creased secretion, the distinction between the two classes of remedies is practically without a difference.

In former times sternutatories were much more commonly employed than they are at present, and the older writers were wont to lay great stress on the efficacy of these agents in the treatment of many apparently dissimilar conditions. Their use was recommended (1) to restore suspended respiration; (2) to effect the expulsion of foreign bodies from the air passages; (3) to increase the secretion of the nasal mucus or of the tears, or to expel accumulated mucus from the sinuses; (4) to awaken the action of the encephalon, restore sensibility, or excite uterine action. At the present time remedies of this class are out of fashion, and the only applications to which they are put are to excite sneezing for the sake of the pleasurable sensations that it causes, to increase the nasal secretions in the dry stage of coryza, and to clear the nasal passages and the adjacent sinuses of accumulated mucus. It is possible, however, if the present tendency of attributing many and diverse morbid conditions to the score of nasal reflexes should prevail, that future generations will restore the sternutatories to their ancient rank among the most prized of therapeutic agents.

The list of substances which have been employed at one time or another for the purposes above enumerated is as long as the moral law, and embraces nearly every drug which can be reduced to a fine powder, and even many gases, such as ammonia. To enumerate only a few of them, we have rosemary, lavender, peppermint, spearmint, white and black hellebore, stavesacre, mustard, euphorbium, betonica, ginger, iris, the peppers, calomel, bismuth, the alkaline carbonates, ipecac, tobacco, sweet marjoram, and a host of others. At present this list is practically restricted to half a dozen substances, the chief of which are tobacco, ipecac, veratrum album, quinine, camphor, and cubebs. Tobacco snuff is seldom employed now, except as a luxury, but the others just mentioned enter, one or all, in varying proportions, into the composition of the different catarrh snuffs prescribed by physicians or sold as proprietary remedies.—*From the first edition of the* HANDBOOK.

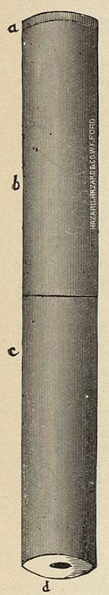

FIG. 4484.—Laënnec's Stethoscope. *a*, Plug; *b*, *c*, sections; *d*, aural extremity.

STETHOMETER. See *Respiration*.

STETHOSCOPES.—HISTORICAL SKETCH.—The credit of having invented the stethoscope has been variously attributed to Hippocrates, Bayle, Hook, Laënnec, and others. It is certain, however, that Laënnec was the first to make the idea practically useful. He hit upon it accidentally, by using a roll of paper which he was holding in his hand. His first instrument was a cylinder of paper compactly rolled and kept in shape by paste. The stethoscope subsequently adopted was a cylinder of wood an inch and a half in diameter and a foot long, perforated longitudinally by a bore three lines wide, and hollowed out into a funnel shape at one end to the depth of an inch and a half. A plug of wood fitted into this hollowed extremity with a perforation through it of the same diameter as that of the rest of the tube. This was used in auscultating heart sounds. It was discarded in stethoscopes made at a later date. The instrument was made in two sections for convenience of carrying. Piorry introduced a more slender instrument, with ivory cap, and later this was altered and made of wood only. An instrument in which the pectoral end was trumpet-shaped was devised by Dr. Williams, of London, about 1843. Since then a large number of monaural stethoscopes have been devised, and descriptions of them are to be found scattered through various medical publications. They have been made of metal, wood, hard rubber, papier-maché, and other materials, used either alone or in combination. Most of these stethoscopes are hollow, the bore of the tube being pretty uniform throughout, except at the pectoral extremity, where it is expanded and bell-shaped. Solid wooden stethoscopes have also been devised, but these are more especially useful in conveying percussion sounds when the method of auscultatory percussion is practised. The monaural instruments do not differ from one another in any important particular. A few are combination instruments, having a percussor and plexímeter attached, or a clinical thermometer, a female catheter, etc., hidden away in them. Among others who have devised monaural stethoscopes may be mentioned Quain, Stokes, Arnold, Barclay, Elliottson, Dobell, Loomis, Burrow, Clark, Cammann, and Ferguson.

FIG. 4485.—Plug of Laënnec's Stethoscope.

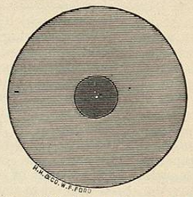

FIG. 4486.—Actual Diameter of Laënnec's Stethoscope.

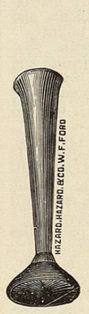

FIG. 4487.

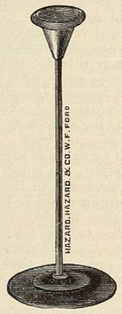

FIG. 4488.

FIG. 4489.

FIGS. 4487, 4488, AND 4489.—Monaural Stethoscopes.

M. Landouzy, of Paris, in 1850, constructed a stethoscope with a bell-shaped chest-piece, with a number of flexible tubes attached, by which several observers at once could auscultate. A single tube was designed for each person, but by the use of two tubes it became a binaural instrument. It was necessary to hold the tubes in the ears by the hands, and it was not found to be of much practical use. Many years previously Dr. Williams, of London, had been accustomed to use a binaural stethoscope made of two metal tubes attached to the bell of an ordinary stethoscope, and with flat ear-pieces. This conveyed sound with increased intensity, but was inflexible, clumsy, and awkward of application. The double stethoscope of Dr. Leared, shown in the Great International Exhibition of 1851, was a great improvement. It is made entirely of gutta-percha. The two tubes are attached at one extremity to a bell-shaped chest-piece, and at the other to ear-pieces similar to those of the monaural stethoscope. These tubes being separated and applied to the ears, exerted a certain amount of pressure by their own elasticity. To use this instrument ordinarily in practice, however, would require three hands, one for each ear-piece, and another to manage the pectoral end. In 1851 Dr. Marsh, of Cincinnati, patented a double stethoscope. This had a membrane stretching over its objective end, and two gum-elastic tubes leading from the chest-piece to the ears. In this instrument the ear-pieces were inconvenient, and the sounds conveyed were muffled and confused. These circumstances rendered it of little value.

FIG. 4490.—Intercostal Solid Cedar Stethoscope.

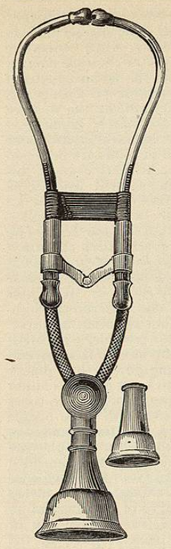

FIG. 4491.—Cammann's Binaural Stethoscope.

Dr. G. P. Cammann devised a binaural stethoscope which, after considerable labor and expense, was perfected in 1852. He was familiar with the instruments of Landouzy and Marsh, and his stethoscope, therefore, was not a new invention, but was, and is now, the best instrument of the kind devised. It is light, durable, easily carried, and a good conductor of sound. The attachment of a rim of soft rubber to the chest-piece, as devised by Dr. Snelling, is of advantage in some cases in applying it more closely to the inequalities of the chest. Oval chest-pieces are also made, which enable the end of the stethoscope to be pressed into the intercostal spaces. In most of the instruments now made the rubber band which served to draw the two tubes together is replaced by a spring. In the latest improvement the spring is placed in the screw which binds the tubes together (Fig. 4495).

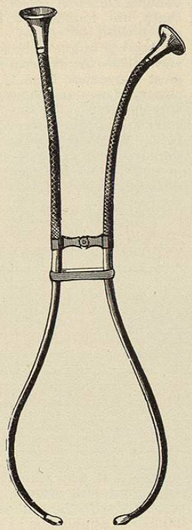

FIG. 4492.—Scott Alison's Differential Stethoscope.

A considerable variety of flexible stethoscopes are now in use. The credit of having first used one is probably due to Dr. Pennock, of Philadelphia. They may be generally described as consisting of a chest-piece, long flexible rubber tubes, and round ear-pieces. The ear-pieces are held in place either by being firmly pressed into the meatus, or by a spring passing over the head or under the chin. A flexible stethoscope was devised by Mr. Brown, in which the ear-pieces are oval. When placed in the ear, with the long diameter vertical, they are said to remain readily in position. The differential stethoscope of Scott Alison is similar in mechanism to Cammann's, but has two chest-pieces, one for each ear, enabling the sounds from different regions of the chest to be conveyed to the two ears at the same time. The hydrophone is another instrument devised by Alison. It consists of an india-rubber bag about the size of a large watch and filled with water. Another inventor had previously constructed a wooden instrument filled with water, but it was not practically useful. Alison found that when water was interposed between two conducting media, sound was conveyed to the ear with increased intensity. The hydrophone may be employed as an instrument by itself, or in aid of the stethoscope.

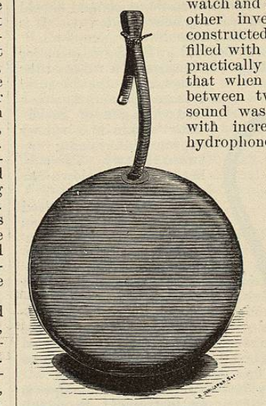

FIG. 4493.—Alison's Hydrophone.

Dr. McBride has devised for use in auscultatory percussion a solid binaural stethoscope of hard rubber, with chest-piece sufficiently small to fit in the intercostal spaces. Dr. Constantin Paul devised a stethoscope with two flexible tubes leading to the ears, and a hollow chamber in the chest-piece connected with a rubber bulb by a long flexible tube. If the air in the hollow chamber is exhausted the instrument is held firmly against the chest. A modification of the chest-piece of Cammann's binaural stethoscope, which can be screwed on in place of the usual chest-piece, has been devised by the writer. In the pectoral end is an air chamber, which is completely closed by pressure against the chest. Connected with this chamber by a small tubular opening is a rubber bulb, through which the sound-conducting tube passes. By pressure upon this bulb, when the instrument is held in position, the air is exhausted in the hollow chamber and the stethoscope is held firmly to the chest wall.

Dr. Heineman, of New York, has devised an attachment to the binaural instrument, in which, by an admirably arranged piece of mechanism, the stethoscope is held firmly against the chest by means of a metal rod extending from the chest-piece to the chin, and both hands are left free.

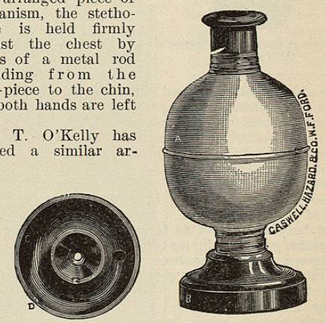

FIG. 4494.—Cammann's Modified Chest-piece. *A*, Rubber bulb; *B*, pectoral end; *C*, air chamber closed by pressure against the chest; *D*, outer rim; *E*, inner rim.

Dr. T. O'Kelly has devised a similar arrangement of a metal rod surmounted by an india-rubber cushion upon which the forehead rests, thus enabling the stethoscope to be held firmly in position.

Dr. D. M. Cammann devised a binaural hydrophone with the two tubes made of hard rubber, and thin hard-

rubber caps at the aural extremities. The pectoral extremity is covered by a diaphragm of soft rubber, and the instrument is filled with water by means of a faucet. The chest-piece has been already described as a modification of the ordinary binaural stethoscope, and is held firmly against the chest, leaving both hands free. It is intended for use in practising auscultatory percussion.

An instrument has been devised by Dr. Solis-Cohen for intrathoracic auscultation. It consists of a rubber tube attached to the binaural stethoscope, and there is a diaphragm of gold-beater's skin in a rubber capsule intervening between the two. The rubber tube passes down the œsophagus.

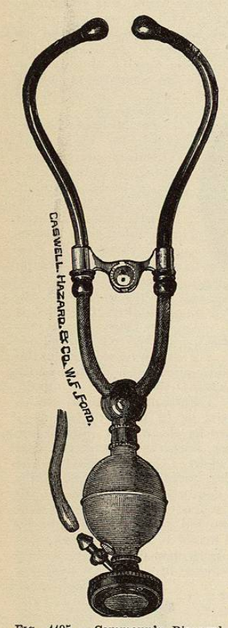

Fig. 4495. — Cammann's Binaural Hydrophone.

Dr. Bowles has devised a chest-piece which can be attached to the binaural stethoscope. It essentially consists of a diaphragm of hard rubber covering the chest-piece, which vibrates and transmits the vibrations to the instrument. It is claimed that with it sounds can be heard more distinctly.

The phonendoscope is an instrument in which there are two diaphragms with an air chamber between, and from the centre of the outer diaphragm a small rod extends, the end of which presents a small surface and, when pressed against the chest, conveys vibrations to the diaphragm.

Both of the instruments last mentioned are patented, and are made by Pilling & Sons, Philadelphia.

In addition to those already described, a number of stethoscopes have in the past ten years been put on the market. They embody no new principle and, so far as the writer is aware, do not convey sound better than the older stethoscopes, when the latter are properly constructed.

Construction of Stethoscopes.—The rules for the proper construction of stethoscopes cannot, in the present state of our knowledge, be formulated with scientific exactness; nevertheless, a knowledge of the laws of acoustics, and of the results of the experiments of others, will aid us in constructing instruments less faulty than many of those now in use. In selecting a material, one should be chosen that, as far as possible, is light, durable, and a good conductor of sound. For the monaural stethoscope nothing has been found better than a light, firm, vibrating wood like cedar. The fibres should run in the direction of the length of the stethoscope. Mahogany, deal, and limewood answer well, but the heavier woods, as oak, beech, lignum vitæ, and boxwood, are inferior and deaden the sonorous vibrations of the bodies upon which they are applied. The quality that makes wood desirable is the same that applies in its use in violins, in sounding-boards for churches, and in the walls of concert-rooms. Other materials, although inferior, are good conductors of sound. Ebonite, a preparation of india-rubber, has the advantage of being light and durable, and easily moulded into shape. The metals, horn, papier-maché, gutta-percha, and ivory are good conductors, and have all been used for this purpose. Hollow stethoscopes are most desirable, as some sounds are conducted best through the solid walls, while others are transmitted most perfectly through the enclosed column of air. The latter is the case with the aërial sounds of the chest, the solid wall of the stethoscope acting as a sounding-board, receiving and transmitting the weakest vibrations. In the practice of auscultatory percussion, a solid wooden stethoscope or the binaural hydrophone is most useful, as sounds produced in solids are best conducted through homogeneous media; but even in this case the ordinary hollow instrument will usually be found to convey sound with sufficient intensity for all practical purposes. The bore of the stethoscope and the hollow in the chest end should not be too large, else there will be caused a confused reverberation of sound; nor should the wall of the stethoscope be of great thickness, both on account of superfluous weight and because the weaker vibrations are thereby checked. It is best that the stethoscope should be of one material throughout and in a solid block. This is not essential, however, and in the binaural instrument is not possible. Theoretically the breaking of continuity, by having it in several pieces, would impair the conducting power; but practically the difference is found not to be as great as might be expected. Flexible stethoscopes, in which the tubes are of soft rubber, or of wire covered with some pliable material, are useful in some cases, but the sounds are modified by reverberation, especially when the tubes are long and with large hollows. The length recommended by Laënnec was one foot divided in two for convenience of carrying. This is unnecessarily long, and six inches is now the usual length. The length of the binaural instrument, from ear to chest-piece, varies from ten or twelve to sixteen or seventeen inches. Most of the binaural instruments have two chest-pieces, one small and narrow, the other trumpet-shaped, which can be screwed on at pleasure. The modified chest-piece may also be used, and can be screwed on in the same way. The smaller end can localize sounds best, and is easier of application to the chest; the larger is more useful in examining the chest rapidly. The edges should not be too sharp, but rounded off both toward the circumference and toward the centre. The ear-piece of the monaural stethoscope ought to be large enough to cover the concha and to close the external meatus. It may be flat, but the most convenient form is with a depression between the circumference and the centre, the latter being considerably elevated. The binaural instruments have small circular knobs, which should not be too large nor too small. If too large, they do not fit closely and allow external sounds to enter; if too small, they cause discomfort by pressure. No instrument will suit all ears, and a stethoscope should be fitted to the ear as a shoe is to the foot.

Value of the Stethoscope.—In considering the value of the stethoscope it is taken for granted that the instrument used is reliable, and that the auscultator knows how to use it. Some skilful auscultators advocate its continual use; others, equally skilful, advise that it be used only occasionally. The cause of this difference of opinion probably lies partly in difference in the acuteness of hearing and the extent of the training of different observers, and partly is a matter of habit. That the habitual use of the stethoscope does after a time render the sense of hearing less acute to the sounds heard over the chest, in immediate auscultation, is, I think, an undoubted fact. Yet the stethoscope is a valuable instrument, and although it is not always needed, often we cannot attain to a full knowledge of a case without making use both of mediate and of immediate auscultation. Often a doubtful or half-heard sound has been clearly brought out and appreciated by the use of the stethoscope; but still oftener, I think, has a sound scarcely suspected with the stethoscope been made evident by the immediate application of the ear. It requires some practice to become accustomed to the use of the stethoscope, especially to that of the binaural instrument. In the latter some sounds are exaggerated, while others are impaired, and there are not the distinctness and simplicity that are observable when we use the ear or the monaural instrument. It is an acoustic fact that sounds are better heard with two ears than with one, and virtually the double stethoscope enables us to place two ears on the chest at the same time. The modified instrument increases the intensity of sounds both by bringing the pectoral end into the closest possible contact with the chest, and by both the hollow air chamber and the rubber bulb acting as resonators. It also leaves both hands of the auscultator free. Alison's hydrophone may be used either by itself or placed between the end of the stethoscope and the chest, thereby increasing the contact and the conducting power when it is difficult to bring the inflexible end of the instrument into close apposition with the chest wall. Bowles' stethoscope is useful in listening to the posterior portions of the lungs in cases of pneumonia in which the patient cannot be turned over.

The value of the stethoscope for purposes of modesty, cleanliness, and convenience, and for examining the supraclavicular and axillary regions which cannot readily be reached by the ear, are obvious, and need only to be mentioned to be appreciated. *Donald M. Cammann.*

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STILLINGIA.—U. S. P., *Queen's Root.* The dried root of *Stillingia sylvatica* L. (fam. *Euphorbiaceæ*). This is a perennial plant, with a large, tough, spongy root, and erect herbaceous or slightly woody stem, a foot or so in height, growing abundantly in the Southern States, where it has been used for about half a century.

The drug usually occurs in short transverse sections of very long, tapering, slenderly fusiform roots, about 2.5 cm. (1 in.) or less in thickness, very light, tough, and spongy; externally of a deep or occasionally a light reddish-brown, finely, shortly, and crookedly longitudinally wrinkled and incompletely annulate, especially the thicker portions, with constrictions which frequently become slight fissures; ends of the sections pinkish, very fuzzy with innumerable partly detached fine bast fibres, the bark very thick, containing scattered fine resin cells and laticiferous ducts; the wood radiate, fibrous, and porous; odor slight, peculiar; taste pungent, bitter, and acrid.

The activity of stillingia depends upon three or four per cent. of a nauseous volatile oil, a large amount of soft resin, and a fixed oil, the composition of which has not been studied, but which apparently holds an acrid substance in solution. There are considerable tannin, starch, and other unimportant constituents.

Stillingia is an emetico-cathartic, like many other plants of its family, and is said to be "alterative." Upon this property depend its principal uses, which are very similar to those of sarsaparilla, in syphilis, rheumatism, gout, etc. That its use is mildly beneficial cannot be doubted. Belonging to the same family with the castor and croton-oil plants (see *Euphorbiaceæ*), it rather actively promotes the excretions, from which result its amelioration of the above-named diseases evidently proceeds. Dose 1 or 2 gm. (gr. xv. to xxx.) two or three times a day. A fluid extract is official (*Extractum Stillingiæ Fluidum*, U. S. P.), dose 1–2 c.c. (♏ xv.–xxx.).

Henry H. Rusby.

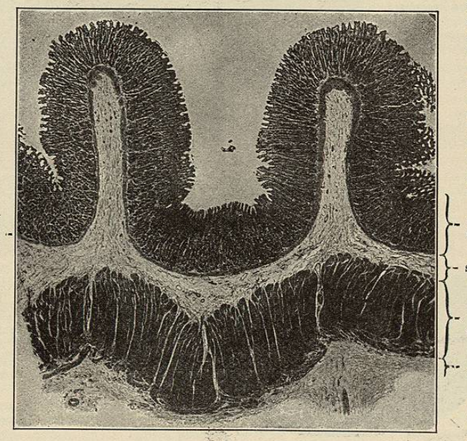

Fig. 4496.—Longitudinal Section of Wall of Stomach of Dog in the Middle of the Curvatura Major, showing Layers. × 10.

Stomach.—The stomach exhibits the usual four layers found in the alimentary tract, called, from within outward, the tunica mucosa, the tela submucosa, the tunica muscularis, and the tunica serosa.

The tunica mucosa is the glandular lining membrane of the stomach. In the fresh condition it is of fleshy consistence and of a pinkish color. The color of the fresh mucous membrane depends on three factors—the amount and venosity of the blood contained in its vessels, the physiological condition, and the character of the glands. In the dog, in the resting condition, the mucous membrane of the greater curvature of the stomach presents a grayish-pink appearance and is relatively opaque. After digestion has been going on for some hours, the grayishness and opacity disappear and the mucous membrane presents a rose-pink color.

If the veins are engorged, the grayish-pink tint is deepened to a chocolate-pink, which rapidly brightens on exposure to the air. The mucous membrane of the pyloric portion of the stomach is always more transparent, paler in color, and firmer in consistence than that of the fundus and corpus ventriculi.

The point of contact of the œsophageal and gastric mucous membranes at the cardia forms a somewhat zigzag line, the œsophageal epithelium extending in the form of irregular conical projections into the stomach (Schaffer) in such a manner that frequently in longitudinal sections engaging the termination of the œsophagus and the beginning of the stomach, portions of the epithelium of the former may appear as isolated patches surrounded by gastric epithelium. This irregularity of the gastro-œsophageal junction is an indication of that tendency of the œsophageal epithelium to invade the stomach and displace the glands, which in some of the lower primates, Innus, Semnopithecus, etc., has resulted in the formation of a distinct chamber of the stomach, lined by stratified epithelium. At the summit of the musculus sphincter pylori the gastric mucous membrane is continuous with the tunica mucosa duodeni.

In the contracted stomach the tunica mucosa is thrown up into a series of coarse folds, the plicæ mucosæ, mainly longitudinal in direction, but with transverse and oblique connecting folds. These plicæ mucosæ involve the whole thickness of the tunica mucosa and the superficial layer of the tela submucosa. When the stomach is distended to its utmost the folds disappear. A permanent fold at the pyloric end of the stomach, caused by the projection into the cavity of the musculus sphincter pylori, forms the valvula pylori.

The whole surface of the mucous membrane in man is indistinctly marked off by irregular sulci, of varying depths, into small fields a few millimetres in width, the areæ gastricæ, giving the tunica mucosa the so-called mammillated appearance.

If the surface of the mucous membrane be examined with a lens, the close-set depressions, foveolæ gastricæ, into which the gastric glands open, may be seen. These openings are separated from one another by delicate partitions which are in the pyloric region often continued into pointed villus-like processes, projecting into the cavity of the stomach as the plicæ villosæ. Cases have been reported in which the whole inner surface of the stomach was beset with these villus-like processes. The number of foveolæ opening upon the surface of the gastric mucous membrane has been estimated by Toldt to be eighty-seven per millimetre. The total extent of the mucous membrane measured in the same individual by means of the planimeter was 76,300 sq.mm., giving 6,638,100 as the total number of foveolæ in the stomach. It seems probable, however, that the number of foveolæ is subject to considerable variation in different individuals. In a number of pathological cases reported by Einhorn, the number varied from twenty to one hundred and sixty per square millimetre.

The whole of the surface of the mucous membrane and the walls of the foveolæ gastricæ are covered with a simple cylindrical epithelium, mucigenous in function, uniform in type throughout the stomach, but differing somewhat in structural details in the different regions. The cells of this epithelium are somewhat conical in shape, but vary with the shape of the surface upon which they rest, the conical shape being more pronounced on convex surfaces. The pointed apex of the cell rests against the reticular tissue of the lamina propria mucosæ; the broad, slightly convex base of the cell is directed toward the free surface of the tunica mucosa. The adjacent surfaces of the epithelial cells are separated from one another by minute spaces, across which the cells are connected by protoplasmic intercellular bridges. The intercellular spaces are closed internally by lines of cement (*Schlussleisten* of Kohn) which connect the adjacent free edges of the cells. This cement substance is not entirely confined to the intercellular location, but, as shown by Carlier in the newt and by Bensley in man, extends over the free surface of the cell in delicate radiating lines which may easily be mistaken by an inexperienced observer for traces of a striated cuticula. The distal portion of each epithelial cell forms a cup-like cavity, the theca, which contains the specific secretion of the cell; in this case mucin or its antecedent substance. The contents of the theca are in the form of small droplets, which appear in sections of properly fixed material, stained in an alcoholic solution without exposure to water, as fine granules. If the mucin has been allowed to absorb water and go into solution, it precipitates in the form of the coarse spongy network which is usually seen in the theca of these cells. The distal portion of the theca contains very little cytoplasm, but in the proximal portion the granules are separated into groups by threads of cytoplasm which form a coarse network. The conical attached end of the cell is occupied by a delicately reticular cytoplasm containing an oval nucleus. This cytoplasm is continuous with the cytoplasmic network of the proximal portion of the theca, and frequently contains, in sublimate-fixed preparations around the base of the theca, numerous minute granules stainable in eosin or acid fuchsin.

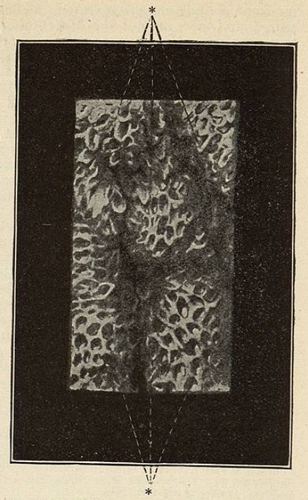

FIG. 4498.—Tunica Mucosa of the Pyloric Region, showing at * the Openings of the Gastric Foveolæ, the Villous Folds, and the Small Gastric Areas. × 16 (After W. Spalteholz, "Handatlas der Anatomie des Menschen.")

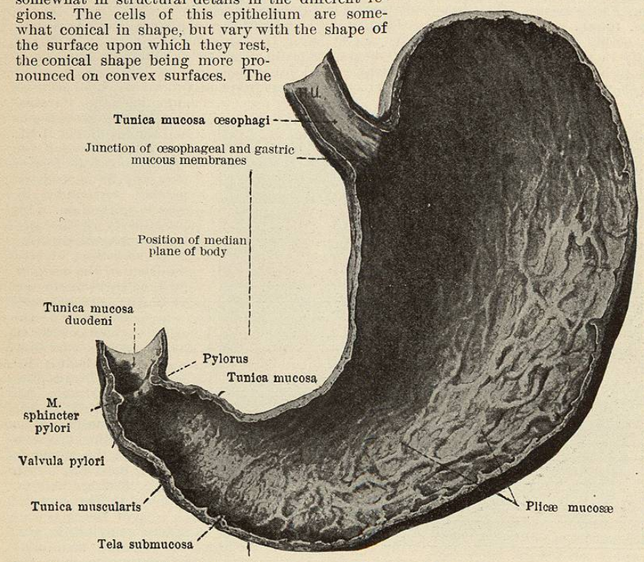

FIG. 4497.—Posterior Half of a Human Stomach, Hardened in a Moderately Distended Condition, showing Internal Anatomical Characters. (After W. Spalteholz, "Handatlas der Anatomie des Menschen.")

Between the nucleus and the theca the cytoplasm stains less deeply than that in the base of the cell, owing to the presence of the structures which have been interpreted by Holmgren as similar to the canal-like structures observed by him in the hepatic cells, to which he has applied the name trophospongium.

The so-called replacing cells (*Ersatzzellen* of Ebstein) do not exist in the epithelium of the stomach, the structures which have been described under this name being, as suggested by Stöhr, in all probability, lymphocytes which have invaded the epithelial layer.

The epithelium of the foveolæ gastricæ is, as has been indicated, similar to that of the free surfaces, but on going down the foveolæ, certain changes of a transitional character make their appearance as the bottom of the depression is approached. Near the mouth of the foveola the cells are slightly imbricated at their attached ends and have a larger theca than those of the free surface. Deeper in the foveola the cells become shorter and more cubical in shape, the nucleus larger, more rounded, and richer in chromatin; the theca tends to become smaller in extent and divided into two more or less distinct masses, a proximal mass near the nucleus and a distal mass near the cavity. These smaller cells of the bottom of the crypt exhibit great activity in division, as is indicated by the presence of numerous mitoses. The cells of the surface, on the other hand, rarely divide. On this fact Bizzozero has based his theory of the mode of regeneration of the surface epithelium, according to which the cells of the bottoms of the crypts are endowed with the property of dividing and producing new cells, which by a gradual process of migrating or displacement finally reach the surface and replace the cells, which for various reasons are being constantly lost there.

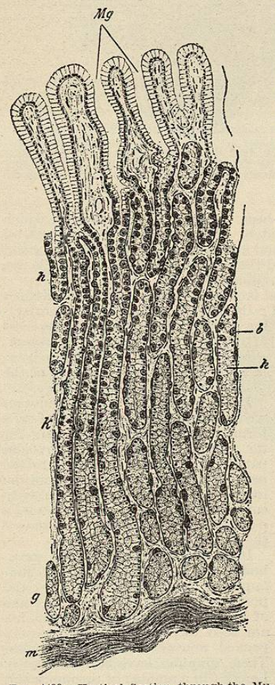

FIG. 4499.—Vertical Section through the Mucous Membrane of the Fundus Gland Region of the Stomach. × 85. *Mg*, Foveolæ gastricæ; *h*, neck of gland; *k*, body of gland; *m*, lamina muscularis mucosæ. (After V. von Ebner, in von Kölliker's "Handbuch der Gewebelehre des Menschen.")

A point of some interest is the occasional occurrence in the human stomach, on the surface of the tunica mucosa, or in the foveolæ, of epithelium of the intestinal type, that is to say, composed of cells with a distinct striated cuticula alternating with goblet cells (Schaffer, Boeckelman, Hári). There is still some doubt as to whether these patches of intestinal epithelium occur normally in the human stomach. They appear to occur most frequently in the pyloric region, but have been observed by Schaffer at the very margin of the œsophagus in the foveolæ of the cardiac glands.

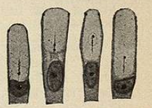

FIG. 4500.—Types of Epithelial Cells from the Gastric Mucosa of Man. (After K. W. Zimmermann. *Arch. f. mikr. Anat.*, Bonn, Bd. lii.)

The great thickness of the gastric mucous membrane is caused by the closely aggregated tubular or tubulo-acinous glands. These are of three kinds, occupying three definite regions of the mucous membrane. The *cardiac glands* (glandulæ cardiacæ) form in man a small area around the cardiac orifice of the stomach, which varies in width in different individuals and in different parts of the circumference of the cardia in the same individual, the extremes, so far recorded, being 0.5 cm. in one of Kupffer's cases, 4.3 cm. in a case described by the writer. The tunica mucosa of the fundus ventriculi, of the curvaturæ major et minor, and of the parietes anterior et posterior is occupied by the *fundus glands* (glandulæ gastricæ propriæ), that of the antrum pyloricum and the adjacent portions of the stomach, by the *pyloric glands* (glandulæ pyloricæ). The cardiac and pyloric glands are, for the most part, mucous glands of simple structure, the acid and pepsin of the gastric juice being in large measure produced by the complex fundus glands.

At the lines of junction of the various glandular zones a gradual transition from one type of gland to the next may be observed, forming thus between the cardiac and fundus zones on the one hand, and between the fundus and pyloric zones on the other hand, intermediary zones of small extent.

The tunica mucosa in the region occupied by the fundus glands differs in thickness according to the location. In man, according to von Kölliker, the thickness of the tunica mucosa is 0.37 mm. to 0.56 mm. at the cardia, 1 mm. in the middle of the greater curvature. Zimmermann gives the thickness of the mucous membrane as 1.2 mm. in a piece of mucous membrane from the fundus gland zone. In material examined by the writer, the thickness of the mucous membrane, including the lamina muscularis mucosæ, was 0.64 mm. at the beginning of the fundus glands, 0.82 mm. in the middle of the fundus ventriculi, 1.2 mm. to 1.3 mm. in the middle of the curvatura major.

The fundus glands (glandulæ gastricæ propriæ), physiologically the most important, are slightly wavy, branched tubules, placed vertically in the tunica mucosa, and so closely aggregated throughout the whole of the zone that the interglandular tissue of the lamina propria mucosæ is reduced to a minimum. Each gland is connected with a foveola gastrica by a short collecting duct (*inneres Schaltstück* of Rollett), lined by epithelium of the same type as that of the deep ends of the foveolæ.

The gland may be divided into two portions, which differ from one another in size and in the character and arrangement of their respective epithelial elements. The more superficial, narrower portion of the gland is called the neck of the gland; the deeper, wider portion, the body of the gland.

The relative lengths of the foveolæ and different sections of the glands is given by Zimmermann as follows:

Thickness of the tunica mucosa		1.200 mm.
Depth of the foveolæ gastricæ	0.256 to .325	"
Collecting duct (*Drüsenhals* of Zimmermann)	.046 to .078	"
Neck of gland (*Schaltstück* of Zimmermann)	.265 to .312	"
Body of gland	.465 to .558	"

The measurements obtained by the writer correspond very closely with those of Zimmermann as regards the length of the body of the gland, but show relatively