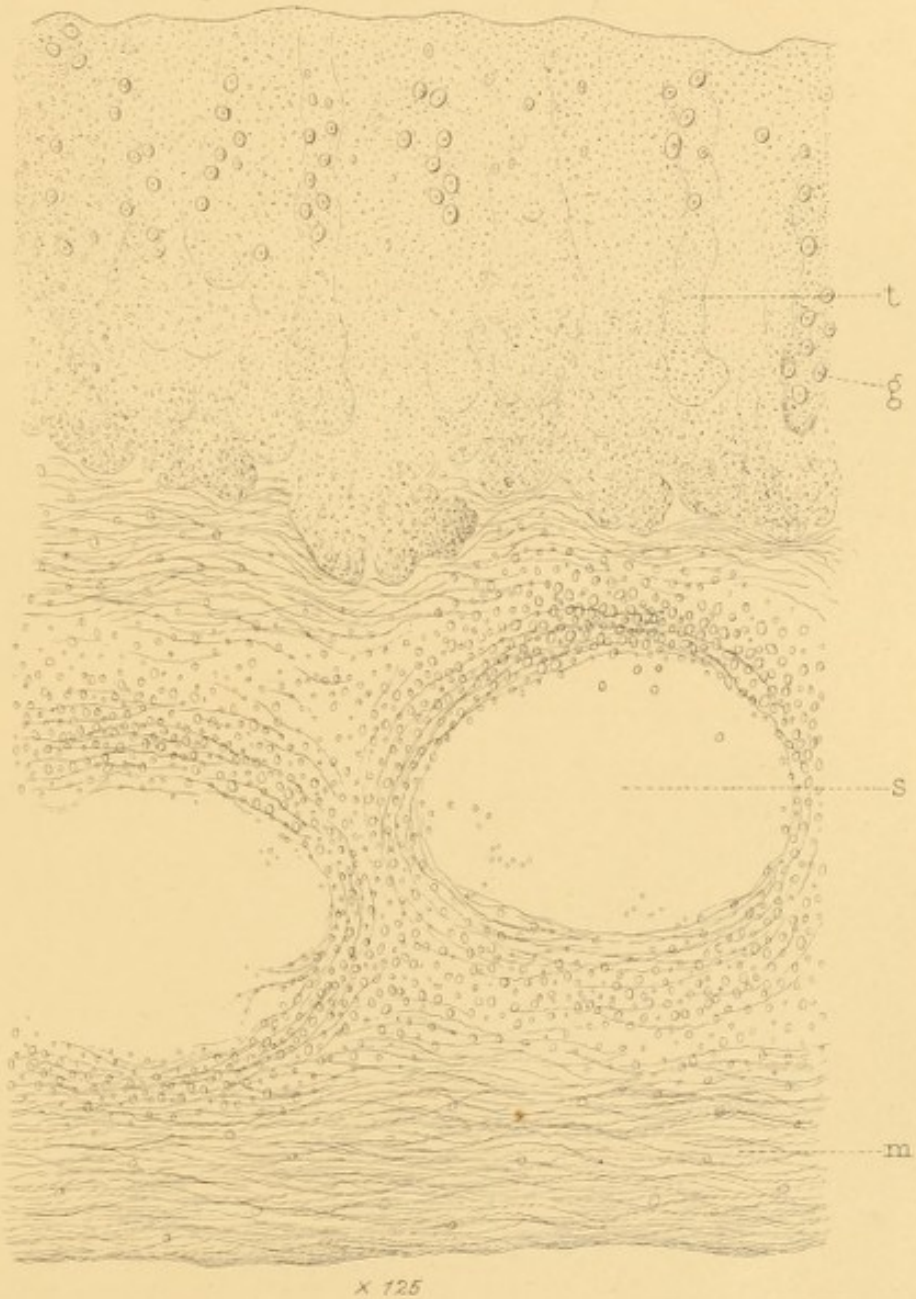


Fig 3.

Fig 1.



Tuffen West sc.

W West imp.

their basement membrane being much thickened, and the connective tissue below and between them greatly increased.

It might appear doubtful whether the appearances in the above case were not caused by the cicatrix of an ulcer, but the great extent of the contraction without alteration in the shape of the stomach itself seems to forbid the supposition. Degeneration was in progress in all parts of the organ, and in cases of simple ulcer of the mucous membrane I have not usually found much structural alteration at a distance from the sore.

Observation 30.—A woman, æt. 55, died January, 1865. The mucous membrane of the stomach was very thin, but not digested. In the middle and splenic regions the tubes could be distinguished, but were firmly adherent to each other; their basement membrane was much thickened, and they contained large fatty gastric cells; the solitary glands were not enlarged. The connective tissue below them was greatly increased, and the muscular coat seemed fibrous.

Although I did not detect any enlarged solitary glands in the two foregoing cases, nuclei were everywhere dispersed in Case 29, whilst in Case 30 there were scattered nuclei in the cardiac and middle regions.

In both of these cases the mucous membrane was very thin; in Case 30 twenty grains of it carefully dried were digested in ether, and lost 32·8 per cent.

in weight. But, as the average amount removed by ether in five cases dying of other diseases was only 12·6 per cent., it is evident that in the case just narrated a considerable amount of fatty degeneration must have taken place.

Eleven grains of solid albumen were digested in an acidulated infusion of the mucous membrane of Case 30 for twelve hours, and, although the albumen became translucent at the edges and softened, it gained one grain in weight. As the average solution of albumen in similar experiments in cases dying of other diseases amounts to four grains, it is plain that the functional activity of the stomach in Case 30 had been greatly diminished.

In the next four cases no serious disease of the gastric tubes could be observed by the microscope.

Observation 31. — A woman æt. 60, died in November, 1864. The mucous membrane of the stomach was remarkably thin. The tubes were distinct and readily separated, but were loaded with granules and fatty epithelium.

Observation 32.—A woman, æt. 50, died January, 186–. The mucous membrane was very thin, weighing only three and a half drachms. Torulæ existed in great numbers in the contents of the stomach. The tubes could be easily separated, but were chiefly filled with granular matter.

Observation 33.—A woman, æt. 49, died July, 1863. The stomach was quite undigested, although that of another person who died the same day of

another complaint was extensively acted upon by the gastric fluid. The mucous membrane was everywhere very thin, and the blood-vessels were greatly enlarged. The tubes seemed healthy, and contained cells. The duodenum was very granular, and Brunner's glands were much enlarged.

Observation 34.—A woman, æt. 59, died January, 1865. The stomach was deeply congested, and the veins were very large. The tubes could be easily separated, but the gastric cells were large and fatty, breaking down with the least pressure.

In none of these four cases was there any evidence of structural disease in the stomach, excepting in the softness of the gastric cells, and the unusual amount of granular matter; but in Case 33 the duodenum was very granular, and its vessels large and injected. Although three of them presented the usual thinness of the mucous membrane, in one this membrane was nearly the average weight, viz., 720 grains. In one case ether removed 19·1 per cent. of weight, showing that some amount of fatty degeneration had taken place. In two cases, in which artificial digestion was tried, there was a mean loss of 4·8 grains of albumen; so that, as far as pepsine was concerned, there had been no deficiency.

It will be remarked that the state of the pyloric region has not been mentioned in the foregoing cases. All reference to it has been omitted on account of the frequency with which this part of the stomach presents morbid changes, especially at and after middle life.

But, it may be asked, if disease of this part so constantly exists, apparently without any constitutional affection arising therefrom, are we justified in supposing that a similar condition of the splenic and middle regions would produce more serious results? I think a consideration of the comparative extent and activity of these different regions will enable us to decide the question. In nineteen cases of death from diseases other than cancer, I found the average weight of the mucous membrane of the middle and splenic regions to be thirteen drachms, whilst that of the pyloric only amounted to two drachms. In seventeen instances artificial digestion was tried with mucous membrane taken from each region, and the average amount of albumen dissolved by two drachms of the pyloric was only 1·4 grain, whilst by two drachms of the middle and splenic it was 3·1 grains. In bulk, therefore, the pyloric did not constitute one-seventh of the whole membrane, and the material of which it was composed had little more than one-third of the digestive power of the more active portions of the organ.

The proportion of these parts also varies according to the age of the individual; thus, of five persons who had died under twenty-five years of age the pyloric formed only 11·9 per cent. of the whole mucous membrane, whilst of fourteen above that time of life it amounted to 16·4 per cent. We may, therefore, conclude that when the growth of the body is fully completed the pyloric region normally undergoes some alteration of structure, and thus the anatomical changes so frequently found in it may not necessarily affect nutrition.

But is the amount of disease as just described in the splenic and middle regions of the stomach greater than is usual in other chronic complaints?

Out of one hundred cases of chronic disease, exclusive of cancer, I found seventeen in which intertubular gastritis had occurred in these regions; and Dr. Handfield Jones relates that in fourteen (of which two were persons who had died of cancer) the tubes in these situations were implicated to a great extent. As has been already seen, the diseases in which this most frequently occurs are phthisis and certain affections of the heart and liver.

But in no disease have I seen the secreting tubes so greatly destroyed as in cancer of the breast; in other maladies the changes are usually limited to thickening of the basement membrane, increase of the connective tissue, enlargement of the solitary glands, and alterations in the epithelium; whilst in many of the foregoing cases of cancer all trace of the tubular structure had disappeared from a large extent of surface, or only masses of fatty cells remained to point out its former situation. Again, in cancer of the breast, the mucous membrane is usually atrophied and fatty; but in cases of diseased heart and liver it is thickened, and the epithelial cells are increased in size and number. These morbid changes have, doubtless, resulted from different causes, as will appear more clearly on examining the following table, which contains the causes of death of those persons in whom the tubes were seriously affected in the splenic and middle regions of the stomach, according to the observations of Dr. Jones and myself. I have also added the observations of Dr.

Fox, although he includes all cases of chronic catarrh, whether limited to the pyloric region or not:

TABLE.

	Dr. Handfield Jones.	Dr. Fox.	Dr. Fenwick.
Tubercle of the lungs	2	9	4
Other diseases of lungs	..	3	—
Diseased heart	4	7	8
Diseased heart and phthisis	..	5	—
Diseased liver	2	1	3
Diseased kidney	4	4	—
Drunkenness	..	2	—
Fever	..	2	2
Other diseases	..	3	—
	12	36	17

It is evident from this table that the diseased state of the stomach is usually the result of an obstruction to the circulation of the blood, for in Dr. Jones's cases 66 per cent. in which this condition existed, consisted of diseased lungs, heart and liver; whilst in Dr. Fox's 60 per cent., and in my own 88 per cent., are to be referred to the same cause. But in cancer of the breast there is no mechanical obstacle to the flow of blood through the mucous membrane, and the frequency with which it is diseased must therefore arise from some other circumstance than that usually producing gastritis.

Looking at the foregoing cases, in which the stomach and intestines were diseased, we find that the morbid changes consisted either in the formation of fibres, or of cells and nuclei, intermixed with an increased amount of connective tissue. A careful examination of scirrhous breasts will show that there are also two varieties of this disease, corresponding to

the above alterations in the gastric mucous membrane. If, indeed, we inspect those parts of the tumour in which the malady has existed for some time, we cannot distinguish one variety from another; but when we carry the sections into the apparently healthy tissues surrounding the morbid structure, we can readily trace the difference between them.

In one form of scirrhus of the mamma we find the connective tissue surrounding the fat lobules thickened, before any appearance of cancer cells can be observed. The capsule of each fat cell also becomes thickened, and this continues until they are surrounded by a ring of fibres. (See plate 9, fig. 6.) Within these walls small nucleated cells appear, at first close to the fibres, but gradually extending inwards until the whole ring is filled with them. At a later stage of the disease all distinction between the separate fat cells is lost, or there remain only a few scattered rings of fibres, containing a mass of nucleated cells.

Beyond the limits of the cancer, the arteries are generally found much enlarged and surrounded by an unusual quantity of connective tissue. Their coats, and especially the outer ones, are thickened, and the vessels are not unfrequently tortuous. In the older parts of the tumour many of the blood-vessels may be seen to be partially or entirely closed by the pressure exerted upon them.

The muscular structure in the vicinity of the cancer is often affected before it presents any appearance of disease to the naked eye. The fibrils are imbedded in fibres, and the sarcolemma sometimes seems greatly thickened. The natural striated appearance is replaced by transverse projections, and I have in

some preparations seen the fibrils wrinkled, as if they had been roasted. (See plate 9, fig. 2.) The internal substance is in many cases absorbed, and they look like empty tubes.

In the same specimen we may often trace the gradual development of cells within the diseased fibrils. First, a few scattered nucleated cells make their appearance; then these, by their rapid increase, distend and distort the tube. Sometimes there remains a little of the thickened sarcolemma, which has been in other parts burst through by the cell growth. (Plate 9, fig. 3.) Gradually all traces of the muscular fibril disappear, and we can perceive nothing but a mass of cells and fibres.

In the other form of scirrhus the formation of cells and fibres takes place contemporaneously. The division between the fat cells appears to be a little wider than in the normal state, chiefly, I suspect, from enlargement of the capillary or lymphatic vessels. A single nucleus or cell appears in this interspace, commonly where three or four contiguous fat cells join, and from this others proceed, so as to surround the whole fat cell with a more or less thickened ring of nucleated cells. By the increase of the latter, the natural structure is entirely lost, and the thickened fibres are pressed together and look like cords running through the mass.

It is doubtful whether the enlarged spaces between the fat cells are blood-vessels; but I have no doubt that, in this form of scirrhus, a considerable amount of the fibrous part of the diseased mass is derived from degeneration of the coats of the blood-vessels. At the margins of the tumour I have sometimes been able to trace a development of capillaries as the first and only

appearance of morbid action, and at other times I have seen caudate cells apparently springing from the nuclei of the smaller blood-vessels.

In the arteries, the cancer cells seem frequently to arise from the nuclei of the middle coat, and by their increase, the vessel is often converted into an irregular or beaded string of cells. In this way are formed the columns and strings of cells so often observed in the older parts of the tumour, and in other parts the gradual conversion of these into fibrous cords can be readily traced.

In both forms of scirrhus, there is every reason to believe that the glandular structure of the breast degenerates before the formation of any cancerous growth. By soaking sections of recently-formed cancers in a solution of cyanide of potassium I have, in some cases, been able to show the remains of the mammary gland as small stunted masses of cells connected with the lactiferous tubes; and it has appeared to me that the glandular structure was much more wasted than could be accounted for on the supposition that this result was produced by the pressure of the new growth around it.

I have not had sufficient experience to enable me to state positively that these two forms of scirrhus of the breast co-exist with the corresponding alterations in the mucous membrane of the stomach, but I am inclined to believe that such is the case. In encephaloid cancer of the mamma I have not met with the attenuated state of the stomach, but on the contrary, have found the gastric tubes unusually loaded with cells.

I have found disease of the liver in some cases of cancer of the breast in which the gastric mucous membrane was also affected. In these the hepatic cells

were more closely united together than in the normal condition, and when sections of the organ were made, the cells presented the appearance of being contained in tubes, the parietes of which were thickened.

There is not much alteration in the muscular structure in other parts of the body. The fibres of the unstriped muscles are sometimes very distinct, and the nuclei of the cells unusually large and prominent. Fatty degeneration of the heart is not often present.

In cases of scirrhus the blood generally contains an unusual proportion of fibrin; if alcohol be added to it, a large firm coagulum is produced, even when the patient has been long affected with purulent discharge. It is probably from this cause that we so constantly find many of the blood-vessels of the tumour blocked up by coagula.

CANCER OF THE UTERUS.

In only three out of twenty-four cases was there any serious change in the mucous membrane of the stomach similar to that described as so often occurring where the disease had affected the breast.

Observation 35.—A woman died in August, 1863. One part of the mucous membrane of the middle region showed no remains of gastric tubes; the whole tissue being white, opaque, and loaded with nuclei. In another part the tubes could be distinguished, but were firmly united together, their basement membrane being much thickened, and the spaces between and below them loaded with nuclei.

Observation 36.—A woman, æt. 30, died February,

1865. A large hard ulceration, but which showed no appearance of cancer, was found in the middle region near the pylorus. In the splenic region the mucous membrane contained only a few bulbs, as the remains of gastric tubes; the solitary glands were enlarged, and the whole tissue was loaded with cells and nuclei.

In another case there was a large hard patch of thickened tissue, like the cicatrix of an old ulcer, and the secreting tubes in every part of the organ were much diseased.

In five other cases the anatomical condition was of a different character; the tubes were easily distinguished, but were very soft; they adhered to each other and to the muscular layer by very fine fibres, and they usually contained transparent cells. The blood-vessels were generally congested, and the surface of the membrane was covered by a considerable quantity of mucus. From the fact that inflammation between the gastric tubes usually terminates in other cases in their adhesion to each other, and from the congestion of the blood-vessels, I suspect the above cases to be of the same nature as those next to be described, excepting that chronic inflammation had taken place in them.

In sixteen cases the anatomical characters were as follows:—The tubes could be readily separated from each other, but the basement membrane was exceedingly thin; they contained gastric cells, more transparent than usual, breaking down into granular matter with very slight pressure. The mucous membrane was but little diminished in bulk, the average of three cases being 660 grains; it was very pale, but this, I think, is not entirely to

be attributed to the discharges produced by the local disease, for in cases in which the connective tissue was increased it did not exist to the same extent. In some instances the tubes seemed bathed in an albuminous fluid; in others the membrane cut as if gelatinous, and in but few instances did spirit or chromic acid harden the membrane, as is the case in its normal condition. The chemical composition likewise varied; in one case the softness seemed to be connected with an increased deposition of fat to the extent of 33·5 per cent. of the entire substance; in another there was nearly 50 per cent. of albumen; whilst in a third, with a small proportion of fat and albumen, there was a large excess of gelatine. It is difficult to estimate the effect these changes had produced upon the function of the organ. As a general rule, *post-mortem* solution was not common, but I have met with it in a few cases, and chiefly, I think, in those in which the change in the membrane was of a fatty character. In nine cases artificial digestion was tried, and in one 3·7 grains of albumen were dissolved; in the remaining eight, although the albumen was softened, no loss of weight had taken place.

Whether, therefore, we refer the loss of pepsin[1] to an alteration of structure or to the anæmia consequent on the cancer, there can be no doubt that during life digestion must have been imperfectly performed.

[1] Some of these specimens had been kept for some weeks in spirit, but artificial digestion was readily effected by the mucous membrane of stomachs of other cases than cancer, which had been similarly preserved for the same length of time.

As 75 per cent. of the cases of cancer in the breast, and only 12 per cent. of those in the uterus, presented morbid changes in the mucous membrane of the stomach, it is probable that the nature of the cancer affecting these organs respectively is different. This opinion is strengthened by the fact, that I cannot call to mind a single case in which both the breast and uterus were simultaneously diseased.

The remaining cases of cancer in which the condition of the stomach was carefully examined, are grouped in the following table, according to the site of the cancer:—

CANCER OF OTHER PARTS THAN THE BREAST OR UTERUS.

	Sex.	Age.	Condition of Stomach.
Cancer of tongue ..	Male	50	Enlarged solitary glands; tubes united, and in places atrophied.
	Male	..	Enlarged solitary glands; tubes united; large perforating ulcer.
	Male	..	Tubes normal.
Cancer of rectum ..	Female	54	Tubes united by fine membrane.
	Male	26	Enlarged solitary glands; tubes diseased.
Cancer of groin, penis, and bladder	Male	..	Great thickening of connective tissue, with adhesion of tubes.
	Male	72	Tubes normal.
	Male	50	Tubes normal.
Cancer of glands, bones, skin, and lungs	Male	71	Tubes normal.
	Female	59	Tubes normal.
	Female	..	Tubes normal.
	Male	82	Tubes normal.
	Male	..	Tubes normal; connective tissue increased.
	Female	45	Enlarged solitary glands; adhesion of tubes.
	Male	29	Tubes normal.
	Male	43	Tubes normal.

I have mentioned a case (Observation 36), in which a large ulceration had formed in the stomach in a person suffering from cancer of the uterus, and it will be observed that a similar lesion occurred in a patient affected with cancer of the tongue. In both, the connective tissue below the muscular coat was greatly thickened, and this condition was also present in another case of cancer of the bladder, in which, although no ulceration had taken place, pus cells were found in the mucous membrane.

The class in which disease of the stomach has been most rare is that composed of cancerous affections of the skin, bones, and lymphatic glands.

As the changes in the stomach are most frequent in cancer of the breast, the organ in which scirrhus is most common, and least frequent in cancer of those organs which are especially liable to the attacks of the softer varieties of the disease, it is, I think, probable that the alterations in the gastric tubes will be found to co-exist only with the harder forms of malignant growth.

From the similarity of the intestine to the stomach in structure, we might expect to find anatomical changes in it also. In the earlier examinations I unfortunately neglected to investigate the condition of the intestine, but in the last twenty-three subjects, in which I have minutely examined it, I have usually found it diseased.

An increase in the quantity of nuclei in the intestinal villi was noticed in Observations 29, 30, and 33. When this form of disease was present, the mucous membrane was usually more firm than in its normal condition. The nuclei were very prominent and distinct,

there was generally a deficiency of granular matter, and the basement membrane was often thickened. Brunner's glands and the intestinal tubes often presented similar changes, their cells being intermixed with nuclei. In Observations 20 and 28, and in a case of cancer of the uterus, the villi were exceedingly fibrous, and looked wasted. The fibres were disposed in a direction parallel to the long axis of the villi, and between them were lines of prominent nuclei. In some instances the ducts of Brunner's glands were greatly thickened and enlarged.

In Case 34, and in two cases of diseased uterus, fatty degeneration of the mucous membrane was present. The appearance of fat was not the result of digestion, for Brunner's glands presented a similar condition. The villi were very thin and transparent, and so soft as to be crushed with the least pressure. Small globules of oil were diffused everywhere, and in many parts the intestinal tubes were either absent, or the remains only of their closed ends were visible. (See plate 6, fig. 4.)

The most common morbid appearance was a dark condition of the villi; indeed in only three cases out of seventeen where no disease of the stomach existed was this change absent, but where the stomach and villi were loaded with nuclei, it did not present itself except to a small extent in one case; in two out of the three exceptions the mucous membrane was in a soft fatty condition. To the naked eye this appeared in many cases of a uniform dark hue, whilst in others the colour was more intense, and the villi could be readily distinguished as minute black spots. When examined by the

microscope, they were seen to be loaded with dark cells and nuclei, which were in greatest numbers at the free ends, but often extended the whole length. In some instances the villi were universally coloured by dark spots of an irregular form; occasionally they were loaded with a fine, dark, granular matter, and in two or three instances I detected minute crystals in their interior. (See plate 6, fig. 5.)

I need not add that this dark appearance of the villi is not peculiar to cancer; it has been described by other observers as occurring in other diseases. I have met with it chiefly in fever, but as I have never found it in persons killed by accidents, and once only in upwards of 100 dissections of wild animals, we may assume that it indicates an important alteration in the intestine.

I have often seen oil-globules in villi thus affected, so that, as far as the mere absorption of fat is concerned, their functions are not destroyed. We know, however, that the albumen of the chyle undergoes changes in its passage through the lacteal system; and as many of the softer forms of cancer seem to consist chiefly of albumen, it is, I think, probable that this morbid condition of the villi may be connected with functional changes of an important character.

It will be observed that out of fifty-seven cases of cancer the stomach was seriously diseased in twenty-one, or in 37 per cent.; and that in nineteen cases in which the intestines were examined, and in which the gastric tubes were normal, morbid changes were detected in eighteen, so that we have reason to suppose that few cases of cancer die in which serious

anatomical changes of a non-malignant nature are not present in some part of the digestive canal.

As the mucous membrane of the stomach in those who have died of malignant disease of the uterus so rarely presents morbid changes similar to those observed in persons affected with cancer of the breast, it will be interesting to ascertain what is the condition of the structures in the vicinity of the local disease.

When the sections are carried beyond the apparent limits of the cancer, we may generally observe that the muscular structure of the organ is in a state of degeneration. The fibres seem first to lose their sharp, clear appearance, and are fatty and opaque. Next, all distinction between them disappears, and as we approach the seat of the cancer, we find collections of fat, enclosed between layers of connective tissue, the only representatives of the former muscular structure. I have in some cases seen a few large cells in the midst of the degenerating muscle, as though a focus of cancerous growth was beginning to form in it.

Where the disease has affected the vagina, the voluntary muscles in the vicinity of the tumour sometimes present a remarkable appearance. They appear fatty, and in some parts no remains of the sarcolemma can be perceived; in others it looks like an empty case, the transverse markings being very clear and distinct, or it separates into rings, as in muscle in the process of digestion. (See plate 9, fig. 4.)

The connective tissue is not increased at the extreme edge of the tumour, but in some places it seems compressed into bands by the new growth.

PLATE IX.

SHOWS THE APPEARANCES PRESENTED BY DIFFERENT TISSUES IN CANCEP.

FIG. 1. Fatty degeneration of the heart in a case of cancer of the rectum.

a. Muscular fibres.

FIG. 2. Fibroid degeneration of muscular fibrils near the edge of a cancer of the breast.

a. The muscular fibrils transversely wrinkled. The transverse markings are very indistinct, and the sarcolemma is greatly increased in thickness.

b. Increased fibrous tissue surrounding the muscular fibrils.

c. The increased thickness of the sarcolemma could be seen at this opening.

FIG. 3. A muscular fibril filled with cancer cells. From the same case of cancer as fig. 2.

b. An outgrowth of cells which has burst through the sarcolemma.

FIG. 4. Degeneration of a muscular fibril near the edge of a cancer of the vagina. It seems to consist only of a case, the inner portion having perished.

a. Pieces of the sarcolemma which have separated from each other.

FIG. 5. Cancerous growth from the lining membrane of a vein in a case of epithelial cancer of the uterus. It was situated at a little distance from the cancer.

v. The coats of the vein.

c. The cancerous growth.

FIG. 6. Fat cells in the vicinity of a cancer of the breast.

a. The fat cells.

b. The capsule of the cell greatly thickened.

Plate 9

Fig 1

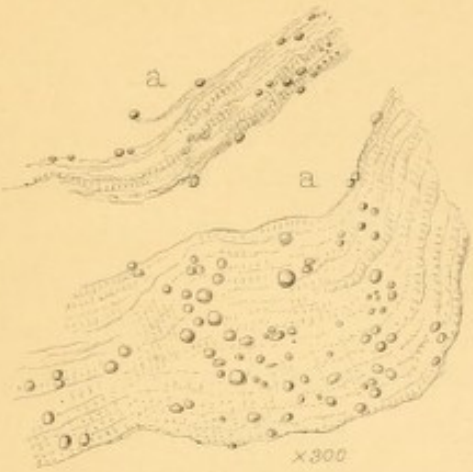


Fig 2

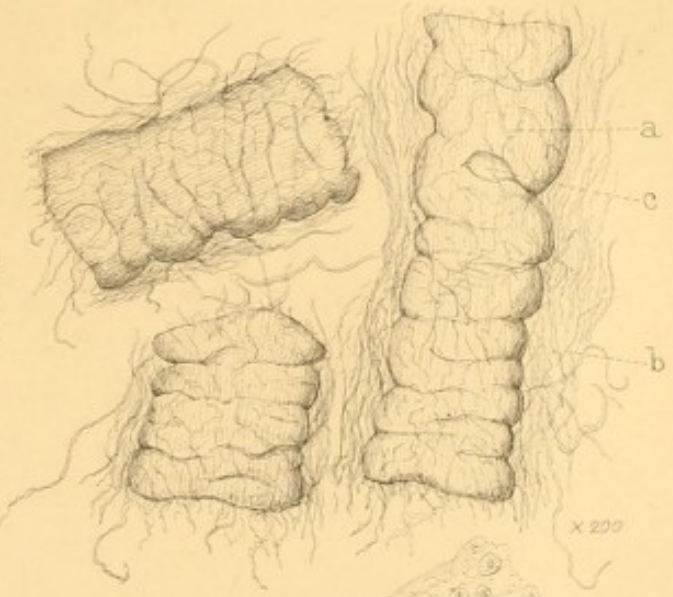


Fig 3

Fig 4

Fig 5.

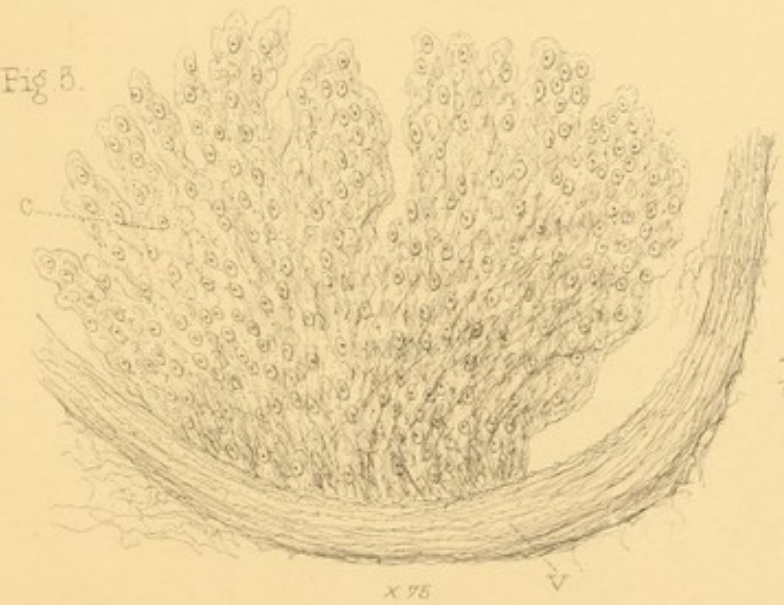
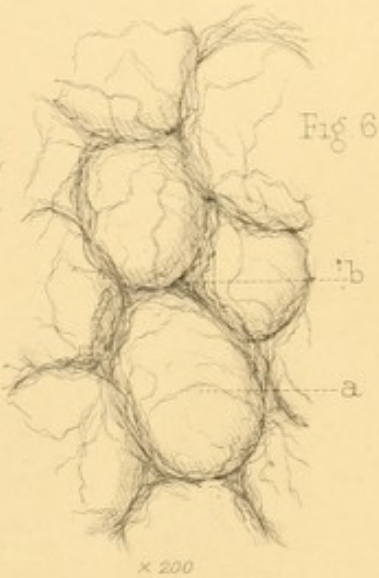


Fig 6.



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The blood-vessels near to and in the cancer are generally large and fatty; and it is no doubt in consequence of this condition that the hæmorrhage is so constant and difficult of control in this disorder. In a case of epithelial cancer of the uterus, I met with the appearance shown in plate 9, fig. 5. At a short distance from the tumour, a cancerous growth was observed connected with the lining membrane of a small vein. There were similar projections in some of the neighbouring veins.

It is not uncommon to find flakes, to which small cells are attached, in the blood of persons affected with cancer. These are generally referred to new growths forcing their way into the veins; but it is not improbable that in many instances they are detached from tumours arising, as in the foregoing case, independently from the lining membrane of the blood-vessels.

But fatty degeneration is not confined to the structures in the vicinity of the cancer. I have often found the muscular tissue of the heart in a state of degeneration. The fibres are very soft, their markings faint, or in some cases entirely lost, and the structure is loaded either with fat globules or granular matter. (See plate 9, fig. 1.)

The blood is very different from that of a person affected with scirrhus of the breast. It coagulates slowly and imperfectly when mixed with alcohol, and seems loaded with fat.

From these remarks there can be no doubt that as in scirrhus we have both locally and generally a tendency to the increased formation of fibres and nuclei, so, the cancers affecting the uterus and some other

organs are associated with fatty degeneration of the whole structures of the body. It is very important to bear in mind that the changes in the distant organs, such as the stomach and heart, are similar in character to those which take place in the neighbourhood of the cancerous tumour, for any severe local action, such as inflammation, produces anatomical changes in the tissues in its immediate vicinity.

But may not the morbid changes in the distant organs be merely the results of the cancer? I think not. For, as we have before seen, although animal poisons produce inflammation of the gastric mucous membrane, it is usually in the form of tubular gastritis, and we have no proof that they can give rise to the fibroid degeneration and rapid wasting of the glandular structures of the stomach so often seen in cancer of the breast. In one female who had died from the effects of amputation of a recently-formed scirrhus of the mamma, and in whom there were no enlarged axillary glands, or other secondary developments of cancer, I found extensive fibroid degeneration of the gastric mucous membrane; and in another, who died some time after the operation, without presenting any return of the local disease, the morbid changes in the stomach were very marked. In neither of these cases could the internal alterations have arisen from the effects of the local malady; for in neither was there any evidence that the system had suffered from the cancerous growth.

Nor can we maintain the hypothesis that the state of the digestive organs is the cause of the cancer. It does indeed appear to me impossible to explain why the gastric mucous membrane should be so constantly

affected in scirrhus of the breast and stomach, and not in cancer of the uterus or rectum, without supposing that there is some connection between those organs in the former instance. But, on the other hand, the facts, that the fibroid degeneration is often not confined to the stomach, that a similar change seems locally to precede the formation of scirrhus, and that great loss of digestive power often occurs without the production of malignant disease—all these seem to me to negative the supposition.

We must fall back, then, upon the only other remaining explanation, viz.—that cancer is a disease requiring for its development a rapid and contemporaneous degeneration of many of the tissues of the body—that, in fact, as tubercle results from an abnormal state of growth, so does cancer arise from a too sudden and rapid decay of the vital powers.

The prominent facts regarding the causation of cancer are in accordance with this theory. The tendency to its development increases with the age of the patient, and this we know is also the case as regards degenerations. It is most liable to attack the breast and uterus at the time of life at which the functional activity of these organs is about to cease. We have already seen that, after middle age, the pyloric region of the stomach loses its powers of secretion, and becomes liable to fibroid and other degenerations, and we find that this organ, and especially this part of it, stands in the third rank as regards its liability to malignant disease.

Degeneration of a tissue appears to arise from a loss of the formative power of the part in which it occurs, and it is upon the results of this that microscopists

chiefly base their diagnosis of cancer. There is no form of cell growth that can be set down as peculiar to malignant disease; but we look at the multiplicity of forms presented by the new growth, and their deviation from the normal structure of the part. In other words, we consider a tumour to be of a cancerous nature, because its growth appears to have taken place uncontrolled by the formative power of the organ in which it has occurred.

But it may be objected that certain forms of malignant disease occur at an age and under circumstances in which we are not justified in assuming the previous existence of degenerative changes; when, for instance, a soft, rapidly-growing tumour follows an injury to the eye, in a child previously in apparently perfect health. The answer to this is, that other forms of degeneration may exist besides those before mentioned, and with which we are unacquainted; and that if the more frequent varieties of cancer can be shown to co-exist with degenerations, it is probable that in the rarer kinds some defect in the formative powers has been inherent in the affected parts.

When we admit the connection of cancer with degeneration of other important organs, much of the interest connected with the often-debated question of the local origin of malignant disease is lost; for, if we allow it to be a local malady, still it is one that arises from a general cause, and, therefore, merely local treatment cannot be expected to free the patient from the chance of its recurrence. Two circumstances seem to me to show that the cancerous material does not arise from an abnormal action in the part in which it is situated. First, that the disease often re-appears

two or three years after an operation, although during this interval no trace of it may have been discovered; and secondly, that, although in every age local remedies have been employed, and malignant growths have been extirpated in every possible manner, no one has been able to prove that he could prevent their recurrence.

I am inclined to believe that cancer arises from something allied to an animal poison, susceptible of being produced during and engendered out of the degeneration of the tissues. We have before seen that it is one of nature's ordinary plans for giving time for the recovery of the system, to deposit in some structure any animal poison that may have found entrance into the blood.[1] As syphilis affects the bones; scarlatina the skin and mucous membranes; tubercle the lungs and glands; so is each variety of cancer localized in that organ for which it has the greatest affinity, or which is in such a state of degeneration as to be susceptible of attack.

Other animal poisons are removed from the body, partly by ulceration, partly by resorption, and such is the case with cancers. The resorption of these poisons is apt to be followed by the reproduction of new and similar growths, and so it is in malignant disease. As the kidney is inflamed by the passage of the scarlatina poison through its tubes, as the absorbents of the groin enlarge when the venereal virus traverses them, so the glands of the axilla become affected when a malignant tumour of the breast breaks up in the course of its removal from the system.

[1] See pp. 123 and 209.

Cancer seems to agree with tubercle in the impossibility of its passing through the ordinary emunctories of the body. Instead of being eliminated, like the scarlatina virus through the kidneys, it is retained in the system; and each breaking up of a tumour leads to the further dissemination of the disease.

The similarity between the new growths in fever and those produced in some of the forms of cancer seems to have forcibly impressed the mind of Rokitanski. He says:—"The products of typhous blood-stasis deposited in intestinal typhus in the follicular apparatus of the bowel, in broncho-typhus in the bronchial glands, and probably in plague typhus in different superficial lymphatic glands, appear to us so analogous in many points with medullary carcinoma, that we do not hesitate, in accordance with an opinion long entertained, to award it a place here." [1] And again, — "The product of typhus presents in its first, but still more in its later stages of metamorphosis, the greatest analogy with cancerous growths, and more particularly with medullary cancer."

Other points of similarity will present themselves to the reader when he compares the foregoing observations on cancer with those previously made on typhoid fever. Thus, both diseases are characterized by the great diminution in the amount of pepsin.[2] Again, Andral first drew attention to the deposit of pigment in the intestinal villi of those who had died

[1] Rokitanski's Pathological Anatomy, vol. i. p. 282. Sydenham Society's Translation.

[2] See pp. 121 and 278.

of fever, and we have seen how frequently the same condition is remarked in those who have been affected with cancer. Furthermore, in these diseases only have I met with crystalline deposits in the villi; and although I am led to believe, from their microscopic characters, that these were different in their chemical composition, yet their occurrence is a matter of interest.[1]

I do not wish, by pointing out these analogies, to insinuate that cancer and fever originate from the same morbid material; I merely desire to show that in each the disease is of a general character, and that if we suppose the one to arise from a poison in the blood, we can scarcely refuse to admit the possibility of the same occurrence in the other.

One of the most remarkable characters possessed by cancers is their power of independent growth. A small tumour may form in some fleshy part, and increase so rapidly that the whole nutrition of the body seems to be concentrated in it, and the other structures lose their bulk in proportion to the rapidity of its enlargement. May not the following experiment afford us some hint as to this mysterious power? A portion of a large and quickly-growing "recurrent tumour" of the breast was boiled in acetic acid. With the exception of a few fibres it quickly dissolved. The fluid was filtered and evaporated to dryness; and it was then mixed with distilled water and boiled, so as to separate the albumen. The fluid was again filtered and evaporated on a water-bath, and the residue was placed beneath a bell glass, with a capsule containing sulphuric acid.

[1] See p. 120.

It formed a brown coloured mass, whose attraction for water was so intense that it became damp if taken from beneath the glass even for a few moments. It retained this power for many months, but at last its appearance changed, and it was converted into a dry, chalky mass.

The hygroscopic property of many animal substances is well known; but I am not aware that any attempt has been made to show what influence this may have upon growth and secretion. It can be readily imagined that if, in disease, any cellular structure should separate a material having an unusual attraction for fluid, an afflux of blood towards it would take place, and rapid and unusual growth would be excited. It is, I think, probable that other pathological phenomena may admit of an explanation on physical principles. If in the growth of ovarian cysts, a fluid is secreted having a greater density than the blood, or possessing a great attraction for water, exosmosis from the vessels will take place, and the contents of the cyst be in this way augmented.

In inquiries of this kind we approach a subject of the utmost difficulty, viz., the relation and subordination of chemical and physical forces to the phenomena of life, and their relations, moreover, to the phenomena which we term degeneration, disease, and death.

The life of every tissue in the healthy human being not only includes a growth bounded by natural limits, but the growth must be so interstitial and progressive that it shall exactly conform to the laws which regulate the normal development of each part of our

bodies in reference to the whole. When organic matter lives and grows, it takes up from the blood the elements on which it subsists, and it subordinates the forces locked up in these elements to its own purposes, in a way that transcends our power to unravel. And the mystery which underlies these phenomena we term life.

But if we are ever to gain an insight into the laws which regulate these things—and the progress of science renders it probable that we shall—it is almost certain that those changes in our animal membranes and tissues which alter their physical relations to the blood, will occupy a prominent position.

CHAPTER XV.

ON ULCERATIONS OF THE STOMACH.

Ulceration of the stomach has of late years attracted more attention than any other affection to which the organ is liable. The great difference in the severity of the symptoms in different cases—the sudden and often unexpectedly fatal termination of some—the long-continued suffering in others—and the want of certainty in our present means of diagnosis, have combined to render this complaint an object of especial interest.

Ulceration is a process of molecular disintegration by which the body rids itself of portions of tissue that have lost their vitality; and the main objects of our inquiry should therefore be to ascertain the causes of the affection, and the best method of preventing them. Unfortunately, many of these causes are as yet very obscure; but it seems to me that the most probable method of arriving at accurate conclusions is to group the cases under separate heads, according to the different conditions under which the disease is manifested. I propose, therefore, to consider gastric ulcers as induced by debility; as resulting from congestion; from inflammation; and lastly, from degenerative processes.

1. SLOUGHING ULCERS INDUCED BY DEBILITY.

This is the rarest form of ulceration to which the organ is liable; it has received but little attention owing to its being unaccompanied by symptoms sufficiently characteristic to indicate its presence; and hence it is seldom suspected until revealed by *post-mortem* examination.

Well-marked examples of this affection may be occasionally observed in the lower animals. For example, in an antelope that died of a disease in the mouth, I found the first stomach greatly congested, and presenting five large ulcerations. The surface of one of these was smooth, of a dark red colour, and slightly raised above the adjoining parts, but there was no separation at the edges. Another was the size of a five-shilling piece, very dark in colour, slightly raised and thickened at the edges, and perforated by two or three minute holes. In a third the slough was detached, except at one point where it was still in connection with the neighbouring structures, and a large perforation of the organ was thus produced.

Disease of the jaw is very common in the whole of the deer tribe when living in confinement. The gums become spongy and ulcerated, and bleed freely; sometimes to such an extent that I have seen death result from the hæmorrhage. The lower jaw is expanded into small cavities filled with a bloody fluid, and is often so soft that it can be cut with a knife. From the similarity of this disease to scurvy in the human subject, there can be little doubt that it arises from a similar cause, viz., the want of the natural food of the animal.

It must be remembered that the sloughs were in the first stomach, and could not, therefore, have resulted from the action of the gastric juice, either before or after death. The disease, in all probability, arose from the general condition with which it was associated.

Facts of a similar nature have been observed in other kinds of animals. Ulceration of the stomach has been noticed in dogs which have been starved to death, and Mr. Simon discovered that when cats are kept in confinement and in a dark place, the same affection is produced in them. Dr. Budd describes the appearances in one he examined as consisting in "several irregular linear abrasions of the mucous membrane, which were of a dark brown colour from the presence of altered blood, and resembled the linear hæmorrhagic erosions of the human stomach."

The appearances presented in this disease, when it occurs in the human subject, are well shown in the following case reported by Dr. Habershon

Case 25.—"Mottled kidney—anasarca—pneumonia—sloughing mucous membrane of the stomach.

"Stephen Fitzgerald, æt. 51, admitted under Dr. Hughes' care April 10th, and died April 20th, 1855, from chest disease. Nine years before he had scarlet fever, and for the last eighteen months he had not been well. On admission, the urine was very albuminous.

"*Inspection fourteen hours after death.*—The body was generally anasarcous. The lower lobe of the left lung was red, consolidated, and almost breaking down. The rest of the lung was very œdematous.

The bronchi full of frothy mucus. The left ventricle much hypertrophied. Weight of the heart, seventeen ounces. At the lesser curvature of the stomach were several sloughs; the largest two inches in length and about one in breadth, black and slightly raised; a section showed that the slough was situated in a sort of cup of slightly thickened tissue. Two smaller sloughs were situated near to it. On microscopic examination, in the adjoining portions of mucous membrane the gland follicles were not distinct; and in the surface were columnar epithelium, crystals, &c. The small intestines were healthy. Spleen small, firm, lardaceous. Kidneys mottled. The malpighian bodies degenerated and lardaceous."[1]

It will be observed that in the above case no symptoms are given which indicated any disease of the stomach; and the probable explanation is, that the sloughs were the results of impaired vitality, both of the general system and of the organ in which they were found.

The great depression of the nervous system accompanying the affection probably may prevent both the sensation of pain and the action of vomiting. Every one knows how bed-sores may form without a single expression of suffering on the part of the patient. In like manner, sloughing appears to take place in the stomach from defective vitality rather than from inflammatory action.

There is another point of view in which this subject is interesting. Descriptions of similar appearances in

[1] Guy's Hospital Reports, 1855.

the stomach are scattered through the older writers. These cases have been generally passed over by modern authors; partly, perhaps, because they were cited as instances of acute gastritis, which they evidently were not, and partly, I suspect, from the idea that the descriptions of the older anatomists are not sufficiently exact for the requirements of science in our day. From this latter opinion I entirely dissent. Our forefathers examined what they saw as carefully as we do; perhaps more so, for the very reason that their opportunities were more limited.

The nature of the ulcerations just described can admit of little doubt; but this is not the case with respect to another form of more frequent occurrence. I allude to what is often termed "the perforating ulcer," as it occurs in young females.

A young woman, shortly after a meal, is attacked with vomiting, accompanied or followed by violent pain in the region of the stomach. The pain spreads rapidly over the whole abdomen, and is increased by the slightest pressure. The patient lies on the back or side with the knees raised. The countenance is pale and anxious, the nostrils dilated, the breathing quick and constrained. The pulse is small and rapid, and in a short time after the attack the abdomen becomes swollen, and its muscles tense and hard. Death generally takes place within thirty-six hours.

On *post-mortem* examination, the cavity of the abdomen is found to contain a turbid or bloody-coloured fluid. The intestines are red, coated with a greater or less quantity of lymph and adherent to each other. On laying open the stomach, a small round or oval ulceration is discovered, seldom exceed-

ing the size of a shilling, and generally situated in the lesser curvature, in or near the pyloric region. The ulcer perforates all the coats of the organ, and is conical in shape, the opening in the mucous membrane being much larger than that through the muscular structure, whilst the aperture in the peritoneum is often very minute. In other cases, it presents an appearance as if the whole of the coats had been more evenly punched out. The edges of the ulcer are thin and sharp, not raised and thickened as in the more chronic forms of the complaint. The remainder of the gastric mucous membrane is generally found to be healthy.

An important question arises as to the nature of such cases. It is possible that they may be produced partly by the action of the gastric juice, by inflammation, or by sloughing from debility.

The appearance of the ulcer is sufficient to negative the idea that the perforation is in any way the result of the secretion of the stomach. When a piece of mucous membrane is digested in gastric juice, the edges of the part dissolved become transparent and ragged; but in these sores the muscular layer is as cleanly cut through as the mucous membrane, and the peritoneum at its base has a dull sloughy aspect, instead of the gelatinous appearance of digested connective tissue. Nor can we refer them to inflammation. The edges are neither raised nor thickened, and there are no adhesions to the neighbouring parts. The remainder of the stomach is almost always healthy, neither congested nor covered with an abnormal amount of mucus. From these facts we can arrive at no other conclusion than that the ulceration

is the result of sloughing produced by deficient vitality.

This conclusion is borne out by the history of the persons in whom the disease occurs. With few exceptions, they have suffered from anæmia, and have been unfavourably situated as regards the means of maintaining health.

Dr. Crisp pointed out that most of the subjects of this form of gastric ulcer have suffered from imperfect menstruation. To this Dr. Brinton objects, "that some of them are expressly mentioned as not having arrived at puberty; others are recorded to have menstruated regularly, and even profusely; and, finally, one of the most characteritsic instances occurred in a person who, though supposed to be a female, was proved by a careful necropsy to be devoid of ovaries, and therefore, physiologically speaking, alike incapable of menstruation, or of any conceivable disorder of the function.[1]

Judging from my own experience, I believe Dr. Crisp to be in the main correct, and that whenever there are no signs of inflammation around the ulcer or in the other parts of the mucous membrane, the sloughing is the result of some cause that has depressed the vital powers of the system, and that, either as a cause or consequence of this state, the menstrual functions will have been imperfectly performed.

The suddenness and fatality of this disease render it a point of great importance to ascertain the nature of the symptoms that precede the perforation. In

[1] Dr. Brinton On Ulcers of the Stomach, p. 32.

none of those that have come beneath my own observation has there been any previous sign of gastritis or other serious disorder of the digestive organs. The patient has generally stated that for two or three weeks before the fatal illness there has been a loss of appetite, a sensation of fulness or a diffused pain of the chest after food, together with constipation of the bowels. There is, in fact, a want of all those painful local sensations which we might expect in a complaint of such gravity. In one case given by Dr. Crisp, a "tall and delicate girl," fifteen years of age, and apparently in the enjoyment of good health, after giving a violent scream, became insensible. "She was cold and pallid, the pupils were much dilated, the pulse scarcely perceptible, and there was vomiting of a glairy matter."[1] No disease was found after death in the brain, the only morbid appearances being those of peritonitis from a perforating ulcer.

Considering the suddenness with which the symptoms of perforation occur, it is not surprising that the suspicion has arisen in many of these cases that death had been produced by poisoning. In a medico-legal point of view, the disease requires careful consideration, and the observations of Dr. Taylor appear to me of such value that I have transcribed them in this place, and would particularly direct the reader's attention to them.

"The attack commences with a sudden and most severe pain in the abdomen, generally soon after a meal. In irritant poisoning the pain usually comes on gradually and slowly increases in severity. Vomiting,

[1] *Lancet*, 1843.

if it exist at all, is commonly slight, and is chiefly confined to what is swallowed. There is no purging; the bowels are generally constipated. In irritant poisoning the vomiting is usually severe and purging seldom absent. The person dies commonly in from eighteen to thirty-six hours; that is also the average period of death in the more common form of irritant poisoning, *i.e.*, by arsenic; but in no case yet recorded has arsenic caused perforation of the stomach within twenty-four hours; and it appears probable that a considerable time must elapse before such an effect could be produced by this or any irritant. In perforation from disease the symptoms and death are clearly referable to peritonitis."[1]

It is generally believed that perforation of the stomach in these cases is always fatal, but the following seems to show that recovery may sometimes take place.

Case 26.—A woman who had for some weeks suffered from slight dyspeptic symptoms was suddenly attacked with an agonising pain in the region of the stomach. When I saw her the same evening, the pulse was small and rapid, the abdomen tense and generally tender. From the great depression, the suddenness of the attack, and the rapid production of the symptoms, I had little doubt that perforation of the stomach had taken place. After being apparently at the verge of death for some days, the peritonitis gradually subsided, and she eventually recovered.

In a case of this kind it may be said that there

[1] Dr. Taylor On Medical Jurisprudence, p. 150.

had been a mistake in diagnosis; but if so, it still shows that a person may present the symptoms supposed to characterise perforation of the stomach, and yet escape death.

This form of ulcer may lay open a blood-vessel instead of producing perforation. On account of the absence or the trifling nature of the symptoms preceding the occurrence, the diagnosis is necessarily difficult.

Case 27.—A young woman had been ill for some days before I saw her. Her exhaustion was so great that she fainted if the head was raised from the pillow, and the pulse was very rapid and feeble. There was occasional delirium, but no complaint of pain. The face and lips were blanched, and there was a systolic murmur at the third rib. The catamenia were stated to have been regular, and she had not previously suffered from anæmia. On careful inquiry, it was ascertained that for two or three weeks before her illness she had been troubled with flatulence and occasional uneasiness after food, but without any severe pain or vomiting. Whilst sitting at work she was suddenly seized with faintness and retching, but vomiting did not occur. For a few days after this attack her mother had remarked all the evacuations from the bowels to be of a dark colour, which she supposed to have been caused by bile. Considering the suddenness of the illness, the previous occurrence of slight dyspepsia, and the evidence of internal hæmorrhage, it was concluded that a blood-vessel had been laid open by ulceration. She ultimately recovered, but it was many months before she regained her former strength and colour.

Although the cases in which gastric ulcers take place are few compared with the numbers of young women who are affected with anæmia, the possibility of this accident must be borne in mind.

Iron and quinine are the best remedies for the dyspepsia accompanying anæmia, but they are frequently commenced too soon. It is generally advisable to precede their use by alkalies, gentle aperients, and vegetable tonics. It is often a good plan to alternate the use of iron with that of a vegetable bitter.

II.—ULCERATIONS ACCOMPANYING CONGESTION.

We meet with the best instances of this form of ulceration in persons who have died from such affections of the heart and liver as tend to produce congestion of the gastric mucous membrane. In such cases we often find on the surface of the stomach numerous round or oval patches of a dark colour. Many of these are covered with a small clot of blood, and when this is washed away an ulceration of greater or less depth may be observed. In some the loss of substance is but slight, in others it extends to a greater depth.

These erosions have been attributed by various authors to *post-mortem* solution of the blood extravasated during the last days of a lingering death. I think this explanation is incorrect, for there is not much *post-mortem* digestion in these cases, and the erosions occur most frequently near the pylorus where

the gastric juice seldom affects the surface to any great degree. In addition to this, the edges of the erosion are clearly marked, and on microscopical examination there is not observed that gradual decomposition of the surrounding tubes which ought to be present if this theory were correct.

The want of correspondence between the symptoms during life and the appearances after death apparently support this explanation, as in such cases there has been seldom any severe complaint of epigastric pain. But it must be borne in mind that, under such circumstances, all the natural sensations are deadened and the patient's attention is absorbed by the urgent dyspnœa or other symptoms with which he has to contend. We cannot, then, be surprised that a passive action like a small local hæmorrhage should fail to attract his attention, or produce effects likely to demand the notice of the practitioner.

This form of ulceration requires no special treatment. As it depends upon the congested state of the mucous membrane, our only hope of relieving it is by removing the overloaded condition of the blood-vessels.

In some cases, and especially in young persons, vomiting of blood takes place; and if this occurrence seems likely to reduce the strength of the patient, it must be combated by rest and astringents. In others, an occasional oozing of blood goes on, and passes off, unobserved, by the bowels. Occasionally the hæmorrhage assists in relieving the congestion, at other times it weakens the patient and tends to hurry the case to a fatal termination.

III.—ULCERS INDUCED BY INFLAMMATION.

This is perhaps the most common form of gastric ulceration. We meet with it not only as an idiopathic affection, but also during the course of other diseases which have a tendency to produce gastritis.

The lining membrane, in fatal cases, is red, swollen, and often considerably softened. It is covered with mucus, which may contain either shreds of blood or "coffee ground" particles. On the surface of the membrane, and chiefly towards the pyloric region, are scattered a number of small brown or sooty-coloured spots, seldom larger than a shilling and often only the size of a pin's head. At other times they look like mere blood-stains, and are irregular in size and shape. With these, and evidently only later stages of the same process, are small ulcerations similar in appearance to the spots, and frequently presenting a dark colour at their edges.

In a dog, to which I had given a small dose of sulphate of zinc a few days before death, I found numerous small spots and ulcerations scattered over the mucous membrane of the stomach. Some of the spots were like those I have described as occurring in the human subject; but in others the dark parts had been thrown off, and small ulcerations had been produced. These ulcers had not elevated edges, but were bounded by a dark red line showing the remains of extravasated blood. A perpendicular section through one of them is shown in plate 10, figure 1, and it will be remarked that the tubes

in the neighbourhood of the ulcer are not united together by inflammation. This I consider to be an important point, as in chronic ulcerations we generally find the secreting tubes at the edges of the ulcer closely matted together.

In the stomach of an Indian civet cat, lately examined by me, the whole of the splenic region was of a uniform red colour, as if overspread by an extensive blush, whilst numerous minute dark red circular spots were scattered over the surface, varying from the size of a pin's head to that of a pea. The pyloric region was less inflamed, but was covered with a thick layer of mucus. The tubes in the splenic region were distended with a confused mass of cells and granular matter, but there was no appearance of inflammatory action between or below them. In the pyloric region the greater number of the tubes were deprived of epithelium and the solitary glands were enlarged. The stomach and duodenum contained some bloody mucus, but there was no suspicion of poisoning, the animal having died of another disease.

I have met with similar appearances in others of the lower animals, associated with inflammation of the mucous membrane, and we may therefore conclude that these superficial ulcerations are a frequent consequence of subacute gastritis.

The small round superficial ulcerations have been named "follicular," from the belief that they originate in an affection of the follicles of the stomach. Dr. Fox states that, "In some cases the enlarged glands ulcerate, and it is to their undergoing this degeneration that I believe the majority of the so-called

follicular ulcers are due."[1] I am unable to confirm the truth of this opinion, believing that the ulcers may arise in any of the structures of which the mucous membrane is composed.

Portions of mucous membrane may be detected in the vomited matters in some cases of subacute gastritis. They are of a dark red colour and of very small size, being usually round or oval in shape, corresponding in these respects with the minute ulcerations before described.

A case of this kind was in the Victoria Park Hospital in which the vomiting had lasted for many weeks, and only subsided when all food was withdrawn, and nourishment was administered by enemata only. Some clear fluid, rejected in the early morning, was examined, and small particles of the mucous membrane of the stomach were detected by the microscope.

I have not as yet found in any case of chronic ulcer portions of mucous membrane in the vomit, although I think it will be possible to do so; and if such should prove to be the case, the microscopic appearance of the particles may be sufficient to show whether they have been thrown off from an inflammatory or from a chronic ulceration.

When the superficial ulceration has existed for some time it may present microscopical characters differing from those just described. In the pyloric region of a person who had died of phthisis an ulcer was discovered the surface of which was irregular from projections of the mucous membrane. These did not correspond to the ends of the gastric

[1] "Diagnosis and Treatment of Dyspepsia," by Dr. W. Fox, p. 175.

tubes, but were very various in thickness. The depth to which the surface was eroded between the projections varied greatly, but in no place had the ulceration penetrated the whole extent of the membrane. The gastric tubes were represented by a few bulbs filled with cells and granular matter. There was no thickening at the edge of the ulcer nor of the submucous tissue; and the blood-vessels were neither enlarged nor fatty.

These superficial ulcerations demand no special treatment beyond that required for subacute gastritis. The only sign by which they can be certainly recognized is the appearance of minute portions of mucous membrane in the fluids rejected by the stomach.

IV.—CHRONIC ULCER OF THE STOMACH.

The forms of gastric ulcer hitherto described are unaccompanied by any well-marked symptoms, and are usually rapid in their progress; but the chronic form of the disease is attended with severe suffering, and often subjects those affected with it to years of ill health.

When we examine the body of a person who has died of this complaint, we find a round or oval ulcer, varying from the size of a shilling to two or three inches in diameter. It is generally single, but occasionally two or three are present, or an ulcer in the duodenum may coexist with one in the stomach. It is ordinarily met with near the lesser curvature and towards the pyloric region, and it affects the posterior rather than the anterior surface of the organ. When

placed near the splenic, it is usually of smaller size than when situated nearer to the pyloric orifice.

The ulcer is usually of a conical form, the mucous membrane being more extensively destroyed than the muscular coat, and this again to a greater extent than the peritoneum; which, when it has been perforated, often shows a mere chink, through which some of the contents of the organ have escaped.

The edges of the sore are generally of a dead white colour, and are raised above the neighbouring mucous membrane. They are hard, and not unfrequently the condensation extends for some distance. The coats of the stomach round the ulcer are closely matted together. Sometimes inflammation takes place in the edges, and they become irregularly elevated and spongy, and when pressure is made upon them, pus exudes from numerous small orifices.

When the whole of the mucous membrane has been destroyed, the base of the ulcer is formed of the subjacent tissues thickened and united to each other; but when adhesions have occurred, the floor may consist of some of the adjacent organs.

A microscopic examination of a chronic ulcer shows the effects of inflammation in all the structures of which the stomach is composed. In some cases, inter-tubular gastritis can be readily traced. At a little distance from the edge of the sore the lower ends of the tubes may be observed unconnected with each other. Above this point they are united, and form a tissue composed of cells, fibres, and granular matter, in which all distinction between the original structures is lost. Nearer to the edge, the tubes are

united to each other in their whole length; at other places, no appearance of them can be seen, but the mucous membrane seems only to consist of cells and fibres.

In other instances, the signs of tubular gastritis are presented. The tubes can be readily distinguished, but they only contain scattered cells and granular matters. Some seem more empty than others; in one part they may be irregularly filled with cells, at another the basement membranes are wrinkled in a longitudinal direction, and the tubes only contain a few cells and deposits of pigment. (See plate 5, figures 2 and 3.)

At the thickened edge, and for a short distance from the ulcer, the muscular coat is generally affected. In recent cases the fibres are intermixed with cells, but when the disease has been of long standing every trace of the normal structure disappears. (See plate 10, figure 2.)

If the lesion be situated in the pyloric region, or along the lesser curvature, where the solitary glands are most numerous, we find these bodies enlarged, and filled with cells and nuclei. When the complaint has existed for some time their contents disappear, and a number of round or oval spaces represent their sites. Occasionally, these spaces are so numerous that a section, when viewed by the microscope, presents an appearance as if the submucous structure had been perforated in every direction.

The connective tissue below the muscular layer is generally much thickened, and forms the floor of the ulcer when no adhesions have taken place to other organs.

PLATE X.

MICROSCOPICAL APPEARANCES PRESENTED IN ULCERATIONS OF THE STOMACH.

FIG. 1. Hæmorrhagic erosion in a dog.

t. Tubes filled with cells.

gr. Blood and granular matter between and below the tubes at the ulcerated spot.

m. The muscular coat.

FIG. 2. Chronic ulcer with great thickening around and below it.

t. The tubes united together by chronic intertubular gastritis.

co. Increased connective tissue between and below the tubes.

m. Altered muscular coat.

c. Thickened connective tissue between the muscular and peritoneal coats. Only a small portion of this structure is shown in the engraving, as it was of great thickness.

FIG. 3. Fatty degeneration of the stomach in a case of chronic perforating ulcer.

t. The tubes filled with fatty and granular matters.

m. The muscular coat also in a state of fatty degeneration.

Plate 10

Fig 1

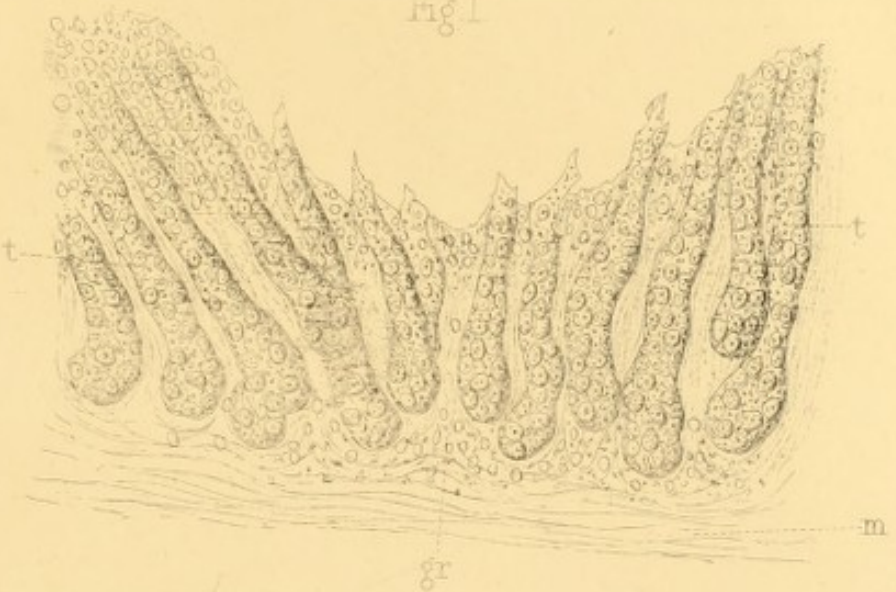


Fig 2

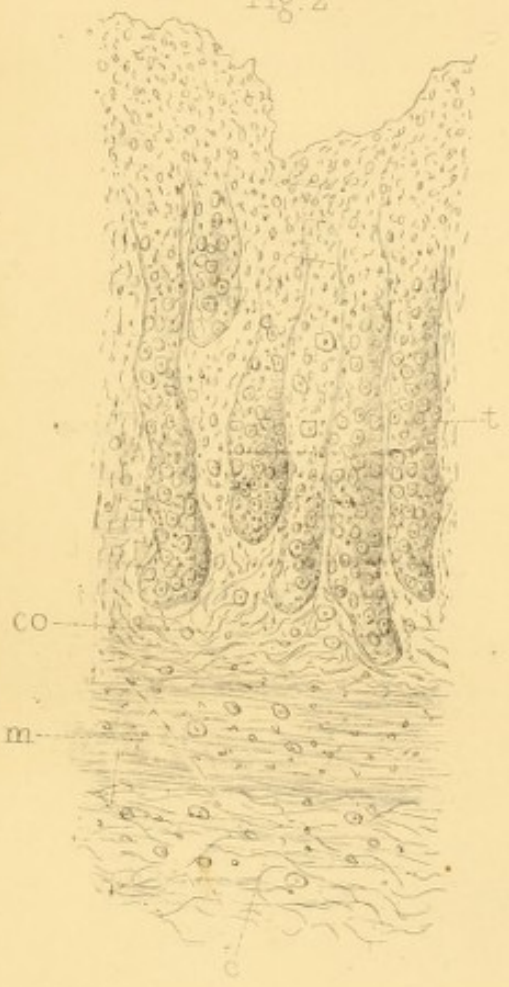
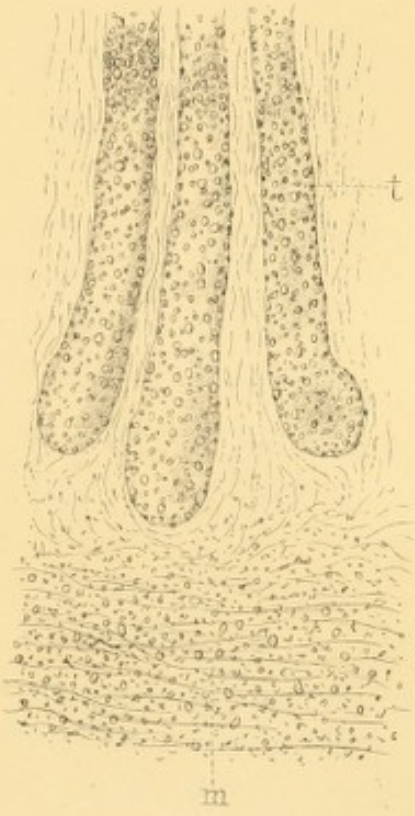


Fig 3



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In nearly every case of chronic ulcer that I have examined with the microscope the blood-vessels have been diseased. Even in the mucous membrane surrounding the sore they are often, as represented in plate 5, figures 2 and 3, enlarged and thickened. These changes are still more frequent in the deeper parts. In some the arteries are most affected, their coats being thickened or fatty, or they are enlarged and tortuous. In other cases, the veins are principally diseased.

It is generally stated by authors, that except the ulceration the mucous membrane is healthy. Unless careful examination be made, this will ordinarily seem to be the case. It is not, however, unusual to find considerable thickening in some other portion of the lining membrane than that on which the sore is situated. Occasionally, small white spots showing fatty degeneration may be observed. This appearance had attracted the notice of Dr. Abercrombie, who remarks that, in a case of gastric ulcer, "higher up towards the cardia there were numerous white or ash-coloured spots of various sizes, like to marks of small-pox. They were much smoother than the surrounding membrane, and of much lighter colour, and there was every reason for considering them as the cicatrices of small ulcers." Microscopic examination often shows that the white spots similar to those just described are not cicatrices, but the result of fatty degeneration.

In the case of an ulcer of the stomach, which had proved fatal by perforation, the whole of the organ was in a state of fatty degeneration, although to the naked eye it appeared healthy. The tubes could be

readily distinguished, but they were filled with large and fatty cells, and the basement membrane was everywhere very thin, and in some places scarcely to be observed. The appearance of the mucous membrane at a little distance from the sore is shown in plate 10, figure 3.

Not unfrequently, the gastric tubes throughout the membrane are filled with cells and granular matter, and present the ordinary appearance of chronic tubular gastritis. From the quantity of tough or glairy mucus often vomited by the patients, and from the frequency with which acidity is observed, there can be little doubt that the ulceration is associated, in the greater number, either with chronic inflammation or congestion of the whole mucous membrane.

The causes of chronic ulcer of the stomach have been frequently discussed. The chief difficulty seems to be, that authors have massed together all cases in which a loss of substance in the lining membrane had been observed, without looking at the other circumstances of the disease.

There can be no question that an ulcer may originate on a mucous membrane in the same way as on the external surface of the body, viz. from sloughing produced by debility, from congestion, or from inflammation, and that it may assume a chronic form, if the powers of reparation be enfeebled.

In a large proportion of the cases it has been found that the patients were suffering from some affection of the heart, liver, or kidneys; diseases which we have already seen are generally attended with congestion or chronic inflammation of the stomach. To this group may be also referred most of the

instances given by authors in which no symptoms of the complaint had been present; the attention of the patient having been engrossed by the sufferings produced by the original disease. Thus, Dr. Chambers gives five cases out of twenty-two in which no symptoms had been remarked, and in three of these there was disease of the heart, in one a disease of the kidneys, and in the remaining one an affection of the liver.[1]

Again, a similar explanation may be given of the connection between gastric ulcer and phthisis. All authors agree that this complaint is very often found in persons who have died of consumption, and it has been computed that 20 per cent. of the whole number occur in tuberculous subjects. We have seen how liable the stomach is to be inflamed in phthisis, and as the powers of life are very feeble we can easily understand that an ulcer once formed will be likely to become chronic.

But we are not, I think, justified in concluding that all chronic ulcers of the stomach originate from sloughing, congestion, or inflammation; and that the difficulty of healing them arises only from feebleness of the reparative powers of the whole system, or from some peculiarity connected with digestion.

Every surgeon knows that morbid alterations in the blood-vessels are the most frequent cause of chronic ulcers of the leg, and that the difficulty in their healing arises chiefly from this cause. As we have before seen, the vessels are constantly diseased in gastric ulcer, we can scarcely doubt that in this

[1] *London Journal of Medicine*, 1852.

fact there is an explanation both of their mode of origin and of the intractability of many of the cases that come beneath our notice.

The ulcers of the lower extremities to which old people are subject are often preceded by thickening of the skin and sub-cutaneous tissue; and as we have proved that structural degenerations often accompany gastric ulcers, we have reason to believe that in some cases such degenerations also give rise to this disease.

It has been the custom to refer the thickening at the edges of the ulcer to inflammation. This is, no doubt, the correct view in many, but not in all cases. Instances are given by Abercrombie, Andral, and others, in which, although symptoms of gastric ulcer had been present, no sore could be discovered after death, but only a thickening of the coats of some portion of the stomach. The following case seems to show still more clearly that ulceration may be the result and not the cause of the thickening.

Case 28.—A man about 30 years of age consulted me on account of a constant pain of the back from which he had suffered for some time. There was no deformity, but considerable pain was experienced when pressure was made upon the spine. He remained for about a year under my care, with but little variation in his symptoms, when he rather suddenly began to complain of pain in the epigastrium and occasional vomiting. He lost flesh and strength rapidly, the vomiting became very frequent, and he sank from exhaustion. On *post-mortem* examination the bodies of two or three of the vertebræ were

found to be carious, and the stomach was attached to the spine at that part by a dense layer of connective tissue. Opposite to the adhesion was a large ulceration with thickened base and edges. No appearance of cancer could be detected with the microscope, either in the stomach or in the newly formed tissue in front of the spine.

From the long continuance of the spinal symptoms and the late appearance of those indicating the gastric disease, there can be little doubt that the complaint originated in the vertebræ, and that the adhesions and ulceration were the results.

It has been proved by Dr. Brinton that, the liability to ulceration of the stomach increases in proportion to the age of the patient, and the same fact is observed with regard to degenerations. But this is not the case with respect to gastritis, for it has been shown that inflammatory dyspepsia is most apt to occur in early life, and that as age increases feebleness of digestion and not inflammation makes its appearance. The usual site of the ulcer is also in accordance with the supposition that it often results from degeneration, for this change chiefly affects the smaller curvature and the pyloric region, the parts most frequently also attacked by chronic ulceration.

In the majority of cases peritonitis is set up as soon as the ulcer has penetrated below the mucous membrane. The surface of the peritoneum becomes opaque and thickened, lymph is effused and glues the organ to some of the neighbouring viscera. When the perforation extends through the peritoneum the base of the ulcer is thus very often found to be formed by the liver or pancreas.

The frequency with which adhesion takes place depends on a variety of circumstances. Jaksch records twenty-two cases of adhesion in fifty-seven ulcerations, or 38 per cent. Of these the pancreas was united to the stomach in fifteen, and the liver in five cases, so that when adhesion takes place it is generally to the one or other of these organs.

The primary effect of such adhesions is to save the patient from the danger of the contents of the stomach being effused into the cavity of the peritoneum. It should be also remembered that a change is often produced by them either in the shape or the position of the stomach. In some cases it is contracted to a very small size; in others, either a pouch is formed which gradually becomes dilated, or the obstruction to the egress of food produces a general enlargement, and we find on dissection, the whole organ thin and greatly increased in size.

When the ulceration is situated at the smaller curvature, this part may be drawn together, and the shape of the stomach completely altered; or, where adhesion to the liver occurs, we sometimes find the middle and pyloric regions drawn under that organ, so that only a small part is visible on laying open the abdomen.

Chronic gastric ulcers are often very rebellious to treatment; and many patients suffer from them during a long series of years. The reasons of their being often so difficult to heal are sufficiently evident.

In the first place, the original cause of the sore usually remains in action long after the ulcer has

been produced. If, for instance, it has been excited by congestion of the mucous membrane, arising from diseased heart or liver, or from degeneration of the coats or blood-vessels of the stomach, it is evident that the mere loss of surface does not remove these morbid conditions.

The thickened edges and base of the ulcer itself must also tend, as in the case of an old sore upon the leg, to prevent cicatrization, by diminishing the supply of blood to its surface.

In addition to these we have to contend against the motions of the organ, and the irritating secretion which is poured out whenever digestion is in progress.

Coupling the above circumstances with the advanced age and feeble health of many of those affected with this complaint, we can easily understand how such cases often resist any remedial measures we may adopt. I have been most successful in the treatment of persons below forty-five years of age, who presented no indications of disease in any of the other organs of the body, and who could trace the commencement of their illness to gastritis, or chronic congestion of the mucous membrane.

In the following case, I had the opportunity of watching the patient until a cure took place, and of confirming, afterwards, the correctness of the diagnosis.

Case 29.—A female, about 35 years of age, had suffered for many years from all the ordinary symptoms of ulcer of the stomach. The pain was

severe after food; and she was much emaciated. She was treated with morphia, bismuth, and other remedies, and, notwithstanding frequent relapses, she eventually recovered. I lost sight of her for many years until I was requested to visit her when attacked with fever. She sank under this disease, and on a *post-mortem* examination we found the stomach partially divided by a stellate contraction situated in the smaller cuvature. When the organ was opened, its inner surface presented a large scar from which cord-like processes radiated in every direction, puckering up the membrane and the subjacent tissues.

Ulceration of the stomach may produce death in various ways.

Considering the severity of the pain from which many patients suffer, it is surprising that so few die from exhaustion. Almost all that have come under my notice, in which a fatal termination occurred in this way, and, where I had the opportunity of *post-mortem* examination, have presented a large extent of mucous membrane destroyed by the disease.

Even where the ulcer heals, if the complaint has been of long standing, it is I think rare to see the patient regain perfect health. He generally remains thin and imperfectly nourished; and we may often remark that such persons do not attain to old age, but are cut off by some other disease.

Hæmorrhage is a much more common cause of death than exhaustion. Dr. Brinton concluded, from his inquiries, that 5 per cent. of those affected with gastric ulcer perished from this accident. But, as in

the majority of cases, the bleeding ceases without producing fatal effects, it is evidently one of the most frequent, as it is one of the most alarming complications of the disease.

When attacked by gastric hæmorrhage the patient usually experiences a sensation of weight at the stomach. This increases until faintness ensues, followed by vomiting of a greater or less amount of blood mixed with any food which may have been in process of digestion. The blood is often clotted, and is usually of a dark colour from being acted on by the gastric juice. Ordinarily the bleeding ceases of itself, to return, perhaps, at a later period of the disease.

The quantity lost and the effects of the bleeding on the progress of the case present great varieties. Sometimes the hæmorrhage is so severe that life is at once destroyed, and we find after death the stomach distended by clots which it had been too feeble to expel. In others, it goes on so slowly that neither vomiting nor faintness is produced; the patient is observed to lose strength and colour, and it is only on finding the stools of a dark hue that the cause of the feebleness is suspected.

The amount of the hæmorrhage is chiefly determined by the source from which it is derived. If the bleeding arise only from an undue vascularity of the ulcer, the quantity is of course small, and its effusion slow and gradual. More alarming symptoms are produced when it is furnished by the capillaries of some of the neighbouring organs which have become attached by adhesions to the stomach. This is most frequently the case with the pancreas and

liver, although sometimes the spleen is the part affected.

One of the larger arteries of the stomach or neighbouring organs is by far the most common source of the bleeding. This was the case in thirty out of thirty-four cases collected by Dr. Brinton; and in sixteen the splenic artery was the seat of the erosion.

The amount of the hæmorrhage need be no measure of the extent of the ulceration, for a large vessel may be laid open by a very minute sore.

It is well to bear in mind that males are more prone to hæmatemesis than females, and that this accident is most liable to take place after the free use of stimulants, violent exertions of the body or mind, or when the stomach has been distended by a full meal.

Its treatment depends upon the condition of the patient. If the quantity of blood vomited is large, and he is threatened with syncope, our efforts should at first be directed to restore the circulation, as the bleeding will be for the time arrested by the diminished action of the heart.

Turpentine has been strongly recommended in these cases. John Hunter, who seems to have been the first to employ it, gave it in doses of one ounce. Dr. Graves recommended ten to twenty minims frequently repeated. I have tried both plans, but have not derived the benefit I anticipated from either.

I suspect that this medicine will be found most useful where the stomach has been so entirely freed from clots that it is directly applied to the bleeding surface, and also that part of any benefit that may be derived from it will arise from its stimulating properties.

I have generally trusted in severe cases to alum, to acetate of lead mixed with acetic acid, or to gallic acid.

Even when the bleeding has been to a small amount, the patient should be confined to the recumbent posture. Frequent doses of dilute sulphuric acid will in such cases generally suffice to prevent a recurrence of the hæmorrhage, but if the weight at the stomach be again complained of, alum, acetate of lead, tannin or gallic acid, may be given.

The quantity of nourishment should be very limited. At first only iced water should be allowed, but as soon as the bleeding appears to have stopped, iced milk in small quantities at a time may be substituted. The return to a more liberal supply of food should be very gradual, and it is advisable that no solids should be permitted until some time after the attack. Perfect rest both of body and mind ought to be insisted on.

It must be borne in mind that when an ulcer of the stomach has once caused hæmatemesis, it has either perforated so deeply, or is so situated as regards large vessels, that the accident is very apt to recur. All the circumstances likely to produce it should be therefore carefully avoided.

The most common way in which ulceration of the stomach produces death is by perforation, and the consequent effusion of a portion of the contents of the organ into the peritoneal cavity. Dr. Brinton reckoned that one in every four cases terminated in this manner, but as the calculation is based upon a large number of gastric ulcers taken indiscriminately, this average is in all probability too high as regards the chronic forms of the disease.

The symptoms arising from this accident have been already noticed, but it is necessary to remark that much more obscurity attends some cases than might be imagined. Partial peritonitis only may be set up; the effusion of the contents being limited by the adhesions surrounding the ulcer. The usual result of this condition is an abscess, which has been known to perforate the diaphragm or the abdominal walls. In other instances an opening takes place into the cavity of the colon or duodenum, the stomach being first united to them by adhesions.

Whilst males are more liable than females to hæmorrhage from gastric ulcer, the latter seem much more prone to perforation. This may perhaps be explained by the fact of fatty degeneration of the stomach and sloughing sores being more common amongst the female sex.

The tendency to perforation diminishes with the age of the patient, although the liability to gastric ulcers increases as life advances. The greater tendency to perforation in young persons is shown by Dr. Chambers to be the case with ulcers in other parts of the digestive canal, from whatever cause they may have arisen.

The site of the ulcer has an important bearing upon the probability of its opening into the abdominal cavity. The regions least capable of motion are necessarily those to which adhesions are most likely to occur, and ulcers in such situations are therefore least liable to perforation. Dr. Brinton states that an ulcer of the anterior surface of the stomach is fifty times more likely to produce fatal peritonitis than one situated on the posterior aspect.

The ordinary exciting cause of perforation is the distension of the stomach by a full meal. The mere stretching of the organ may suffice to tear asunder the slight partition which often alone divides the digestive cavity from that of the peritoneum. In some cases the rupture has been produced by an accident; in others, the fatal symptoms have followed immediately after severe vomiting.

The diagnosis of perforation of the stomach is sufficiently easy, if peritonitis follows directly after the occurrence of the accident, and the history indicates the existence of ulceration; but it is sometimes difficult to determine the exact nature of the complaint when the peritonitis is local, and the previous indications of gastric disease have been but slightly marked.[1]

We are also liable to mistake it when the ulceration occurs in the course of some other malady whose symptoms are sufficiently severe to engross the attention of the practitioner. Jaksch and Engel state that 27 per cent. of the ulcers of the stomach are accompanied by pneumonia or pleurisy, and although these cases are less liable to perforation than others, yet the accident may take place.

Dr. Chambers gives a very instructive instance of this. The patient was a girl nineteen years of age, and, when admitted into St. Mary's Hospital, she was suffering from pneumonia and bronchitis. She had also some pain in the shoulder-joints, and of the abdomen, which was tender upon pressure. She had no vomiting, but there was a peritoneal rubbing

[1] For some instructive cases of perforation of the Duodenum, see Dr. A. Clark's papers in the *British Medical Journal*, 1867.

sound. On *post-mortem* examination the bronchi were greatly congested, and the left lung partially solidified. The peritoneum was inflamed and contained much fluid, and there was a hole the size of a threepenny-piece in the lesser curvature of the stomach.[1]

The difficulty of diagnosis in this case consisted not only in the great prominence of the chest symptoms, but also in the fact that the patient had previously enjoyed good health until a week before her illness, and there had been no indication of any gastric disorder.

Although perforation of the stomach is usually followed by death, a fatal result is not a necessary consequence of the accident. Cases have been recorded in which recovery has taken place; the fact of the perforation having occurred being proved after death from other causes. We should not, therefore, despair, nor neglect any means at our disposal to avert a fatal issue.

When the symptoms indicate perforation, our first aim should be to give as perfect rest as it is possible to do to the stomach and abdominal muscles. The head and knees should be well raised, and retained in their positions. Perfect abstinence from food and drink should be insisted upon, and nourishment given only by enemata. Full and repeated doses of opium should be given; or, if vomiting is produced by them, morphia may be injected subcutaneously. These measures ought to be diligently carried out, as they afford the only probability of saving the life of the patient.

[1] *London Journal of Medicine*, 1852, p. 60.

Dr. Murchison has recorded two cases in which suppuration of the liver was present with gastric ulcer. In one, an abscess was also found in the pancreas connected with the sore; in the other, the disease was accompanied by pneumonia.[1] In the former, it seems probable that the suppuration in the liver was the result of the ulcer; but in the latter there is more room for doubt, for there was also an abscess of the shoulder. We have before seen how liable persons affected with pneumonia or liver disease are to ulceration of the stomach; and as no signs of inflammation could be discovered around the ulcer, and the signs of pneumonia were present when the patient was first seen, it is possible that the ulcer was the effect, and not the cause of the disease in the other organs.

The symptoms of chronic gastric ulcer are always better marked than those of the more acute forms of the disease. The appearance of the patient is peculiar; the face is pale, and has a look of suffering and distress. There is loss of flesh; and languor and want of strength are usually complained of. Pain is the most striking and constant symptom. In the earlier stages of the complaint it is often described merely as an uneasiness affecting the lower part of the chest, and occurring only during digestion; but it gradually becomes more constant and more severe. It varies very much in its character: in some patients it is sharp; in others it is described as a gnawing or burning sensation. It is generally referred to the epigastrium, but occasionally it affects the umbilical

[1] Transactions of the Pathological Society, vol. xvii. p. 146.

region, or the lower part of the chest. Pain in the back, a little to the left of the spine, is usually present along with that in the epigastrium, and in many cases an increase of suffering in the one site is accompanied with a diminution of that in the other.

Pain is a very common symptom in a variety of the complaints of the stomach, but that arising from chronic ulceration is usually characterized by its being referred to one spot, and by its extreme severity. It is also increased when constant; or, otherwise, it is excited by all food, especially by such as is of an indigestible character. The suffering commences from five minutes to a quarter of an hour after a meal, and continues whilst digestion is going on, or until vomiting relieves the stomach of its contents. It is aggravated by hot liquids, and in most cases by stimulants and spices. It is also increased by motion, and relieved by rest after food.

As was first pointed out by Dr. Osborne, the site of the ulcer may be often diagnosed from the position of the body in which the patient finds most relief. Ordinarily, we may observe him lying on his face, or bending across a chair, whilst digestion is in progress; as in this way he removes the acid contents from the usual seat of the ulcer. In other cases, the left or right side is chosen, according to the end of the organ affected.

Cases have been recorded where the pain has exhibited a periodical character, a circumstance very apt to mislead the practitioner in his diagnosis.

It sometimes happens that the pain entirely—perhaps suddenly—subsides during treatment, and the patient imagines that the complaint has been

cured. A slight indiscretion in diet, however, soon convinces him of his mistake.

Occasionally there is an absence of pain, and a large ulcer may exist without its being suspected. The following case is an instance of this.

Case 30.—I was requested to visit a man about sixty years of age, who seemed rapidly sinking. I could obtain very little history of his disease, except that he had been a drunkard and out of health for some time, and that the bowels had been constipated for a week. He had not complained of any pain in the stomach, but looked pale and thin. As milder purgatives had produced no action of the bowels, a dose of croton oil was prescribed. He had no sooner taken the pill than he experienced violent burning pain in the epigastrium, which continued until his death a few days afterwards. On *post-mortem* examination, a large ulcer with thickened edges was found in the stomach, the other organs being healthy.

I have observed an absence of pain in other cases of gastric ulceration, especially in old persons; and careful consideration should therefore be given to all the symptoms of a case before the practitioner concludes that this disease is not present.

Tenderness on pressure is seldom absent in cases of chronic gastric ulcer. It is not the general soreness so common in chronic gastritis, but is often so localised that the tender spot can be covered with the finger end. It is usually situated in the epigastrium, but it may be in the left hypochondrium, or in the umbilical region. Frequently, when pain is

absent, it is induced by the pressure of the finger, and continues for some time afterwards. The examination should be made both before and after a meal, if the indications are doubtful.

Vomiting is not such a constant accompaniment of ulceration of the stomach as pain and tenderness. It commonly comes on some time after food, and relieves the patient from the sufferings induced by digestion.

The vomited matters are usually sour, but occasionally they are tasteless. In some the vomiting comes on when the stomach is empty, and large quantities of thick ropy mucus are discharged.

This symptom is generally less rebellious to treatment than the pain, and it may be absent for many months at a time, although no favourable change has taken place in the condition of the ulcer.

Nausea is very commonly complained of both before and after food, but it is so often met with in all disorders of the digestive organs that it is of little value in the diagnosis of ulceration.

Hæmatemesis is the most important symptom in indicating the existence of gastric ulcer. In all probability there are but few cases in which bleeding does not take place to some extent, although it may be insufficient to excite vomiting. Whenever the disease is suspected, the alvine evacuations should be frequently and carefully examined.

In order however to arrive at a correct conclusion in any case in which vomiting of blood has occurred, we must be careful before referring it to ulceration to ascertain that other conditions, which are also liable to produce it, are not present.

It may arise from a blood-disease such as purpura or scurvy. A very fluid condition of the blood seems at times to take place without any apparent cause. These cases occur chiefly in females about the period when the catamenia usually cease.

Case 31.—A stout and healthy looking woman about fifty years of age, had for two or three years been affected with an ulcer of the leg, which resisted various methods of treatment, but ultimately healed. Shortly afterwards she was attacked with bleeding from the nose of so severe a character, as to necessitate plugging of the nostrils. When this was arrested, however, uterine flooding came on, which was again followed by severe hæmatemesis. She sank under these repeated bleedings, and on a *post-mortem* examination, no structural change could be found in any organ of the body. The stomach was pale and healthy, and without any trace of ulceration.

Vomiting of blood may be vicarious of the menstrual discharge. This has been doubted by many authors, because it is in persons suffering from irregular menstruation that we so often find gastric ulcer. The objection cannot apply however to those who experience this symptom during pregnancy. A lady about thirty-five years of age, who had no children, and had never suffered from dyspeptic symptoms, was suddenly attacked during the night with vomiting of a large quantity of dark clotted blood. She was much exhausted by the hæmorrhage, but presented no symptoms indicating disorder of the stomach. The next catamenial period passed without

the usual discharge, and she was confined of a healthy child within nine months of the hæmatemesis.

Another lady was under my care who had vomiting of blood during two of her pregnancies without any symptoms of gastric ulcer.

Hæmatemesis may also arise from congestion of the portal system produced by diseased liver or heart, or it may be connected with a morbid condition of the spleen, or with a waxy or amyloid degeneration of the smaller vessels of the stomach and intestines.[1] In these cases we have the general and physical signs of the accompanying diseases to guide us in our diagnosis of the source of the hæmorrhage.

The bowels are usually much confined in cases of ulceration of the stomach, but sometimes the patient suffers from diarrhœa.

The tongue is generally clean, and presents no indication of the disease in the stomach.

It is evident that no one of the above symptoms by itself is sufficient to enable us to diagnose the presence of gastric ulceration; but by taking into consideration the whole history of the case we can generally arrive at a correct conclusion. In a patient who suffers from severe epigastric pain increased shortly after food and accompanied by tenderness on pressure, and in whom there has been either hæmatemesis or tar-coloured stools, without there being any other disease likely to account for the hæmorrhage, we may be tolerably certain that ulceration of the stomach is present.

There are, however, exceptions to all general rules,

[1] Dr. Wilson Fox, *Medico-Chirurgical Review*, 1865, and Dr. G. Stewart, *ibid.*, January, 1868.

and both Andral and Abercrombie have recorded cases where there had been vomiting of blood or coffee-ground materials along with symptoms indicating ulceration, but in which no such affection could be discovered after death.

If there be so much uncertainty at times in ascertaining the existence of chronic ulcer of the stomach, may we not expect some assistance from the use of physical means of diagnosis? Unfortunately few attempts have been hitherto made to ascertain how far we can rely upon such methods of examination in this disease. The following remarks are brought forward as suggestions only; inasmuch as I have not had sufficient opportunity of verifying the diagnoses by *post-mortem* examinations.

It has been already mentioned that the shape of the stomach is altered in a considerable number of cases of ulceration. If, therefore, in a person exhibiting the symptoms of ulcer, we should find the organ very small in size, or abnormal in its shape or position, we might obtain confirmatory evidence of the existence of this complaint. It must be remembered however, that the physical signs must be accompanied by the symptoms of the disease; for the stomach may present considerable alterations in shape and position, without being in a morbid condition.

It has been calculated that adhesions to some of the neighbouring organs occur in 40 per cent. of the cases of ulcer, and this is in all probability below the truth as regards the chronic form of the complaint.

Adhesions not only alter the shape of the organ, but they also embarrass or prevent its movements. We might consequently expect that the movements of

the organ during respiration would be chiefly hindered by adhesions of its anterior surface, and that in such cases also the stomach, being prevented from collapsing, would occupy the same position both when full and empty. A middle-aged female, who presented all the symptoms of ulceration, complained of a fixed pain at the lower border of the left costal cartilages, where there was also considerable tenderness upon pressure. When examined by "auscultatory percussion," the lower edge of the stomach seemed to curve up to this point, and the organ retained its position both before and after food. The vomited matters contained large quantities of sarcinæ. As the symptoms and history of the case indicated ulceration, and the sarcinæ showed that the food was long retained in the stomach, I concluded from the alteration in the shape of the organ, that the disease had arisen rather from adhesions accompanying ulceration than simple dilatation.

A man who had long suffered from the ordinary symptoms of gastric ulcer, complained of a fixed pain and tenderness in the umbilical region. The stomach was found to reach down to this part, and did not vary in size when examined before and after food. This case I surmised was one of gastric ulcer of the greater curvature, in which adhesions had taken place to the colon and neighbouring parts. The most frequent site for adhesions is at the posterior surface, and the attachment is usually to the pancreas. When this is the case, the movements during respiration will be probably unaffected, but there will not be the natural difference in size between the full and empty conditions of the organ. When the attach-

ment is to the liver the pyloric end is often tucked up beneath that organ, and we may then find a considerable difference in the size of its larger, and not of its smaller end before and after food. In many cases of this kind the rectus muscle is in a constant state of tension, so that it is impossible to relax the abdominal parietes. The pain is also referred to the part of the epigastrium where the dull sound of the liver can be discovered by percussion, and deep pressure at this spot increases the patient's suffering.

The changes taking place around a chronic ulcer render it improbable that we should find in the vomited matters similar particles of the mucous membrane to those that may be met with in the more acute forms of the disease. But it has been shown that chronic tubular gastritis is generally present around the edges of the sore, and I have discovered numerous casts of the tubes in such cases. These may represent either parts or the whole length of the glands; they are opaque, and seem to be composed of cells and granular matter. Although they may occur in cases of chronic gastritis arising from any cause, I have never met with such perfect specimens as in cases of chronic ulcer.

The extension of the ulceration is usually slow around its margins, but often much more rapid at its base. This is especially the case where it has involved the liver or pancreas, and in the following instance I found what appeared to be particles of pancreatic tissue in the vomited matters.

Case 32.—A man about fifty years of age had been

ill for two or three years, with constant pain at the epigastrium, tenderness on pressure, frequent vomiting, and other symptoms of chronic gastric ulcer. I directed him to drink warm water early in the morning, in order to excite vomiting. The fluid rejected from the stomach presented a considerable amount of mucus and numerous tube casts. With these there were a number of pieces of white matter, which, microscopically examined, had the appearance of ramifying tubes, intermixed with a tissue obscurely cellular. Every part of the substance was loaded with long needle-shaped crystals, exactly like what we so often meet with in pancreatic tissue.[1] Taking into account the symptoms of the case, and the improbability of any other structure of a like character presenting itself, I came to the conclusion that the patient was affected with a chronic gastric ulcer that had involved the pancreas.

The above conclusion is strengthened by the following interesting case, in which ulceration of the duodenum and disease of the pancreas were suspected during life from the appearance of portions of the gland passed by stool, and where the correctness of the opinion was verified by *post-mortem* examination. The case was kindly furnished me by Dr. Marston.

Case 33. — "Captain H——, a well-nourished, healthy-looking man, above the middle age, of light complexion. I saw this case in consultation with Dr. St. John Edwards, of Malta. The previous history was shortly this :—He had occasionally been subject to fits of an epileptiform character, and had

[1] See page 176.

suffered on many occasions from severe attacks of dyspepsia and colicky pain. The attacks came on about four or five hours after a meal, and were attended with acidity, intense heartburn, and violent pain in the stomach. Sometimes he vomited, and this gave him relief; and he particularly remarked that the pain was much increased by lying on his back, and relieved by leaning forward or lying on the stomach. To lie down after a meal was a sure method, he said, of producing these symptoms.

"Shortly before I saw him, he had been one night seized with an attack after supper, and after suffering from distressing heartburn, he vomited and became collapsed. He slowly recovered from the collapse, but his stomach rejected all food with heartburn and pain. His stools were of a very peculiar character; they were loose, yeasty, and one of them contained small portions of some glandular substance. On examination with the microscope the glandular character was very clearly seen, and we tried to account for it on the supposition that he must have eaten some sweetbread. Numerous minute acicular or needle-shaped crystals were likewise discovered.

"There was very little fever: the pulse was small and very frequent, and he complained of tenderness on pressure over the site of the stomach and duodenum. He was fed by enemata of brandy and beef-tea: ice with opium and bismuth only being given by the mouth. One night, after taking a little chicken-broth, he was seized with violent pain, vomited the broth with a little blood, became collapsed, and died in a few hours.

"The *post-mortem* examination revealed extensive

disease of the mesenteric glands, which were filled with cheesy and calcareous deposits; the pancreas was softened, sodden, and doughy; it broke down on pressure, and pieces of stroma could be readily torn away with lobules of the gland attached; the reflexions of the peritoneum at this part were inflamed. The gland itself appeared to be in the condition of a moist slough. The transverse duodenum was carefully opened, and three small ulcers were discovered on its posterior aspect. One of these was of the size of a fourpenny piece, and projecting through it was a piece of pancreas which separated very readily on slight pressure, and fell within the bowel. No disease of importance existed in the other organs.

"It was clear in this case that the acid chyme, on its entry into the duodenum, came into contact with the pancreas through the openings of these ulcers, and there can be no reasonable doubt that the glandular substance found in the stool during life was a minute piece of softened pancreas. On microscopical examination, the appearances were identical; moreover, the juice expressed from the pancreas and the fluid in the duodenum contained innumerable small acicular crystals, exactly resembling those found during life.[1] The *post-mortem* examination was made very carefully in the presence of four medical men, and we were unanimous as to the exact state of the parts and of the origin of the substance found in the stools which had so puzzled us during his life. The crystals were, in all probability, lactate of lime and margarine. The explanation of his heartburn, pain, and acidity in

[1] See pp. 176 and 336.

the recumbent posture, was readily afforded by a reference to the site of the duodenal ulceration."

We should be careful not to excite vomiting unnecessarily in persons affected with gastric ulceration. The patient whose case is before related had been almost entirely relieved of his pain, but immediately after the vomiting it returned, and persisted until he ceased his attendance at the hospital. Still more serious were the results of an emetic in a person under the care of Andral; the coats of the stomach gave way, and fatal peritonitis was produced. In the majority of cases vomiting takes place spontaneously, and by giving clear liquids—such as thin arrow-root, or well-strained beef-tea—as food, the desired information as to the mucous membrane can be obtained.

There are few diseases that, in their treatment, require so much perseverance and self-denial on the part of the patient as gastric ulcer. Relapses are continually taking place, and appear to undo all the good that has been already effected. Nevertheless, patience and care will always relieve, and very frequently will produce a permanent cure.

Whenever the pain is very severe and is attended by frequent vomiting, we may be sure that inflammation is going on either around the edges or at the base of the ulcer; and the case must be treated as one of subacute gastritis.

Perfect rest should be enjoined, and the patient should confine himself for a few days either to the bed or sofa, on the same principle that the surgeon insists upon a person suffering from an inflamed ulcer of the leg keeping himself in the recumbent position.

The application of a few leeches to the epigastrium is sometimes required; but, generally, the use of poultices, turpentine fomentations, or dry cupping, is alone necessary.

The main point in the treatment is the regulation of the diet. Sometimes, as when dangerous hæmatemesis has previously followed a severe attack of pain, a recurrence of this symptom should be met by a temporary withdrawal of all food, and the patient ought to be supported by enemata. Usually, small quantities of farinaceous food may be given at frequent intervals. Arrow-root, milk, and gruel agree best. The frequent use of ice often relieves the pain, and obviates the necessity of larger quantities of liquids.

If the bowels are confined, it is better to relieve them by enemata, and, as a general rule, severe purging should be avoided.

The best medicines for the more acute stages of the complaint are morphia and hydrocyanic acid. They may be combined with small doses of nitrate of potass, or, if there be much acidity, with magnesia or soda.

As the pain lessens in intensity and duration, and the vomiting becomes more rare, the treatment must be gradually changed. The patient may be allowed to take more exercise, although much exertion of body or mind should still be forbidden. Blisters applied to the epigastrium generally alleviate the suffering, and the raw surface may frequently be dressed with morphia with advantage. Rather more liberal quantities of food may be given, but the patient should be still restricted to liquids. Beef-tea, chicken-broth,

and various kinds of farinaceous food may be used. It is when the pain is moderate that the use of bismuth and lime-water is most beneficial. The bismuth is best given in combination with magnesia and morphia; the lime-water with milk.

As the case continues to improve, tonics may be employed. If the urine deposits phosphates, the mineral acids with calumba may be prescribed. Sooner or later the practitioner will find it necessary to have recourse to iron. The best plan is to begin with the citrate or the reduced iron, and gradually to increase the strength of the preparation as improvement goes on. The sulphate generally answers very well. I have often prescribed the nitrate or oxide of silver, and the salts of copper or zinc, with very good results. Indeed, ulcer of the stomach forms no exception to the rule, that we can generally obtain by a variation in the form of a tonic, advantages that are not to be derived from a long continuance of the same drug.

In the more acute periods of the complaint, stimulants should be avoided, but as the patient progresses towards recovery great benefit often follows the use of a little brandy or pale sherry.

In some very obstinate cases, I have known a residence abroad effectual, after all treatment at home had failed to afford relief. In all probability it is not the mere change of air, but the variety of scene and diet and the mental rest, that are the beneficial agents in these cases.

CHAPTER XVI.

CANCER OF THE STOMACH.

We have seen that the stomach is liable to degenerative changes, and we have also found that there is much reason for believing that anatomical alterations of this kind precede the development of cancer. It can therefore excite no surprise that this organ is peculiarly prone to malignant disease. The portions of it most liable to degenerations, viz., the pyloric end and the smaller curvature, are also those most frequently attacked with cancer. As life advances, so does the tendency to malignant disease of this organ increase. It is rarely met with below thirty-five years of age; whilst among old persons a considerable number fall victims to it.

The stomach is liable to be affected by all the varieties of malignant disease, viz., scirrhus, encephaloid, colloid, and villous cancer. Of these, the first is by far the most frequent; the last is rarely met with. It is, I think, doubtful whether colloid disease should not be classed as a form of degeneration; but as it gives rise to local symptoms similar to those of cancer, and as it is equally incurable, it will be more convenient to consider it along with the others.

Cancer usually commences in the sub-mucous tissue, and gradually spreads into the muscular layer below, and into the mucous membrane above. Although it presents the same anatomical characters as when it invades other structures, it will be found that alterations simultaneously occur in various parts of the organ, without a knowledge of which, the phenomena presented by the disease are difficult of explanation.

If we carefully examine a section of the pylorus in the neighbourhood of a scirrhous tumour, we may observe that the muscular layer has a different appearance from that which it usually presents. This change is more evident on microscopic examination. We see, even where the cancer cells cannot be discerned, that the muscular fibre cells are in course of degeneration. Here and there a few may be teazed out, but they are thin, long, wrinkled, and scarcely present any appearance of nuclei; the remainder have been replaced by fibrous tissue. As we approach the limits of the cancer, a few nucleated cells may be observed scattered in the degenerated structure.

The blood-vessels of and around the affected part are, as in cancer of other organs, generally diseased. In scirrhus we usually find the coats thickened; a condition which probably tends to the production of the ulceration that so generally accompanies the malady.

The mucous membrane over the seat of the cancer is, I believe, always diseased long before any breach of the surface has occurred. It becomes firmly fixed to the sub-mucous tissue; the solitary glands are enlarged; sometimes they are empty, in other cases

they contain only a few layers of cells and nuclei. The tubes are matted together, and so altered as scarcely to be distinguished from each other. The blood-vessels are enlarged and thickened.

As the cancer cells make their appearance, ulceration takes place, and either a cavity with hard thickened walls and base is produced, or fungoid projections shoot out, according to the form of the disease with which the part has been attacked.

We have seen that in the majority of cases of scirrhus of the breast the mucous membrane of the stomach presents very striking anatomical and physiological changes; and it will be therefore necessary to inquire what is its condition when the organ itself is the seat of malignant disease. In order to show that similar alterations take place in cancer of the stomach, I have added the following observations:—

Observation 37.—A man died of cancer of the stomach, omentum, and liver. The stomach was firmly attached to the pancreas, and at this part there was an ulceration an inch and a half in diameter. In some portions of the mucous membrane the gastric tubes could be separated, but in others they were matted together and greatly diseased.

Observation 38.—Cancer of the stomach in a male. There was a large ulcer at the pyloric end, the edges of which were hard and round. The whole mucous membrane was diseased. In some places the remains of the gastric tubes could be discovered as bulbs filled with cells and granular matters, but in many parts

even these had disappeared, and the structure seemed to be composed only of cells, fibres, and nuclei.

Observation 39.—A woman, aged forty-seven, died of cancer of the stomach and uterus. The stomach was remarkably small and contracted, and an ulcer the size of a crown piece was situated along its smaller curvature, near the pylorus. In its cardiac region the mucous membrane was a confused mass of nuclei, cells, and fibres. The only remains of the gastric tubes were in the shape of bulbs. The solitary glands were greatly enlarged, and filled with cells and nuclei. In the middle region the tubes were matted together, and showed considerable thickening of the basement membrane; the solitary glands of this part were also enlarged. Everywhere the muscular coat was greatly hypertrophied, and was firmly united to the connective tissue above and below it.

Observation 40.—A woman, between forty and fifty years of age, died of cancer of the stomach. In the smaller curvature was an ulcer of the size of a half-crown piece. The neighbouring glands and the omentum were cancerous, and there were also deposits in the liver. In every part of the stomach the mucous membrane was diseased. The tubes were much altered in shape, loaded at their bulbous ends with fatty epithelium, and surrounded with very thick basement membranes. They everywhere adhered firmly to each other.

Observation 41.—A man died of cancer of the stomach. The middle region was occupied by a

large irregular ulcer, which had perforated the colon. In every part of the organ the mucous membrane was diseased. In the greater portion the gastric tubes were scarcely discernible. The solitary glands were much enlarged, and filled with cells and nuclei.

These are all the cases of cancer of the stomach in which my notes enable me to speak positively as to the state of the mucous membrane; but my impression is, that it will be found in a morbid condition whenever any part of the organ is affected with scirrhus. Lebert is the only author who, as far as I am aware, has directed attention to this diseased state of the mucous membrane. He does not appear to have examined it with the microscope, but observes that he has found it injected, softened, or thickened at a distance from the seat of the malignant disease. He also remarks that the mucous membrane of the cul-de-sac of the organ is often affected when the cancer does not extend beyond the pylorus.

It is of importance to contrast this state of the structures of the stomach in cancer with that which coexists with simple ulceration. It has been already shown that where a chronic ulcer is present, the mucous membrane presents only chronic inflammation, or patches of degeneration in its immediate neighbourhood. But in cancer the muscular layer is often seriously injured, and the glandular structure is usually to a greater or less extent destroyed. It is therefore, I believe, to these anatomical alterations in the muscular and motor apparatus of the organ that we must look in order to explain many of the more important differences between the symptoms and results of cancerous and simple ulcers.

Some authors have affirmed that cancerous ulcerations of the stomach occasionally heal in the same way that similar sores do in other parts of the body. Although this may be the case, it has never fallen to my lot to meet with an instance of the kind. Cancer of the stomach runs so rapid a course, and is so generally accompanied by degeneration of the glandular structure of the organ, that there is but little hope of obtaining anything beyond an alleviation of the symptoms by medical treatment.

The most frequent termination of such cases is by exhaustion of the strength of the patient; affording in this respect a striking contrast to the constitutional effects of simple gastric ulcer. Dr. Brinton calculated that only one per cent. of those affected with non-malignant ulcerations sank from this cause; and Dittrich reckoned this mode of termination at three per cent. This difference between cancerous and simple ulcers is not to be explained by the greater severity of the local symptoms in the former; for the loss of strength in gastric cancer usually precedes the vomiting and pain; and in some cases death has ensued from exhaustion where neither vomiting nor hæmorrhage has been noticed. We must, therefore, refer it to the coexisting degenerations and to the spread of the malignant disease to other organs.

Where, as in the case of the softer forms of cancer, the mucous membrane of the stomach may not present much alteration, we shall probably find that the heart has undergone fatty degeneration. I have not proved this supposition to be correct in any instance of encephaloid disease of the stomach, but I have found it in similar affections of other parts of the digestive canal.

In the majority of cases of malignant disease of the stomach other parts are apt to be affected secondarily. This took place according to the observations of Lebert in thirty-two out of fifty-seven cases. The organs most frequently attacked were the liver, peritoneum, lymphatic glands, the pancreas, lungs, pleuræ, and the bones.

Adhesions are very frequently found between a cancerous stomach and the neighbouring organs. As far as we can draw any inference from the small number in which the position of the attachment is exactly specified, a considerable difference appears to exist between cancerous and simple ulceration in regard to the organ to which the stomach becomes united. Jaksch gives twenty-two cases of adhesion in simple ulceration; and of these fifteen were to the pancreas, five to the liver, one involved the mesentery, and one the spleen. Lebert quotes twenty cases of adhesions of cancerous stomachs, of which number only seven were to the pancreas, twelve to the liver, and one to the colon.

The shape of the stomach is often altered by malignant disease. The amount of contraction is much greater than in the case of simple ulceration, and the distortion is consequently more manifest; thus I have seen the organ reduced to the size and the shape of the colon. Dilatation is a very frequent consequence of a cancerous tumour affecting the pylorus. Lebert found that in one-quarter of his cases this change had been produced, and in some the cardiac region was dilated and the opposite end reduced in size.

The profuse vomitings of blood which are such common results of simple ulceration are rare in

malignant disease. Occasionally death occurs from this cause, but generally the bleeding takes the form of a constant oozing from the surface of the ulcer. This perhaps arises from the condition of the blood-vessels. In cancerous tumours, and especially in scirrhus, it is a common circumstance to find the arteries blocked up with fibrine during the enlargement of the ulcer, by which severe hæmorrhage is prevented. But in this, as in other malignant sores, the smaller vessels are constantly discharging a bloody-coloured fluid, so that the rapid exhaustion of the patient is partly due to the drain upon his strength.

The danger of death from perforation is much less in cancer than in other forms of ulceration. This arises partly from the more intimate adhesions to the neighbouring organs, and partly from the large amount of new tissue generated at the edges and base of malignant growths.

There is probably no other disease of an equally fatal character in which there is such a variety in the character and number of the symptoms as is presented by different cases of cancer of the stomach. In one they may be so strongly marked that it is almost impossible to mistake the nature of the complaint; in another, it is only by the most careful consideration of the whole of them that the existence of such a formidable malady can be inferred. In like manner each separate symptom presents the greatest variety in different cases, so that we are unable to fix upon any one as certainly indicating the disease.

Pain is one of the most general symptoms of malignant disease of the stomach. The suffering, when

the malady has existed for some time, is usually very severe. By some it is described as a constant gnawing; others compare it to a burning sensation, or complain of a shooting pain, as if a knife were being thrust through the part. It is generally most intense at the epigastrium or behind the sternum, but it is occasionally referred to the hypochondriac regions, to the back, or to various parts of the abdomen. As a general rule, the fixed dorsal pain is less frequently remarked than in simple chronic ulceration; which may be explained by the pancreas being less frequently involved in the disease. The pain is often almost constant, and although it is aggravated by food, it is usually much less so than in simple ulceration. In the earlier stages the suffering is less intense; often only an occasional shooting pain is complained of, or it is present as a dull uneasiness or sense of fulness after eating; but as the disease progresses, it gradually augments both in severity and constancy.

It should be borne in mind that pain is not an invariable accompaniment of cancer. I have found it absent even where a tumour of considerable size could be felt. Every now and then we meet with cases which proceed to a fatal termination without the patient having ever uttered a complaint of suffering, and it is not at all infrequent for the pain felt in the early stages to disappear a few days before death. As a general rule, the pain in cancer differs from that of non-malignant ulceration in its gradual increase, in its greater severity in the later stages, in its being less influenced by the process of digestion, and in its often affecting parts of the abdomen at a distance from the seat of the malady.

There is usually a certain amount of tenderness in the epigastric or hypochondriac regions, less localized however than in chronic ulcer, and also much less acute. When a tumour can be felt it may be but little sensitive to pressure. It is, I think, probable, that when great tenderness at the epigastrium is present, it arises rather from the coexisting gastritis than from the original disease.

A sensation of nausea is another of the earlier and commonest symptoms of gastric cancer. It often remains during the whole illness; in other cases, it ceases when vomiting becomes frequent.

Vomiting after meals is a very common symptom of the complaint. In the outset of the disease it occurs only occasionally, perhaps after the ingestion of some more than ordinarily indigestible substance. As time goes on it becomes more frequent, so that it may take place every day, or frequently in the twenty-four hours. As in non-malignant ulceration, every meal may be rejected, or the patient may himself provoke the vomiting for the purpose of obtaining relief from the suffering attendant on digestion.

The frequency and character of this symptom vary greatly, according to the seat of the disease. If the cardiac orifice be affected we generally observe that the patient swallows with difficulty, or complains that the food sticks at the lower part of the gullet, whence it is shortly returned by a sudden effort. If, on the other hand, the pylorus be implicated, the rejection of the meal takes place some hours after eating. When the organ is enlarged, the vomiting partakes of the characters of that which accompanies dilata-

tion; that is, it occurs some time after a meal, and a large quantity of fermenting liquid is discharged at once. Where the organ is thickened and contracted as a consequence of cancer, there is seldom much power to retain food for any length of time.

There is no doubt, also, that the state of the mucous membrane greatly determines the frequency and severity of the vomiting. Thus, if gastritis be present, there is often so much irritability that it is easily provoked.

If the vomiting commence early and be frequently repeated, it is usually a sign that the progress of the disease will be rapid; for the strength of the patient becomes exhausted by the combined want of nourishment and the constitutional effects of the malady.

Sometimes vomiting is never present during the whole course of the complaint. In Lebert's experience this took place in about six cases out of forty-two. It seems to be most generally absent when the orifices of the stomach are unaffected. It is not uncommon for the vomiting to cease towards the termination of the disease, probably from the exhaustion of the nervous system.

The earliest symptoms are to be found in the changes that take place in the power of digestion. It is stated by Lebert, that in most of those who fall victims to gastric cancer the digestion has been previously good. Flatulence is at first alone complained of, coming on occasionally, but gradually increasing, and the food causes a sense of weight at the stomach. Frequent eructations take place, and the attention of the patient is soon attracted to his decreased powers of digestion.

The tongue is seldom furred; generally, it remains clean through the whole course of the disease, or shows only a slight coating towards the back.

The appetite is early impaired. At first it is more fastidious than usual, or the patient loses his relish for particular kinds of food. In the later stages it is often either completely lost, or replaced by a loathing of every kind of nourishment. This does not depend upon the pain or vomiting, for a gradual decrease of appetite may be noticed when scarcely any other symptom is present to call attention to the digestion. There can be but little doubt that it arises from the early and complete degeneration of the secreting tubes, to which I have before alluded as generally accompanying the disease.

The bowels are almost always confined in the earlier stages, as in other serious disorders of the stomach. As time goes on occasional attacks of relaxation occur, and towards the termination of the case diarrhœa commonly sets in. The stools in the later stages are often of a dark pitchy colour from an admixture of blood.

Thirst is generally complained of, but the pulse is quiet. The skin is cool, and as a rule, unless other organs are affected by inflammation, there is a total absence of fever. Even in the earlier stages the skin is often unusually cold, and this feebleness of the circulation is readily explained, when we remember how frequently cancer is associated with degenerative changes in the heart, and how often the blood itself shows evidences of being altered.

The aspect of the patient is in itself indicative of the serious nature of the malady with which he is

affected. The countenance is anxious and expressive of suffering, and the skin is pale, often of a yellowish hue. This appearance of the skin, though noticed by many authors as peculiar to cancer, is often simulated by non-malignant ulcers, where nutrition has been seriously affected. The chief ground of distinction between these two classes of cases is, that in cancer the change in the colour of the skin often precedes, whilst in simple ulcer it always follows the development of the symptoms of the local disorder.

Emaciation is almost always present, and is usually very marked at the time of death, unless the patient is cut off at a very early stage by some other co-existing disease. It is a symptom that soon attracts the attention of the patient and his friends, and often is the first indication to the practitioner of the serious nature of the malady with which he has to deal.

Whilst the general symptoms alone cannot be relied upon, they sufficiently point out the disease when the accompanying physical signs are taken into account.

The same methods should be used for ascertaining the size and situation of the stomach as were recommended in the case of chronic ulcerations. In one quarter of the whole number of cases the organ is dilated, and this condition we can usually detect. In others, it undergoes contraction and alteration in shape, or its natural movements are limited by adhesions to the neighbouring parts.

The most important evidence of cancer is the existence of a tumour in or near the region of the stomach. This can be usually discovered by careful examination. Sometimes we are unable to detect it

in the earlier stages of the disease, but as emaciation proceeds it becomes perceptible to the touch.

The probability of detecting the tumour varies greatly with its position. If it occupy the cardiac portion alone, it may be so deep as to elude our search, especially when the organ is bound down by adhesions. When situated at or near the pylorus, it is so much more superficial that we seldom fail to ascertain its presence.

In the majority of cases the tumour is situated in the epigastrium, to the right of the median line. In others it approaches the umbilicus, or may be detected in the hypochondriac regions. It must be borne in mind that when the stomach is dilated the pylorus may be dragged from its normal position, unless it has been attached to some of the neighbouring parts. Should this displacement have occurred, the tumour may be found at a distance from its original place, and before we decide as to the part affected by the cancer, we must take into account both the history of the case and the shape and size of the stomach.

The tumour is generally irregular in form, but varies greatly in bulk, not only from the size it may itself have attained, but also from the extent to which the neighbouring organs may have become implicated. Thus, if the pancreas, the omentum, or the liver be involved, the swelling is much larger than when the disease is confined to the stomach. Its surface is usually uneven, and it feels hard and stony to the touch. There is seldom much tenderness, and if pain be produced by pressure, it is not of an acute character.

I need scarcely repeat my previous remarks as to the necessity for care and patience when engaged in the examination of suspected abdominal tumours. The patient should be placed in different positions, and the colon should, if necessary, be previously emptied by a purgative or an enema.

In some cases ascites, produced by secondary disease of the liver, deprives us of all chance of finding a tumour. In others, especially in the earlier periods of the disease, the epigastrium seems full both to the eye and hand, but no distinct evidence as to the cause of the fulness can be obtained by examination. Under such circumstances, palpation and percussion should be frequently and carefully repeated, until we can satisfy ourselves as to the exact nature of the complaint.

We might anticipate that in a disease so beset with difficulty in its diagnosis at an early stage, the examination of the matters vomited by the patient would be of value. There is no doubt that such is the case, and in all probability future researches will increase our knowledge upon this point.

In the earlier stages, before ulceration has begun, there is often a regurgitation of a sour liquid; sometimes a glairy or ropy mucus is rejected, whilst in other cases it is bitter, as if from an admixture of bile. Fluids presenting similar characters are often vomited in chronic gastritis and in simple ulcer, so that from these alone no definite opinion can be formed.

When cancerous ulceration has taken place, there is almost always an admixture of blood in the matters vomited. As previously stated, profuse hæmorrhage

is comparatively rare, but the fluid rejected from the stomach generally contains flakes of blood, is of a black colour, or resembles coffee-grounds. Slight bleedings also may occur in simple ulceration, but they are not so constant as in cancer. When, therefore, we find the matters vomited by a patient *continuously* mixed with blood, we have good reason to suspect malignant ulceration.

There are certain circumstances which act as predisposing causes of cancer of the stomach, and these are well worthy of attention.

We have before seen that simple ulcerations of the stomach are more frequent in the female than in the male in the proportion of two to one; but the male is more subject, on the contrary, to malignant disease of this organ.

Non-malignant ulcers, as before stated, may occur at any period of life, but cancer of the stomach rarely commences before the degenerative processes of middle age come into operation. Out of one hundred and fifty-nine cases analysed by Lebert, only one was below thirty; seven took place between thirty and thirty-five; five between thirty-five and forty; and all the rest at subsequent ages.

In simple ulceration the disease is often of very slow progress, and the general health may be but little affected, even in cases of some years' duration. In cancer the symptoms rapidly increase in severity, and in the majority of instances death takes place within a year from the commencement of the complaint. Out of thirty cases given by Lebert, two died within three months; seven within six months; and eighteen within one year.

In the earlier stages of gastric cancer the real nature of the disease is often overlooked. There may be neither pain nor vomiting, and yet the fatal malady may be progressing. We have already seen that in the majority of cases of dyspepsia occurring in middle life some symptoms of indigestion have been before experienced, or its approach has been slow and gradual; but of those attacked by cancer there has generally been no previous affection of the stomach, and the symptoms, when once they have made their appearance, rapidly and steadily increase in severity.

If the patient, in addition to the dyspepsia, present a very rapid loss of strength and flesh, we have reason for suspecting that malignant disease is present. In ordinary indigestion, feebleness and emaciation are the results of the affection of the stomach, but in cancer they often precede the dyspepsia, or at any rate are out of proportion to its duration and severity.

In the later stages, the chief difficulty in diagnosis is to distinguish the simple from the malignant ulcer. If the patient be a female under thirty-five years of age, and the disease has lasted for some time without any great diminution of flesh or strength, the presumption is in favour of her being affected with chronic ulcer; but if, on the other hand, the patient be between forty and fifty, if the symptoms rapidly increase in severity and are not relieved by treatment, if the general health be seriously affected, and if the vomited matters have the characters of those furnished by a cancerous sore, we have every reason for believing that malignant disease is present. In any case, a most careful examination should be made, both of the abdomen and of the matters vomited.

If there be discovered in the epigastrium a tumour of an irregular shape and hard uneven surface, cancer is present; or, if without the existence of a distinct tumour, there should be a general fulness of the epigastrium, and the fluid rejected from the stomach frequently contain flakes of blood, or be of a coffee-ground colour, we must arrive at the same conclusion. On the other hand, if we can find no swelling, and the pain be chiefly confined to the period when digestion is going on, and if the vomited fluid contain casts of the gastric tubes, or particles of any of the neighbouring organs, we may reasonably hope that the disease is not of a malignant character.

The treatment of cancer of the stomach can be only palliative, but we have the power, nevertheless, of greatly relieving the sufferings of the patient.

The diet should be similar to that recommended for non-malignant ulceration. It should be given frequently and in small quantities. Liquids are to be preferred, such as milk or animal broths, or they may be thickened with farinaceous substances. Stimulants are generally required, and of these brandy agrees best. It should be well diluted or mixed with ice, in case the vomiting is troublesome.

Digestion may be much assisted by means of pepsin and dilute mineral acids. Preparations of iron, such as the carbonate, are often of great value, both in improving the general health, and probably also, by acting as a sedative to the mucous membrane.

As the two most prominent symptoms are pain and vomiting, these usually require especial attention. The pain is best relieved by preparations of

opium, which must be given in considerable doses. When it assumes a neuralgic character, small blisters or applications of belladonna are useful. The injection of morphia beneath the skin is by far the best method of giving relief in such cases. It should be frequently repeated, and its employment may be often entrusted to the patient or his friends. Other sedatives, such as conium, belladonna, and hyoscyamus, have been greatly recommended, but according to my experience they are much inferior to opium.

The treatment of the vomiting depends entirely upon the pathological condition from which it arises. If the matters rejected be clear, watery, or acid, the use of lime water and other alkaline remedies is indicated. If they consist of mucus, astringents, such as bismuth, oxide of silver, kino or tannic acid may be given with or without opium, as the circumstances of the case require. When signs of decomposition are present, creasote or charcoal will be found useful. If the symptoms indicate dilatation of the stomach, the treatment must be directed to the relief of this condition.

APPENDIX.

STATISTICAL INQUIRY INTO THE CAUSES OF DYSPEPSIA.

It is very desirable that we should know how far the different circumstances under which men are placed operate in the production of disease, and which are more particularly injurious. With the view of ascertaining this as regards indigestion, I carefully inquired into the habits of about five hundred persons who came under my care. Half of this number were dyspeptics; the other half had never suffered from any disorder of the digestive organs. All the subjects of this inquiry belonged to the "working classes," and care was taken to avoid "leading questions."

The dyspeptics were grouped according to the form of the disease from which they suffered. The cases included under the head of "painful digestion," were all affected with subacute gastritis. Those who complained of *constant* acidity were considered as labouring under chronic congestion or inflammation of the mucous membrane, and were consequently separated from those who applied for medical relief on account of the symptoms of "weak digestion." [1]

[1] See p. 135.

NOTE A.

THE INFLUENCE OF AGE UPON THE PRODUCTION OF INDIGESTION.

I have alluded to the changes which take place in the symptoms of indigestion, and shown that the same individual may suffer from different forms of the complaint at different periods of his life. The proportions per cent. of those who at each age presented themselves for medical relief were as follows :—

TABLE 1.

	YEARS OF AGE.					
	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	Abve.60.
Numbers per cent. who applied for medical relief on account of indigestion	per cent. 6	per cent. 27	per cent. 30	per cent. 20	per cent. 12	per cent. 5

From this Table we might be led to conclude that the greatest liability to dyspepsia is in the middle period of life, and that the chances of suffering from it are about equal between ten and twenty years of age and above sixty. The great difference in the numbers alive during the above periods must, however, be taken into account; and, when this is done, we find the probability of any person becoming affected with indigestion varies greatly at different periods of life.

I have assumed that 236 persons may be at one time suffering from indigestion out of every 1000 of the population; and I have calculated, in the next Table, the numbers per cent. who, on that supposition, would at each separate age be affected with it. It must be understood that 236 is an arbitrary number, and simply taken for convenience.[1]

[1] The number 236 was adopted because I had ascertained the ages of so many dyspeptics, and 1000 as being a convenient number on which to calculate the proportion of persons living at different ages. The Table was formed as follows: Of the 236, there were fourteen between the ages of 10 and 20, and twelve above 60 years of age. But as the proportional numbers in 1000 persons living in Newcastle-upon-Tyne (to which town and its neighbourhood the patients belonged) in 1861 were 196 at the former, and 55 at the latter period of life, the percentages of dyspeptics at these periods were 7 and 21 respectively.

TABLE 2.

	YEARS OF AGE.					
	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	Abve. 60.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Numbers per cent. of the population who at each age would suffer from indigestion.....	7	33	50	46	44	21

Instead of being equally liable to indigestion, persons above sixty years of age are here seen to be three times more so than when they were below twenty. The greatest tendency to suffer from the complaint is manifested between thirty and forty years of age; it decreases between forty and sixty; and is still smaller between twenty and thirty.

We might expect that age and its accompanying influences would produce a decided effect, not only in exciting indigestion in those otherwise liable to the disorder, but also in the development of the primary attacks of the disease.

In the next Table, the numbers per cent. are grouped according to the form of the disorder with which the indigestion was ushered in.

TABLE 3.

	YEARS OF AGE.					
	Under 20	20 to 30.	30 to 40.	40 to 50.	50 to 60.	Abve. 60.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Numbers per cent. of persons first affected with weak digestion	11	13	14	8	4	4
Ditto ditto with acidity....	4	17	11	6	0	0
Ditto ditto painful digestion	3	5	0	1	0	0
Ditto ditto bilious attacks..	4	1	0	0	0	0
Totals[1].....	21	35	24	14	3	3

In nearly one quarter of the whole number of cases, the first symptoms of indigestion were experienced below twenty years of age, and one-tenth remembered to have suffered from the complaint when under ten. After fifty it is rare to have persons affected for the first

[1] Decimals have been avoided; and the numbers in the sub-divisions, consequently, will not be found to agree with the totals.

time; and the period when there is the greatest tendency to its production is at the completion of the growth of the body—viz., from twenty to thirty years of age.

The contrast between weak digestion and acidity is strongly marked. Thus, the liability to the latter rises from 4 per cent. before twenty, to 17 per cent. between twenty and thirty; falls after thirty to 11 per cent., and between forty and fifty to 6 per cent.; whilst 11 per cent. of those under twenty years of age exhibit primary symptoms of the former; and it is not until fifty that any very marked change in the liability takes place.

Painful digestion seems limited, as a primary disorder, to those under thirty years of age. Almost all those who afterwards were affected with this form of the complaint had experienced symptoms of dyspepsia at an early period of life.

Bilious attacks not uncommonly usher in dyspepsia, but they seem chiefly confined, as a primary disorder, to persons under twenty years of age.

In the next Table the cases are grouped according to the form of the disease for which the patients applied for relief, and to that from which they originally commenced to suffer. The figures under each heading are calculated on the supposition that 236 were dyspeptics out of every 1000 of the population.

TABLE 4.

CASES TREATED FOR WEAK DIGESTION.

No. of cases in 1,000 persons which commenced as	YEARS OF AGE.									
	Under 20.		20 to 30.		30 to 40.		40 to 50.		Above 50.	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
Weak digestion	2·4	4·8	4·4	6·6	6·7	4·5	5·4	3·2	2·1	2·1
Acidity	·9	·6	3·3	1·1	2·2	1·5	2·1	0	0	0
Painful digestion	·2	2·2	1·1	2·7	0	0	0	0	0	0
Bilious attacks	1·1	2·4	0	0	0	0	0	0	0	0
CASES TREATED FOR ACIDITY.										
Weak digestion	·6	3·3	1·6	1·1	1·5	1·5	0	0	0	0
Acidity	2·2	·9	8·8	3·8	3·0	4·5	2·1	2·1	0	0
Painful digestion ...	0	1·3	0	1·1	0	0	0	·1	0	0
Bilious attacks	·2	·9	0	1·1	0	0	0	0	0	0

I have drawn attention to the fact that feeble digestion may be the result of previous inflammation of the mucous membrane. The above Table shows how frequently this occurs, and how much less liable acidity is to arise from a weakened state of the stomach. The proportion of cases of painful digestion and of bilious attacks is also seen to be much greater as a prelude to weak digestion than to acidity, especially amongst the males, who are least liable to these forms of the disorder. Amongst those labouring under symptoms of feeble digestion, the greater number under twenty years of age have commenced with symptoms of that disorder only; and when ushered in by inflammatory symptoms, these have been connected with painful digestion or bilious attacks. Between twenty and thirty years of age, the greater number of primary attacks of an inflammatory nature showed themselves amongst the males by acidity; but in the other sex they were accompanied by pain. This tendency for weak digestion to commence with inflammation is, as might be expected, of longer continuance amongst the stronger sex. Thus, whilst it ceased entirely at forty amongst females, it was still found in the males at fifty; and even then in much greater proportion than at any age above thirty in the other sex.

Of cases of acidity, only a small number commenced with symptoms of feeble digestion; the majority being of inflammatory origin. Under twenty, the females, as in the former Table, commonly first suffered from bilious attacks and painful digestion; whilst in the males acidity showed itself generally from the first. It is more rare to find acidity appear for the first time after forty; but when it does so, it is almost always in patients who have not previously been affected with other forms of dyspepsia.

NOTE B.

THE HEREDITARY TRANSMISSION OF INDIGESTION.

The transmission of indigestion from the parent to the child is a subject which requires careful investigation, not only on account of its important practical bearings, but also from the little attention hitherto bestowed upon it. There is greater difficulty in obtaining trustworthy evidence respecting indigestion than other more fatal

diseases; inasmuch as a parent may have suffered from it without the children being aware of the circumstance. I have been, therefore, very careful only to count those cases in which either the patient could speak decidedly as to his parents' health, or in which I was personally acquainted with the family history.

I have recorded the state of health of the parents of 360 persons, 147 of whom had never suffered from indigestion, whilst the remainder were subject to it. Of the healthy, only 12 per cent. of their parents were dyspeptics; but of the other class, no less than 45 per cent. were the children of those liable to this complaint. No stronger evidence can be required to prove that persons may transmit an imperfect state of the digestive organs to their offspring.

The development of indigestion, in those hereditarily predisposed to it, seems to vary with the sex. Thus, of 99 males who had continued healthy, 16 per cent. were born of dyspeptic parents; but of 48 females who had never suffered from the complaint, only 4 per cent. could trace a similar tendency. The probable explanation of this is, that the more favourable habits of the men enabled them to resist an influence which the circumstances of the other sex tended to bring into operation.

The mother appears to be more liable to transmit indigestion than the father, in the proportion of 3 to 1; and this proportion remains nearly the same with respect to both the male and female children.

In the following Table, only those cases are classified in which the patients were able to state clearly the age at which the disease commenced.

TABLE 5.

	YEARS OF AGE.			
	Under 10	10 to 20.	20 to 30.	Abve. 30.
Number of persons hereditarily predisposed to indigestion	10	46	33	10
Number of persons not predisposed hereditarily	8	36	28	42
Percentage of persons hereditarily predisposed	55	56	54	19

It appears from this Table, that up to thirty years of age the hereditary predisposition acts with about equal force; but that after that time its influence rapidly decreases. It is rare for persons who

are able to trace the complaint to their parents to be attacked for the first time in old age; although it is common enough for those hereditarily predisposed to it to suffer in early life, and, after recovery for many years, again to become subject to their former malady as the strength of their constitution declines.

The effects of hereditary transmission vary at different ages, according to the sex, as shown in the following Table :—

TABLE 6.

	DYSPEPSIA COMMENCING AT			
	10 years of age.	20 years of age.	30 years of age.	Above 30 years.
Percentages of males hereditarily predisposed	66	63	64	7
Percentages of females hereditarily predisposed	50	53	39	33

The health of the parents seems to influence the males before thirty years of age more than the other sex ; whilst, after that period, family predisposition shows itself four times more frequently in the females. The most probable explanation is, that the majority of males are as much exposed to the exciting causes of indigestion before thirty as after that period ; whereas, in the case of females, many of the circumstances tending to produce it—such as repeated pregnancies and long-continued nursing—do not come into general operation until a later time of life.

The power of hereditary transmission varies according to the form in which the indigestion first commences ; thus, where it began with symptoms of weak digestion, only 42 per cent. were born of persons subject to dyspepsia ; when it first appeared as acidity, there were 46 per cent. ; when the first attack was characterized by severe pain, the numbers were 52 per cent. ; whilst of those whose first ailments were bilious attacks, 64 per cent. were children of persons liable to gastric disorder.

The same rule is here seen as in those analysed as regards the influence of sex—namely, the more strongly the predisposition existed, the earlier was its tendency exhibited, and the earlier was the age at which its influence disappeared. These facts are shown in the following Table :—

TABLE 7.

	YEARS OF AGE.		
	Under 20	20 to 30.	Above 30
Numbers per cent. of cases of hereditary transmission, commencing as weak digestion	56	50	17
Numbers per cent. of cases of hereditary transmission, commencing with acidity	57	54	26
Numbers per cent. of cases of hereditary transmission, commencing as painful digestion	46	62	
Numbers per cent. of cases of hereditary transmission, commencing with bilious attacks	65	50	

This Table shows that, in those whose complaint commenced as a liability to bilious attacks, and in whom the hereditary predisposition was the strongest, not one of the patients was attacked after thirty years of age ; and in those beginning with painful digestion, who stand next in their inherited tendency, although a smaller number were affected under twenty years of age, the tendency to the disorder ceased at thirty years. In the forms of indigestion which are more liable to appear for the first time at a later period of life, the liability to transmission from the parent to the child seems to be smaller.

NOTE C.

THE EFFECTS OF ANXIETY OF MIND UPON THE DIGESTION.

The labouring classes are but little fitted to display the injurious effects of mental care. The necessity for constant exertion to procure their daily food prevents them from dwelling so much upon sorrow, as is the case amongst the wealthier classes ; and the nature of their engagements does not subject them to those embarrassments which bear down the energies and prostrate the mental powers of those engaged in the turmoil of mercantile or professional life.

I have in the next Table brought together all the cases of healthy and dyspeptic persons, dividing them according as they stated them-

selves to have been a prey to care or otherwise. The causes producing anxiety were very various: thus, their illness was ascribed by some to the loss of relatives and friends; by others, to cares incident to trade, to loss of property and employment, or to deep religious convictions.

TABLE 8.

	HEALTHY PERSONS.			DYSPEPTICS.		
	Males.	Females.	Totals.	Males.	Females.	Totals.
Numbers per cent. of persons who had been subjected to anxiety of mind	14	22	16	33	41	38
Numbers per cent. of persons who had not been subjected to anxiety of mind	86	78	84	67	59	62

The influence of mental anxiety is sufficiently obvious from this Table. Amongst those free from indigestion, only 16 per cent. had been subject to it; while 38 per cent. had been affected in this way amongst the dyspeptics.

The females seem to have suffered more than the males; and it requires but little acquaintance with the circumstances of the poor to understand this. The wife participates in any misfortune affecting her husband; and her more sedentary habits deprive her of opportunities of mitigating the physical effects of grief by exercise or change of thought. If unmarried, the woman has cares to which, on account of his greater power of earning his livelihood, the single man is not liable.

In the next Table I have analysed the cases according to their ages.

TABLE 9.

	20 to 60 years of age.		Above 60 yrs. of age.	
	Healthy.	Dyspeptics.	Healthy.	Dyspeptics.
Numbers per cent. who had been subjected to anxiety of mind	19	42	16	22
Numbers per cent. who had not been subjected to anxiety of mind.....	81	58	84	78

The results are what we might have anticipated. Under twenty years of age, excessive care does not seem to have been experienced;

but in middle life, when the anxieties of men are greatest, the most injurious effects have been produced. In old age, although there have been 6 per cent. more cases in the first line amongst the dyspeptics, it is evident that anxiety produces a slighter influence on the digestive powers.

I have next grouped the cases of indigestion by themselves, dividing them according to the form of the disease presented for treatment.

TABLE 10.

	Weak Digestion.	Acidity.	Painful Digestion.
Numbers per cent. of persons subjected to anxiety	56	42	2
Numbers per cent. of persons not subjected to anxiety	49	40	11

The general result of anxiety appears to be—the increase of 7 per cent. amongst those suffering from feeble digestion, and the diminution of 9 per cent. of those affected with painful dyspepsia. These conclusions are, however, modified when the cases are divided according to sex, as in the following Table :—

TABLE 11.

	MALES.			FEMALES.		
	Weak Digestn.	Acidity.	Painful Digestn.	Weak Digestn.	Acidity.	Painful Digestn.
Numbers per cent. of persons subjected to anxiety	52	46	2	58	40	2
Numbers per cent. of persons not subjected to anxiety.	53	47	0	46	36	18

The almost perfect accordance in the proportions amongst the males and the great difference in the other sex are worthy of remark.

The worst cases of weak digestion in persons belonging to the middle and higher classes of society are to be found amongst those who have suffered from great mental anxiety. In many, these symptoms have been preceded by acidity ; but the inflammatory state

seldom continues for any length of time, and it is succeeded by an enfeebled condition, both of the digestive and of the nervous systems.

In the next Table the females only are classified, as we before found so little difference amongst the other sex.

TABLE 12.

	20 to 40 years of age.			Above 40 years of age.		
	Weak Digestn.	Acidity.	Painful Digestn.	Weak Digestn.	Acidity.	Painful Digestn.
Numbers per cent. of females subject to anxiety	47	53	0	70	27	3
Numbers per cent. of females not subject to anxiety	54	26	20	43	50	7

From twenty to forty, the effect of anxiety appears to be the production of acidity; above this period, the cases of weak digestion greatly preponderate.

NOTE D.

THE INFLUENCE OF THE CONDITION OF THE BODY ON DIGESTION.

It has been stated that the form of dyspepsia from which a person may suffer seems dependent upon the state of his general health, and that, whilst acidity is often connected with a plethorio condition, painful digestion commonly attacks those who are of spare habit.

The figures in the following Tables give only an approximation to the truth, as it is impossible to define exactly the amount of fat which entitles a person to be called stout; nor would many persons, perhaps, agree in what ought to be described as an average or moderate degree of stoutness. I have, however, been careful to admit none into the classes of thin and fat respectively who were not decidedly so; so that any conclusions which may be drawn will be trustworthy, if confined to the cases under these heads.

TABLE 13.

	Weak Digestn.	Acidity.	Painful Digestn.
Numbers per cent. of spare persons	60	30	10
Numbers per cent. of moderately stout persons ..	53	40	7
Numbers per cent. of stout persons	45	51	4

The numbers of those affected with weak digestion are 60 per cent. in the spare; 53 per cent. in the moderately stout; and amongst those of a grosser habit of body, they are 45 per cent.

Acidity was most common amongst those loaded with fat; of the thin, only 30 per cent. were affected with it. Painful digestion is chiefly met with in spare persons, and is extremely rare in those of a full habit of body. As we before found that weak digestion was much more frequently preceded by acidity than the reverse, so we may reasonably infer that, if the first symptoms of each attack had been ascertained, the proportions of stout persons affected with acidity would have been much greater than appears in the foregoing Table. The next figures are intended to show that these conclusions are not altered, when the cases are divided according to the sex of the persons affected.

TABLE 14.

	Weak digestion.		Acidity		Painful Digestion.	
	Males.	Females.	Males.	Females.	Males.	Females.
Numbers per cent. of spare persons	65	57	35	27	0	16
Numbers per cent. of moderately stout persons ..	55	52	43	38	2	10
Numbers per cent. of stout persons	45	46	55	49	0	5

The difference here seems chiefly to arise from the greater liability of the female to painful digestion; and the more spare the person, the greater is the probability of her being attacked by the disorder. In both sexes the predisposition to weak digestion seems to increase with the spareness of the body.

Amongst the thin, the only remarkable difference presented at different ages is, their greater liability under twenty to painful

digestion. This is found to arise from the fact that persons under twenty chiefly suffer from a form of subacute gastritis connected with debility, whilst later in life the symptoms are more often due to serious organic disease.

The tendency of acidity to manifest itself in persons of a plethoric habit of body increases according to the age; it is comparatively rare to find this symptom strongly marked after fifty, unless in individuals loaded with fat.

In the next Table, the cases are arranged according to the form of dyspepsia with which they were at first attacked. As most of the cases of painful digestion applied for relief shortly after the commencement of the complaint, I have excluded them, and confined the figures to those who came under treatment for feeble digestion or acidity. The majority of these had for many years been liable to disorder of the stomach, and seemed, therefore, to offer a surer basis for such conclusions as might present themselves for consideration.

TABLE 15.

	COMMENCED AS			
	Weak Digestn.	Acidity.	Painful Digestn.	Bilious Attacks.
Numbers per cent. of spare persons	40	22	32	6
Numbers per cnt. of moderately stout persons	41	35	17	7
Numbers per cent. of stout persons	34	51	7	8

The very small proportion of stout and the large number of spare persons whose illness had commenced with painful digestion are worthy of remark. As none of these came under treatment for this form of dyspepsia, there seems no possibility of error in the conclusions, that either painful digestion so injures the stomach as to leave the body thin and insufficiently nourished afterwards, or that the same form of constitution which in after life is associated with a spare habit of body, is liable at an earlier age to develope subacute inflammation of the mucous membrane.

From other observations, I believe the former of these explanations to be correct; and that of all the forms of dyspepsia this is the most lasting in its results. Of the total number of those whose illness was ushered in by "bilious attacks," only sixteen were thin in later life.

This is quite in accordance with daily observations, and I believe

that bilious attacks are, in many cases, a means taken by nature for eliminating an excess of waste matters; and that when they cease, unless the habits of the individual are at the same time changed, such attacks are often replaced by gout, asthma, acidity, eruptions on the skin, or some other form of disease.

NOTE E.

THE EFFECTS OF IMPERFECT MASTICATION ON THE DIGESTION.

We have no distinct test by which to estimate the results produced by rapid eating; for it is clear that one person may eat twice as quickly as another, and yet may more thoroughly masticate in doing so. Many of the working classes contract a habit of eating quickly without being aware of it, on account of the short time allowed for their meals. The only way, therefore, was to register each person's opinion as to the quickness of his own eating; trusting that on the whole we might obtain useful evidence.

I have in the following Table classified the cases under the heads of healthy persons and dyspeptics, and also divided them according to their sex, and into the two divisions of quick and moderately quick eaters.

TABLE 16.

	HEALTHY PERSONS.			DYSPEPTICS.		
	Males.	Females.	Totals.	Males.	Females.	Totals.
Numbers per cent. of persons stating themselves to be quick eaters.....	25	7	19	61	44	51
Numbers per cent. of persons stating themselves not to be in the habit of eating rapidly	75	93	81	39	56	49

The evidence afforded by this Table is very strong as to the ill effects of imperfect mastication, only 19 per cent. amongst the healthy having been addicted to the practice; but 51 per cent of those liable to deranged digestion had been in the habit of eating rapidly. The females are, as we might expect, more influenced by it

than the other sex ; for whilst among the healthy, only 7 per cent. of these are in the first line, the proportion rises amongst the dyspeptics to nearly one-half of the whole number examined.

I have in the next Table tested the effects of rapid mastication as modified by age.

TABLE 17.

	YEARS OF AGE.							
	Under 20.		20 to 30.		30 to 60.		Above 60.	
	Healthy	Dyspt.	Healthy	Dyspt.	Healthy	Dyspt.	Healthy	Dyspt.
Numbers per cent. of quick eaters	13	45	23	53	23	51	16	50
Numbers per cent. of those not eating quickly	87	55	77	47	77	49	84	50

It is evident from the above figures that rapid mastication tends to produce indigestion at all ages. This is the case in both sexes, although I did not think it necessary to give them separately.

Under twenty and above sixty years of age, the relative proportions of quick eaters have been greater amongst the dyspeptics than during middle life.

In the next Table the cases are arranged according as the patients stated themselves to be fast eaters or otherwise, and they are further divided according to the form of indigestion for which they came under treatment.

TABLE 18.

	Weak Digestion.	Acidity.	Painful Digestion.
Numbers per cent. of quick eaters	52	42	6
Numbers per cent. of persons not eating quickly	52	39	9

As the numbers are so evenly balanced, it is plain there is no evidence that the practice of eating quickly has tended to induce one form of indigestion more than another. The proportion of cases of painful digestion is smaller in the first line than in the second; which seems to show that this complaint does not often orginiate from the practice of imperfect mastication.

This conclusion is further supported by the fact, that most of these

cases occur at the time of life when the teeth are quite capable of performing their duty.

There is but little difference in the relative proportions of weak and inflammatory indigestion under forty years of age, when the teeth are usually serviceable, and the stomach vigorous; but as old age creeps on, we find that the lumps of food which result from imperfect mastication tend to inflame the mucous membrane.

In this way it probably arises, that the proportions of acidity are 8 per cent., and of painful digestion 3 per cent. higher amongst the quick than the slow eaters.

NOTE F.

EFFECTS OF TOBACCO SMOKING.

In no part of these inquiries have I been more surprised than at the results obtained respecting the smoking of tobacco. I expected no difficulty in proving the noxious influence of this habit on the digestion; and it was only after carefully interrogating the facts in every way that I abandoned my preconceived opinion.

As will be shortly seen, the males alone afford a fair opportunity for comparison; and I have in this first Table contrasted the weekly amounts of tobacco smoked by men subject to dyspepsia, and by those who have never suffered from that disorder.

TABLE 19.

	Healthy.	Dyspeptics.
Numbers per cent. of healthy and dyspeptic persons who abstained from tobacco	38	35
Numbers per cent. of healthy and dyspeptic persons who smoked less than one ounce of tobacco in each week	16	18
Numbers per cent. of healthy and dyspeptic persons who smoked between one and two ounces of tobacco in each week	18	17
Numbers per cent. of healthy and dyspeptic persons who smoked between two and three ounces of tobacco in each week	6	6
Numbers per cent. of healthy and dyspeptic persons who smoked three ounces and upwards of tobacco in each week	21	24

It will be seen from this Table that there is such a close correspondence in the quantities smoked by dyspeptics and healthy persons, that we are unable to obtain any evidence in favour of the opinion that smoking is peculiarly injurious to the stomach. There are doubtless cases in which ill effects are experienced, but on the whole, the results of the examination are remarkably similar in each class of cases.

Taking all those of each class who smoked less than three ounces in the week, the numbers are exactly alike—namely, 41 per cent.; but there are 3 per cent. in favour of the abstainers amongst the healthy, and 3 per cent. more of the excessive smokers have been amongst the dyspeptics. We shall perhaps see the similarity more plainly by looking at the figures in a different manner.

Of 80 persons who were abstainers from tobacco, 39 were subject to dyspepsia, and 41 were healthy; 89 smoked less than three ounces a week, and of these 45 were dyspeptics, and 44 healthy; of 48 who smoked three ounces and upwards, 26 were subject to indigestion, and 22 had never suffered from the disorder.

But as there is a difference in favour of the abstainers, it will be necessary to ascertain what form of indigestion is most liable to be induced by this habit.

There is a general impression that smokers are peculiarly subject to feeble digestion, arising from the waste of the saliva. I have constructed the next Table in order to ascertain the truth of this opinion.

TABLE 20.

	Weak Digestn.	Acidity.	Painful Digestn.
Numbers per cent. of persons not smoking at all..	52	38	10
Numbers per cent. of persons smoking less than one ounce in the week.....	58	42	
Numbers per cent. of persons smoking between one and two ounces in the week	50	50	
Numbers per cent. of persons smoking between two and three ounces in the week	60	40	
Numbers per cent. of persons smoking three ounces and upwards in the week	46	54	

The great irregularity in these numbers is very striking, and on adding all the smokers together, the proportions of weak digestion and inflammatory dyspepsia are nearly the same as amongst those not

in the habit of using tobacco—viz., 54 per cent. and 46 per cent. Very few of the females confessed to the habits of smoking, excepting those liable to excessive flatulence. The use of tobacco is a popular and very efficacious remedy for this symptom—a sufficient proof that it possesses stimulating properties on the stomach.

The stimulating effects are shown in the next Table, which is composed entirely of males.

TABLE 21.

	Weak Digestion.	Acidity.
Numbers per cent. of males who did not smoke at all	64	36
Numbers per cent. of males smoking less than three ounces in the week	53	47
Numbers per cent. of males smoking more than three ounces in the week	46	54

It will be remarked that amongst persons not addicted to tobacco, the proportion of feeble digestion to acidity are as 64 to 36; that in those smoking moderately, the numbers are reduced to 53 and 47; whereas amongst excessive smokers, the tendency is rather in favour of inflammatory than of the feeble form of indigestion. On inquiry of numerous patients who have indulged in the practice to excess, I have found heartburn the only symptom of gastric disorder that seemed to arise from the habit.

In the next Table are grouped the cases according to age; those under twenty years of age being omitted on account of the small number who were habitual smokers.

TABLE 22.

	20 to 40 yrs. of age.		Above 40 years.	
	Weak Digestn.	Acidity.	Weak Digestn.	Acidity.
Numbers per cent. of males who did not smoke at all	47	53	90	10
Numbers per cent. of males who smoked less than three ounces in the week	50	50	61	39
Numbers per cent. of males who smoked more than three ounces in the week	47	53	43	57

If we are to judge by this Table, the effects of smoking are but

little felt during the middle period of life, as the proportion of cases of weak digestion to acidity is the same amongst the non-smokers as among those addicted to excessive indulgence in tobacco. When the digestion becomes enfeebled by age, a marked difference is observed; the amount of weak digestion being very great amongst those who do not smoke, the proportions lessening with those who use it in moderation; whilst amongst such as have employed it to excess, there are more affected with inflammatory dyspepsia than with the other form of the disease.

NOTE G.

THE USE AND ABUSE OF ALCOHOLIC STIMULANTS.

When we attempt to ascertain statistically the effects of fermented liquors, we experience difficulties which are not encountered in any other similar inquiry. Many persons who are "total abstainers" have been drunkards in earlier life, and are consequently sufferers from the results of their former excesses. Some, who are in the daily habit of taking a considerable quantity of stimulants, have become so accustomed to the practice, that they do not consider it as excess; whilst in others fits of drunkenness alternate with lengthened periods of sobriety.

In the following Table I have grouped the cases under five heads; dividing them also according to sex.

TABLE 23.

	HEALTHY PERSONS.			DYSPEPTICS.		
	Males.	Females.	Totals.	Males.	Females.	Totals.
Numbers per cent. of total abstainers	14	31	19	30	57	45
Numbers per cent. of drunkards	5	..	5	12	..	5
Numbers per cent. of persons using malt liquors alone and in moderation	30	65	40	33	35	34
Numbers per cent. of persons using spirits alone and in moderation	4	2	3	..	2	2
Numbers per cent. of persons using malt liquors and spirits in moderation	47	2	33	25	6	14

The first and most important point is the large proportion of those liable to dyspepsia who were total abstainers; 45 per cent. being of this class, whilst amongst the healthy there were only 19 per cent.

That this is not accidental is shown by its occurrence amongst both males and females, being greater in case of the latter. This accords with common observation, for it is in the enfeebled condition of the stomach, to which the weaker sex is more peculiarly liable, that the use of stimulants is most advantageous, both for the purposes of prevention and of cure.

None of the females pleaded guilty to excessive indulgence, so that our attention must be given on this point solely to the males. The proportion of drundards is twice as great amongst the dyspeptics as in the healthy; and if we could have arrived at perfectly truthful accounts on this matter, I have no doubt that the difference would have been much larger.

There are few questions more interesting, in a social point of view, than, whether the moderate use of alcohol is useful or pernicious. The arguments on both sides have been drawn from such a variety of sources, the conclusions have been so sweeping, and, above all, such an amount of extraneous considerations have been imported into the dispute, that it is difficult to speak impartially upon it. In the present instance, however, we have not to decide upon the general question, but only whether in those liable to dyspepsia, the moderate use of stimulants is for the most part useful or injurious.

Amongst the females, so little spirits seem to have been taken, that we may confine our attention to those taking malt liquors only, and here there can be no doubt as to their usefulness; 65 per cent. of the healthy, and only 35 per cent. of the dyspeptics, having been in the habit of employing them.

I suspect that part of this advantage consists in their substitution for tea and coffee; for I have constantly found that where malt liquors have not been used by females of middle age, an immoderate quantity of these beverages has been taken.

The most surprising fact in these figures is, that the proportion is greater in favour of the men taking both ale and spirits than of those using malt liquors only. This I am unable to explain, as it does not accord with the impressions I had formed.

Whatever conclusions different persons may draw from these figures, all must agree that wherever, from former habits, hereditary tendency or any other cause, a person is liable to be led into excess, it is far wiser to suffer any amount of dyspepsia than to subject himself to the innumerable evils resulting from drunkenness.

In the following Table I have attempted to investigate the value of ale and spirits in the different forms of dyspepsia.

TABLE 24.

	Feeble Digestn.	Acidity.	Painful Digestn.
Numbers per cent. of total abstainers	53	38	9
Numbers per cent. of drunkards.....	57	36	7
Numbers per cent. of persons using malt liquors alone in moderation.....	55	37	8
Numbers per cent. of persons using spirits alone in moderation	33	67	0
Numbers per cent. of persons using both ale and spirits in moderation	41	56	3

It will be observed that those addicted to intemperance have presented the largest number of cases of feeble digestion. The first effect of such stimulants as contain a large quantity of alcohol is to inflame the stomach; as seen in the proportion of 67 per cent. of cases of acidity to 33 per cent. of weak digestion in those who had taken spirits only. For the same reason, amongst persons in the habit of drinking both malt liquors and spirits, the numbers of inflammatory dyspepsia are 59 per cent. to 41 per cent. of cases of feeble digestion. But in drunkards the frequent attacks of inflammation leave structural defects in the mucous membrane of the stomach, and then the proportions are reversed, viz., 57 of the latter to 43 of the former.

NOTE H.

ON THE DEFICIENCY AND EXCESS OF ANIMAL FOOD.

An insufficient supply of animal food has been often stated to be a frequent cause of feeble digestion, and the following Tables are designed to test the correctness of this opinion.

Cases treated in hospital or pauper practice would have been more suitable for this investigation; for those here examined have been so well supplied that, of 437, only 29 persons were without a daily meal of animal food.

It must be remembered, that a sufficient amount of animal food

has not only an important bearing upon the health of the individual, but is also a proof of his possessing the necessaries and some of the luxuries of life. There are few voluntary vegetarians amongst the working classes; the exhaustion produced by their bodily labour induces them to recruit their strength with the most nutritive aliment they can procure, and they leave the practice of a purely vegetable diet to those whose leisure permits them to theorize upon the subject, and whose want of active employment enables them to dispense with more stimulating food.

In the following Table are grouped the cases of healthy and dyspeptic persons, according to the number of meals of animal food they were in the habit of consuming: —

TABLE 25.

	HEALTHY PERSONS.			DYSPEPTICS.		
	Males.	Females.	Totals.	Males.	Females.	Totals.
Numbers per cent. of persons using animal food occasionally	1	10	4	3	11	8
Numbers per cent. of persons using animal food only once a day	60	78	64	60	74	70
Numbers per cent of persons using animal food more than once a day ..	39	12	32	37	15	22

The proportion of persons taking meat only occasionally is, amongst the females, nearly the same in both groups; and although there is a smaller number of men who have been deprived of it amongst the healthy, the cases are so few, that no safe conclusion can be drawn from them.

Looking at the total results, we may observe that 10 per cent. more of those having meat oftener than once a day have been amongst the healthy. This must not necessarily be considered as arising from the abundance of animal food preventing disease; for the greater appetite may have been the result, and not the cause of good health. That this is probable may be seen by comparing each sex separately, when it will be remarked that the percentage of the males is greatest amongst the healthy, but that of the females amongst the dyspeptics.

In the next Table the cases are arranged according to the form of indigestion for which they came under treatment, and also according to the number of meals in which animal food was taken.

TABLE 26.

	Weak Digestn.	Acidity.	Painful Digestn.
Numbers per cent. of persons using animal food occasionally	70	26	4
Numbers per cent. of persons using animal food only once a day	49	42	9
Numbers per cent. of persons using animal food more than once a day	50	45	5

It will be remarked, that amongst those who have been supplied with a daily allowance of meat, the cases have been nearly equally divided between those affected with feeble digestion and those suffering from inflammatory affections of the stomach. In those who have been less plentifully fed, 70 per cent. have been affected with weakness of the digestion, and only 26 per cent. with acidity.

The proportion of patients troubled with painful digestion seems to have been augmented with a free supply of animal food. Although persons affected with this disorder are usually spare and weak, I have not generally found them in actual want.

It seems in opposition to former remarks, that the proportion of cases of acidity is not much increased in those who have had more than one daily meal of animal food, but the explanation is not perhaps difficult. The wages of the working classes do not permit their indulgence in an excessive amount of meat, and those, therefore, who seem to have partaken of it so freely have perhaps been in the habit of eating only small quantities at a time. The only exception to this is in the case of sailors, who often consume beef or pork two or three times a day, but the quality of the meat is so much impaired by salting, that the nourishment derived from it is comparatively small. The exertion they undergo is also so great, that a large amount of nutriment is required.

Sex does not seem to modify the influence of animal food, for amongst the males who partook of it only occasionally, 75 per cent. were affected with feeble digestion, and 25 per cent. with acidity; whilst amongst the females, the proportional numbers were 68 and 26 per cent.

The numbers are so small, that we cannot safely trust the results of an analysis, when they are divided according to age, but they seem to prove that the deprivation of animal food is most felt at the middle and most active period of life; the proportions of weak digestion and of acidity being, under forty years of age, at 77 and 25 per cent.; and above that age, 60 and 40 per cent.

NOTE I.

THE EXCESSIVE USE OF TEA AND COFFEE.

It is difficult to ascertain the limits beyond which the use of these beverages becomes excess.

They do not present any physiological action which arrests the attention, as in the case of alcoholic stimulants; nor are we able to ascertain, as I have attempted to do in the case of tobacco, the quantity by weight weekly consumed. I have therefore presumed, that when used twice a day, only a moderate quantity will be taken; but all who have been in the habit of employing one or both of them more frequently, I have considered as taking them in excess.

Amongst the healthy persons, only 10 per cent. were on this supposition given to excess; but of 276 dyspeptics, 26 per cent. were accustomed to take an undue quantity.

Of the healthy males only 9 per cent., and of the females 12 per cent., took them in excess; but of the former 22 per cent., and of the latter 27 per cent., exceeded twice a day amongst those liable to indigestion.

I have formed the following Table of the numbers per cent. of those addicted to excessive indulgence in tea and coffee separately, or combined, distinguishing the males from the females.

TABLE 27.

	HEALTHY PERSONS.			DYSPEPTICS.		
	Males.	Females.	Totals.	Males.	Females.	Totals.
Numbers per cent. of persons in the habit of taking tea alone more than twice a day	10	15	14	20	27	25
Numbers per cent. of persons taking coffee alone more than twice a day..	..	..	..	50	100	75
Numbers per cent. of persons taking both tea and coffee more than twice a day	8	8	8	21	28	25

None of those who have remained free from indigestion have been in the habit of taking coffee alone to excess; whilst 75 per cent. of the coffee-drinkers who have been subject to stomach complaints have

indulged in undue quantities. There were unfortunately only eleven in this list, so that we can draw no safe conclusion from them.

From a comparison of the first and third lines, we may conclude that less injury is inflicted on the digestion by excess of tea alone, than when the use of the two is combined; for although the percentages are alike in both cases amongst the dyspeptics, the excessive use of tea alone has been more general amongst the healthy.

In the next Table, the cases are grouped according to the moderate and excessive use, of either or both of these beverages, and are also divided according to the form of the disease for which they came under treatment.

TABLE 28.

	Weak Digestion.	Acidity.
Numbers per cent. of persons affected with weak digestion and acidity who have been moderate in their use of tea and coffee	53	47
Numbers per cent. of persons affected with weak digestion and acidity who have taken tea and coffee in excess	66	34

The greater effects of excess in weakening than in inflaming the stomach are shown by this Table; for whilst there are only 6 per cent. more of those taking tea and coffee twice a day amongst persons affected with feeble digestion, only one-third of the whole number of cases habituated to their excessive use have been treated for acidity.

It will be necessary to separate the beverages, in order to ascertain if these results depend upon the action of both of them. This has been done in the next Table.

TABLE 29.

	TEA ONLY.			TEA AND COFFEE.		
	Weak Digestn.	Acidity.	Painful Digestn.	Weak Digestn.	Acidity.	Painful Digestn.
Numbers per cent. of dyspeptic persons using tea and coffee moderately ..	50	43	7	49	46	5
Numbers per cent. of dyspeptic persons using tea and coffee to excess	58	35	7	65	24	10

It appears that the numbers of cases of feeble and of inflammatory indigestion are nearly equal in those using both in moderation; but amongst persons addicted to excess in either of them, there is a great preponderance in favour of a feeble condition of the stomach.

It will be remarked that the proportion is greatest in those in the habit of taking coffee, whereas the contrary might have been anticipated.

This is however explained by the fact, that in the greater number of cases recorded, the patients had found heartburn and other painful symptoms so constantly increased by the use of coffee, that they had abandoned it before applying for medical advice.

In the next Table the cases are divided according to sex.

TABLE 30.

	MALES.			FEMALES.		
	Weak Digestn.	Acidity.	Painful Digestn.	Weak Digestn.	Acidity.	Painful Digestn.
Numbers per cent. of dyspeptics using tea and coffee in moderation....	54	45	1	47	42	11
Numbers per cent. of dyspeptics using tea and coffee to excess	52	48	..	64	21	15

It is evident from this Table that the injurious effects of tea and coffee have been chiefly experienced by the females, for there is but little difference in the other sex in the proportions of those who employed them moderately and in excess. This may be explained on the supposition that their effects are counteracted amongst the males by other circumstances.

In order to ascertain at what age excess is most injurious, I divided the females according to the ages at which they applied for medical assistance.

The weakening effects of excess in tea and coffee upon the stomach would appear from this classification to be limited in the females to the middle period of life; the proportions of inflammatory indigestion being about the same, whether these beverages have been used in moderation or excess before and after that period. This

scarcely accords with other observations; for although their effects have appeared to me most strongly marked in persons from twenty to forty years old, yet in old age I have constantly met with cases in which the withdrawal of a part of the tea they had been in the habit of using has been attended with beneficial results.

NOTE K.

OUT-DOOR EXERCISE.

The beneficial effects of exercise on the digestion have been repeatedly noticed, and it is therefore necessary to examine this part of the subject.

In the following Table I have arranged the cases according to their sexes, dividing them also as they were healthy or dyspeptic.

TABLE 31.

	HEALTHY PERSONS.			DYSPEPTICS.		
	Males.	Females.	Totals.	Males.	Females.	Totals.
Numbers per cent. of persons stating themselves to be much out of doors	87	50	75	80	30	50
Numbers per cent. of persons confined much to the house	13	50	25	20	70	50

From this it appears, that of the healthy persons, 75 per cent. were much out of doors, whilst of those liable to dyspepsia, there were only 50 per cent. who enjoyed the same advantage.

Twenty per cent. more of the healthy females and only 7 per cent. more of males are in the first line, showing how great are the effects of exercise in warding off those disorders of the stomach, to which their other habits render the weaker sex peculiarly liable.

In the next Table, the cases are arranged so as to show the proportions per cent. of persons suffering from each variety of the complaint having sufficient exercise.

TABLE 32.

	Persons affected with Weak Digstn.			Persons affected with Acidity.			Persons affected with Painful Digestion.		
	Males	Fem.	Total	Males	Fem.	Total	Males	Fem.	Total
Numbers per cent. of persons using sufficient exercise	76	33	50	83	28	54	100	26	30
Numbers per cent. of persons not using sufficient exercise	24	67	50	17	72	46	..	74	70

Looking only at the totals of this Table, we might conclude that confinement to the house chiefly predisposed to the painful form of indigestion, but as the numbers in this group are all females and comparatively few, we cannot trust to such a deduction.

If we regard the males alone, we find that the greatest number of those confined to the house, applied for treatment, on account of the symptoms of feeble digestion.

This does not seem to be the case with females, for a larger proportion have had sufficient out-of-door employment amongst those treated for weak digestion than for acidity.

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