RECENT LITERATURE.

CRITICAL SUMMARIES AND ABSTRACTS.

MEDICINE.

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SOME RECENT WORK ON THE DIGESTIVE TRACT.

During the last few years a steady advance has been made in our knowledge of the normal and abnormal movements of the stomach and intestines. This has come largely from the work of the Röntgenographer, who has been able to observe the shadows thrown on the fluorescent screen, after the introduction into the alimentary tract of a bismuth meal.

Valuable information has been obtained likewise by other means, but I shall limit myself to only a few of these, viz., permeation, abdominal auscultation and gastroscopy.

I. BISMUTH MEALS AND RÖNTGENOGRAPHY.—Before 1896 our knowledge of the movements of the stomach depended almost exclusively on the experiments of William Beaumont on Alexis St. Martin, followed more recently by the work of Pawlow and his school. In 1896, however, Cannon of America observed for the first time the actual peristaltic movements of the stomach in cats, by giving them meals mixed with bismuth subnitrate, and viewing the shadows cast by the X-rays on the fluorescent screen.

Shortly afterwards Rieder in Munich and Holzknecht in Vienna observed similar shadows for the first time in the human individual.

It is from the results of these observers that our knowledge of this subject has mainly sprung, modified in part and more fully worked out by Hertz, Jolasse, Groedel and others.

How Bismuth is Taken.—Various methods have been used in taking bismuth.

Cannon mixed up 40 grms. of bismuth in 400 grms. of gruel and made this the test meal for cats.

Rieder employed the following method:—He mixed up 40 grms. of bismuth subnitrate with water or milk, and added boiled rice or potato purée little by little to the bismuth suspension, disguising the taste if necessary, the whole having the consistency of porridge. By this method the stomach is made out easily by the screen or photographic plate.

Groedel advised, as a preliminary, simply the swallowing of 10 grms. of bismuth in water.
Pirie, in his case of oesophageal stricture, gave 2 drachms of bismuth carbonate mixed up in half a cupful of biscuit and milk, the whole to form a semi-fluid mass. Each mouthful is seen by the screen to descend when the patient is in the oblique position, reaching the diaphragm in about 3 seconds, and disappearing wholly out of the normal stomach in 6 seconds or so.

Hertz used bismuth carbonate in 1 to 2 oz. doses, with no ill effects, and without producing, which one might expect, constipation.

Levy-Dour was the first to introduce bismuth capsules and to observe their passage down the gullet. Becker was the first to use a bismuth suspension in water introduced by the stomach-tube. Bismuth cakes and bismuth water biscuits have been used also for the same purpose.

Cases are on record of poisoning by large doses of bismuth subnitrate. It is believed that a nitrite gets formed by intestinal fermentation. Quite recently a case of poisoning by bismuth subnitrate was reported by Don (see p. 134) of Dundee. The case was one of synovitis and cellulitis of the knee, the result of an accident. Fairly large quantities of a 33 per cent. solution of bismuth subnitrate in vaseline were injected into the abscess cavities. The author describes undoubted symptoms of poisoning, and cautions the use of the substance when given in large quantities and for simply diagnostic purposes. Hertz believes that the oxychloride and carbonate of bismuth are quite harmless, even in large doses—a view which is generally held by other workers.

Instantaneous Röntgenography. — Although ordinary tubes have usually been used with ordinary exposures for photographic records of the gastro-intestinal movements, Leonard has recently written a paper strongly advocating instantaneous Röntgenography, as he believes this is the only method of eliminating motion in the small intestine and of observing the exact positions and movements of organs at stated times. He employs a current capable of supplying 40 to 60 milliamperes to the tube, with an exposure of only half a second. He concludes his paper by saying, "Instantaneous radiography has opened up a new and interesting field in physiology, a study which will no doubt yield material of great value both to the clinician and to the therapeutist."

Orthodiagraph. — For exact drawings of the appearance of the shadows at stated times, an apparatus called the orthodiagraph has been widely used. The orthodiagraph was invented by Professor Moritz of Giessen, but for abdominal work a modified form has been made by Groedel of Bad Nauheim.

Physiological Movements of the Alimentary Tract.—Hertz has done much to elucidate by the bismuth method the peristaltic movements of the alimentary tract, and quite recently in a paper which he read before the Royal Society of Medicine has shown that chronic consti-
pation may be treated more promptly when one knows the exact seat of the obstruction, or of any diminished peristalsis in the bowel.

He describes details of 8 cases, where he was able to show that there was delay in the sigmoid flexure and rectum, or in the small bowel, or in the transverse colon, &c.

Deglutition.—Hertz examined the process of deglutition in 14 normal young men. He used as a fluid 2 ozs. of bismuth to the pint of milk. He found that the average time between the commencement of deglutition and the disappearance of the last trace of fluid from the oesophagus was $5\frac{3}{5}$ seconds. Half of this time was occupied in passing down the gullet, the other half in passing through the cardia. For solids he used bread, the flour of which, before baking, had been mixed with bismuth carbonate. If the solids were properly chewed before swallowing, the time occupied in its transit into the stomach was the same as for fluids, but if not, the bolus passed slowly down the oesophagus, taking sometimes 15 minutes.

Hertz noted that there were two distinct sounds heard in swallowing, the first, sharp and short, heard best under the chin, and due, he thinks, to the impact of fluid against the posterior wall of the pharynx; the second, of a trickling or squirting nature, heard best in the epigastrium, lasting 2 to 3 seconds, and commencing about 4 to 10 seconds after the first sound. This sound is heard best when the stomach contains about 10 ounces of fluid. This sound is of a trickling character when the patient is in the vertical position or lying on the left side, while it is of a squirting nature when the patient is in the supine position, or on the right side. The squirts are usually 2 to 5 in number, and each one lasts about one second. Hertz noted, therefore, that the second sound was in the form of a trickle or a squirt, according to the position of the patient, and he believed that it was difficult to explain the nature of this sound, but it probably was due to “a fall in pressure in the bottom part of the oesophagus, and the rise in pressure in the stomach, when the fluid passes through the cardia. These may force gas from the stomach into the oesophagus, and so produce the sound.”

Movements, Shape, Size and Position of Stomach, &c.—The stomach has been studied by the X-rays. A better and fuller light is now thrown on its physiological movements, its shape and size, its motor and secretory activity. The old view that the stomach was merely a receptacle for churning up food, so that it might become intimately mixed with gastric juice, has been abandoned. It is found to consist of two distinct physiological parts:—(1) the fundus; (2) the pyloric part. At their point of juncture there is a strong muscular band of circular fibres called the sphincter antri-pylorici. Food simply collects in the fundus, and when it becomes overfilled a tonic contraction takes place, and part of its contents are squeezed into the pyloric part.
There strong rhythmical contractions take place every 10 to 20 seconds; the waves are both peristaltic and antiperistaltic, so that the food is thoroughly acted upon before it is passed through the pylorus into the duodenum. It is prepared for intestinal digestion, and the pyloric sphincter remains closed as long as the duodenum is loaded with food, and as long as its contents are acid and contain unsaponified fat. Reflexes from the duodenum regulate the passage of food stuffs through the pylorus.

From this one can argue that spasmodic contraction of the pylorus will take place if irritating solids be in the stomach, or if the contents be hyperacid. If the acidity be 7 per cent. to 8 per cent., there results prolonged pyloric spasm. It is highly probable then that many cases of dilation of stomach depend on hyperacidity and spasm, and not on pyloric stenosis. If an opening be made in the stomach and a sound passed through into the pyloric canal, the instrument will be firmly gripped from muscular spasm. One has again to be careful not to diagnose this condition as pyloric stenosis.

In normal persons the motor activity of the stomach should be such that after a bismuth meal the whole of the contents should have left the stomach in from 3 to 4 hours. If the food remains much longer than this, there is motor insufficiency or pyloric stenosis.

Hertz has discussed the subject fully, and likewise Craven Moore, in a recent critical review of recent work on the stomach.

By the X-rays the secretory activity of the stomach can be also studied. Jolasse, in his paper, tells us that Schwartz found that gold-beaters’ skin was soluble in hydrochloric acid, and if bismuth were placed in small bags of this material, he observed that in presence of acid a diffuse irregular shadow was seen, whereas, in its absence, a small, clear circular shadow was apparent for a longer time. He noticed that in hyperacidity the small bag was dissolved in 1½ hours; in normal acidity, in 2½ hours; whereas in anacidity it took 5 hours or longer.

The shape and size of the stomach has been worked up especially by Groedel, with the aid of his orthodiagraph. By means of his apparatus the passage of the bolus down the oesophagus can be seen, the patient standing obliquely, so that the shadow is seen between the spinal cord on the right, and the heart on the left. He finds that on looking dorso-vertically lower down, the exact position of the stomach can be made out. The stomach does not assume the position that most diagrams in text-books lead us to suppose. It passes vertically downwards and is “funnel-shaped.” It reaches a point at about the level of the umbilicus, and then curves on itself, giving the appearance of a fish-hook, and consisting of a descending portion, a stomach sac, and an ascending portion. The upper pole is called the cephalic pole, and the lower the caudal pole. This type of stomach, when the patient assumes the vertical position, is present in 99 per cent. of the
cases examined. Groedel finds that the descending portion is to the left of the middle line; the sac is \( \frac{2}{3} \) to the left and \( \frac{1}{3} \) to the right, and the ascending portion is somewhat to the right of the middle line, terminating at the pylorus, which occupies a pretty central position.

He finds also that the female stomach lies more vertically than the male; the ascending portion is shorter; the stomach sac is broader; and the distance from the caudal pole to the symphysis pubis is less than in the male. He finds also that the shape of the stomach alters with respiration and with posture. When the patient lies on the back the stomach falls backwards, and the greater curvature is above the umbilicus; if the patient turns to the left side the stomach falls over to the left side likewise.

Holzknecht\(^{15}\) holds that the normal appearance of the stomach with the patient in the erect position is "horn-shaped," the pylorus being the most dependent part of the stomach. Groedel observes this shape in only 1 per cent. of his cases, and he views this shape as an anomalous type.

**Movements in the Small Intestine.**—Cannon\(^{15}\) described a type of movement in the small intestine that occurs also in the large intestine, which he calls "segmentation." The shadow showed the bowel divided into segments, and he believed that each portion of the bowel in turn assumed this peristaltic movement, in order that the food might be thoroughly mixed with the bile, pancreatic and intestinal juices. The shadows are not so well seen in the small intestine as they are in the stomach and large bowel, unless obstruction be present, when, above the seat of the obstruction, the bismuth becomes more thickly deposited, and a distinct shadow is seen. The faintness of the shadow in the small bowel, Hertz believes, is due to the rapidity in which the food stuffs pass along, and also to the large quantity of the digestive juices poured into the bowel at this part. Hertz also noted that the shadow in normal persons appeared in the cæcum in 3½ to 5 hours after the last meal, and he calculated from this that the contents are propelled along the small bowel at about 5 feet to 7 feet in the hour, or 1 inch per minute.

**Movements of the Colon.**—Hertz noted that the contents appeared in the cæcum about 3½ to 5 hours after a meal. They reached the hepatic flexure in from 5 to 8 hours, and the splenic flexure in from 7 to 10 hours. From then, onwards, the passage was slower, taking in all 28 to 48 hours before defæcation occurred. He observed, as did Jolasse, Groedel and others, that antiperistaltic waves are set up, beginning in the middle of the transverse colon and forcing the food from thence backwards down the ascending colon, but not with sufficient force to affect the closed ileo-cæcal valve. He noticed that the contents of the small intestine entered the large bowel by spurts at regular intervals, the spurts being directed downwards towards the
external haustrum of the cæcum. The iléo-cæcal valve acts much in the same way as the pyloric does above, allowing small portions of food material to enter the large bowel at stated intervals, the whole being under the influence of reflexes, which control its movements.

*The Process of Defecation.*—Hertz continued his observations in this direction also, and found that at first the diaphragm and the hepatic flexure were greatly depressed; the ascending colon then became flattened and broadened, and the transverse colon descended below the umbilicus, while the splenic flexure descended in a slighter degree. After defecation the ascending and descending colon rapidly rose again, while the transverse colon remained down for over an hour. Hertz therefore believed that defecation depended not only on increased peristaltic action of the descending colon and rectum, but as well on pressure exerted by the cæcum, ascending and transverse colon.

*Pathological Lesions of the Digestive Canal.*—Anything causing obstruction in the gullet can be easily made out. Pirie's case showed well how the gullet was compressed by an intra-thoracic growth. Simple spasm causing obstruction can be differentiated from organic stricture; for, if simple spasm, the bismuth shadow disappears, whereas, in organic stricture, the shadow is thinned down and is more gradual in its disappearance.

In the stomach one can sometimes locate ulcers, as the bismuth clings to the ulcerated part, and may remain there, giving rise to fine streaks of shadow for hours. Hemmeter has diagnosed several cases of ulcer in this way, and he found that the bismuth spot in the ulcer remained for 24 to 36 hours, whereas it normally disappears in 4 hours or so. Hourglass contraction can be made out, but must not be confused with the normal action of the sphincter anti-pylorici. Pyloric stenosis of organic origin can be diagnosed; for, if simple spasm, it is not likely that the food stuffs will remain in the stomach over 6 hours, and, as an aid here, the secretory activity of the stomach could be estimated. Tumours can often be made out by the irregularity of the shadow, and all forms of dilatation of the stomach and gastrophtosis can be observed. In gastrophtosis, Groedel noted that the pylorus was very freely movable, differing thereby from the normal pylorus. Davis, on the other hand, is very doubtful of this. He thinks that, "from the firmness and extent of the attachments of the duodenum, one would expect it to be held up, but recent skiagraphs have suggested that it too descends. We are in need of accurate post-mortem examinations to determine the position of the pylorus and duodenum in cases of marked ptosis."

A very exhaustive and interesting paper by Worden, Sailer, Pancoast and Davis deals with the value of the bismuth skiagraph in determining the topography of the gastro-intestinal tract. They em-
phasise the importance of this method now, especially in stomach cases, for it gave them a knowledge of the true state of matters in many cases, where inspection, palpation, percussion, auscultation, inflation with CO₂ gas or air, illumination by the electro-diaphane all failed. Many beautiful skiagrams are shown and an analysis of 78 abnormal cases is given. The résumé of the cases is as follows:—

- Gastroptosis, examined, 50; positive diagnosis, 49.
- Gastroptosis and ptosis of colon, 6; positive diagnosis, 5.
- Ptosis of colon, 8; positive diagnosis, 7.
- Ptosis of sigmoid, 4; positive diagnosis, 2.
- Carcinoma of stomach, 3; positive diagnosis, 1; unsatisfactory, 2.
- Esophageal stricture, 2; positive diagnosis, 1; negative, 1.
- Intestinal obstruction, 4; positive diagnosis in all; carcinoma of colon, 1; carcinoma of sigmoid, 2; obstruction by adhesions, 1.
- Faecal fistula, 3; satisfactory results in all.

Many other cases occur in recent literature of obscure diagnosis being cleared up by this method of examination. There should be little difficulty in making a diagnosis of “stricture, dilatation, prolapse, hour-glass stomach, and cancer of the stomach; stricture, dilatation and tumour of the intestine; prolapse of the colon and sigmoid” (Worden 19).

II. PERMEATION IN THE EXAMINATION AND TREATMENT OF STOMACH AND INTESTINES.—In a recent paper by Scheltema 20 this novel procedure is described. By permeation he means the automatic sounding of the alimentary tract by a sound driven through the whole canal by the peristalsis of the gut itself. He introduces a thin flexible tube through the nose, catching the end of it in the mouth and then fixing a bulbous extremity—a pilot knob—to it. It is then guided into the pharynx, when it passes down into the esophagus and gradually works its way itself into the stomach. At this stage the patient is given a large meal, and after some hours, by the X-rays, it will be seen to enter and pass through the pylorus, which in some cases may take many hours, and then to pass more quickly through the small and large intestines. The author claims for this method of treatment a reliable means of locally applying medicaments to the diseased portion of bowel and a method of syphoning off fluid contents from the small intestine for chemical analysis. By longer tubes he was able to treat the large bowel for parasites, &c. Permeation, he believes, will prove an additional help in the diagnosis and treatment of obscure intestinal diseases. All his observations have been made on children, and on no occasion was any difficulty experienced. The patients eat as usual during the operation and lie in bed.

III. ABDOMINAL AUSCULTATION AS AN AID IN DIAGNOSIS.—Hertz has recently shown that sounds may be heard by auscultation over the cæcum at definite intervals, and that these undergo changes through-
out the day. In the early morning before breakfast no sounds were heard, but from 3½ to 4½ hours after breakfast, a few sounds could be heard, which gradually increased in loudness up to the 6th and 7th hour. The sounds, he found, corresponded with the appearance of the shadow in the cæcum after bismuth had been taken with the breakfast. This is of importance, for it will allow many who have not access to the X-rays (and it may be said here that the X-ray apparatus required for gastro-intestinal diseases must be of the highest efficiency) to detect for themselves the time occupied by the transit of food from the mouth through the stomach and small intestine to the cæcum. The sounds are heard best when the patient is in the erect position, and depend probably on the iliac contents being ejected at regular intervals into the gas-containing cæcum.

Hertz showed also that if the peritoneum in the neighbourhood of the ileo-cæcal valve was affected, the valve remained permanently closed and the sounds were not heard. On the other hand, in 12 cases of appendicitis which he examined, he heard the cæcal sounds in all cases, showing that the peritoneum was not involved. This diagnostic sign, then, is of the greatest importance to the surgeon.

In typhoid fever gurgling is always heard in the cæcal region, but this is of itself not of great importance, as typhoid patients get small feeds frequently repeated and the cæcal sounds are constantly present. If on the other hand they cease in typhoid fever, Hertz says that it is almost certain that a perforation has occurred and general peritonitis has set in. He concludes by saying, "The presence of sounds in the abdomen in suspected cases of peritonitis is of greater importance than their absence, as, when the seat of origin of the sounds can be recognised, it may be assumed that the peritonitis has not spread to that locality, or inhibition of peristalsis would have occurred."

IV. THE DIRECT INSPECTION OF THE GASTRO-MUCOUS MEMBRANE BY THE GASTROSCOPE.—In a recent paper Souttar and Thompson describe their new gastroscope, which is more easily manipulated and more delicate than those of Nitze and Leiter, or Mikulicz and Leiter. Their apparatus consists of a metal bougie encased in rubber, and composed of short segments of metal tube so connected that the whole forms a flexible rod, but can be straightened when desired. Mirrors are set at the angles of the tube so formed. In the nose-piece an incandescent lamp is fixed, and a window closed by one side of a reflecting prism. By means of a system of lenses the observer can see an area of about 6 inches in diameter. No anaesthetic is required in passing the instrument. It simply slips down the œsophagus like an ordinary stomach-tube. When once in the stomach, it is straightened and the stomach is blown up with air by a pump, forcing a column of air down a channel in the instrument. The light is switched on, and the stomach wall brought into focus by the eye-piece. The nose-piece can be made
to rotate by turning a wheel at the eye end, so that successive portions of the stomach wall can be examined.

They find that they can easily detect the branching vessels of the gastro-mucous membrane. In one case they observed extravasations of blood in the mucous membrane, while in another they detected a new growth at the pylorus.

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