ROBINSON (B)

The peritonaeum.

ROBINSON (B.)

[Reprinted from the AMERICAN GYNÆCOLOGICAL AND OBSTETRICAL JOURNAL for February, 1895.]

THE PERITONÆUM.

BY BYRON ROBINSON, M. D., CHICAGO.

From the epoch-making periods of Wolff, Meckel, Fleischmann, Oken, Haller (1708–1777, German anatomist, physiologist and philosopher) and others, we will glance at a period when certain opinions were becoming general property and settled. The work done on the anatomy and development of the peritonæum and digestive tract had brought to light many natural facts. The time was right for the investigation which told the story of the development of the final complicated structure known as the peritonæum. This subject had engrossed the attention of men for a quarter of a century. The first great pioneers had passed to the unknown or retired from active labors. We will discuss the views entertained at the beginning of the second quarter of this century, after which we will pass to modern and more practical matters. In the development of the peritonæum the names of L. Fr. von Froriep (1779–1847, German anatomist and obstetrician), Lauth (1758–1826, professor of anatomy at Strasburg) and J. Mueller, stand prominently. The especial questions which man had to ask were (*a*) How does the great omentum arise from the peritoneal sac? (*b*) Why are the stomach and colon alone connected with it? (*c*) Why does the omentum arise in man and certain lower animals only and not in all?

The epoch-maker in the development of the peritonæum was Johannes Mueller, who published his labors in 1830. Mueller started his labors where others left off and by dissecting and examining many embryos under four months old, finally stated that he hoped he had discovered the cause of so noteworthy a formation as the great omentum. Mueller's idea was that the layers of the omentum coalesced and finally presented a double layer of peritonæum reaching from the greater curvature of the stomach to the transverse colon and from the transverse colon to the posterior abdominal wall. From Fleischmann (1777–1850, German anatomist), Kieser (1779–1862, German biologist) and Meckel, Mueller knew that the digestive tract at

first was a straight tube reaching from the heart to the cloaca. Also Oken (1779–1851, a German biologist whose name is connected with the Wolffian or Oken bodies) laid further foundations for Mueller's final conclusions. By this date (1830) it was well known that the stomach turned from the left to the right and that it also twisted on its axis and by these two processes in the second month of fœtal life the stomach loses its perpendicular position in the body. He also knew from the labors of others that the digestive tract below made a peculiar long, parallel loop which passed out at the umbilicus and was connected at its pointed angle to the vitelline duct. This loop gradually returned into the abdominal cavity. Mueller considered it of noteworthy interest to investigate the connections of this intestinal loop to the abdominal wall after it returned.

As is known in very young embryos (four weeks) the stomach is perpendicular; hence the double fold of peritonæum which holds it will also be perpendicular and arise from the middle of the dorsal wall. The double fold of peritonæum which arises from the middle of the dorsal wall and passes to the posterior border of the upright stomach, was named by Mueller, the mesogaster. When the mesogaster arrives at the stomach, its two blades diverge to receive it and then pass forward on the right and left sides of the stomach until they arrive at the anterior or lesser curvature, after which the two blades of peritonæum again come together and pass to the liver. The part of the double peritoneal membrane stretching from the stomach should be named the anterior mesogaster, but anatomists call it the gastro-hepatic omentum. After clearly recognizing that the posterior mesogaster (great omentum) is the mesentery of the stomach or the double-bladed membrane stretching from its origin, the middle of the dorsal wall, to the posterior border of the stomach and that the anterior mesogaster (lesser omentum) is the double-bladed peritoneal fold which extends from the transverse fissure of the liver to the lesser curvature of the stomach, the story of the formation of the great omentum is simplified.

In the second month of fœtal life the stomach makes three movements: (*a*) It rotates from left to right, (*b*) it twists on its axis, and (*c*) it descends lower into the abdominal cavity. The result of the three movements is (*a*) the right surface of the stomach becomes posterior and the left anterior and (*b*) the stomach assumes a horizontal position or rather the pylorus is carried backward. As the stomach passes through these movements the greater curvature is carried to the left and forward so that the mesogaster must necessarily elongate. The

mesogaster elongates by moving toward the left and in so doing it creates at first, a wide, shallow depression behind the stomach. As the stomach completes its rotating and twisting the shallow depression behind the stomach becomes deeper and the circumference of its mouth becomes narrower until, finally, in the fourth month the depression becomes the lesser bag of omentum and its mouth becomes the foramen of Winslow (foramen epiploon), to use Johannes Mueller's words, from his original article in 1830, "Diese Beobachtung ist neu, und mir eigen; sie ist, wie ich glaube, der Schüssel zur Bildungsgeschichte des grosses Netz." ("This observation is new and my own; it is, as I believe, the key to the development of the great omentum.")

Now, since the mesogaster arises from the middle line of the dorsum and reaches around to the greater curvature of the stomach, there will exist behind the stomach a space or sac made by the folds of the elongated mesogastrium. In order to reach from the mid-dorsal line to the greater curvature of the stomach the mesogaster must needs stretch very much. The bag found behind the stomach gradually assumes such a position that the mouth opens just at the right of the vertebral column at the point known as Winslow's foramen. Winslow's foramen should open in the middle line, but the liver (enormously large in embryos) atrophies rapidly and drags it to the right over the spinal column. Winslow's foramen opens at the lower part of the lesser curvature of the stomach. Now the anterior wall of the lesser omental cavity is the stomach itself, while the posterior wall is the mesogaster itself. This aperture, Winslow's foramen, is the narrow neck leading to a wide bag of peritonæum lying behind the stomach, known generally as the lesser omental cavity. The neck or foramen is at first simply a wide depression in the mesogaster, but gradually the bag narrows at its neck, until it admits one to three finger tips in the adult.

It should be noted that the mesogastrium and mesenterium of the duodenum are one and the same thing; that the mesogaster ceases when the mesentery begins. In early embryos this is at the pylorus, but in adults it is at the junction of the duodenum and jejunum. In between the stomach and jejunum there is a piece of bowel in adults without a mesentery, lying behind the peritonæum. It is the duodenum, however, in embryos, in the lower animals the duodenum has a long mesentery.

The notable feature in development of the great omentum and colon is that they remain a long time without any relation or contact. But the more the colon bends and fixes itself in a higher position the

more the great omentum assumes a bag-like form. At this time (say six weeks) the great omentum (mesogaster) assumes an oblique insertion and the mesentery of the colon also assumes an oblique or transverse insertion. The two more and more approach each other until the great omentum passes directly from the greater curvature of the stomach to the transverse colon. It has been asserted and reasserted that there is a coalescence or an absorption of some of the layers of the great omentum in order to produce the condition found in adults. I shall attempt to show, both by embryos and especially by the dog, that this is not the case, but that the whole matter concerning the relations of the great omentum and the transverse colon is brought about by a readjustment of parts. Certain organs in developing and assuming their positions appropriate portions of peritonæum, while others give up some peritonæum. It will be observed in both embryos and dogs that the final adjustment of the great omentum to the transverse colon in the adult begins at the right end of the transverse colon and progresses toward the left. The credit of announcing just how the omentum and transverse colon coalesced, Mueller gives to Meckel. Many ideas of the peritonæum and its folds have been copied without the slightest recognition of the labors of Meckel and Mueller. But right here it would seem to me to be appropriate to copy the figures which Mueller drew sixty-five years ago to represent the development of the great omentum, a discovery which he says belongs to the industrious Meckel. However circumstances forbid.

I wish to state that I consider Mueller's figures as well as Meckel's views partially wrong. It should be remembered that what is transitional in man's embryo may be permanent in the lower animals. The great natural fact is that man goes through the development, in embryo, of all the animals below him. Hence we must learn the thread of progressive development by the examination, not only of the rapid transitional stages of man's embryo, but of the permanent stages of the lower animals. The dog, for example illustrates a peculiar permanent condition of a stage of development far below man in two special conditions. One represents the partial rotation of the intestinal canal. The cæcum remains near the navel and does not descend. Another is that the great omentum does not directly insert itself into the colon at all.

In some mammals the omentum will remain bag formed. In others it still remains a part of the original mesentery, *i. e.*, the mesogaster may remain a simple mesentery of the stomach or it may show

different degrees of sac formations as dog and man. Also a peculiar point arises that the spleen may be far away from the stomach as in man or directly in contact with the stomach as in embryos and some animals. Again in man one can easily observe that the pancreas is posterior to the peritonæum, but in the dog it is distinctly in the mesentery in contact with the stomach and duodenum. The same may be observed in certain stages of human embryos. Further, the foramen of Winslow is large in human fœtuses, but the same opening in some other animals is hardly an inlet at all, but a wide plane or depression. Hoffman's sloth simply has a wide-mouthed bag for a lesser omental cavity, so that this omentum as found in man is the result of long ages of evolutionary development. But one can observe the evolution of unnumbered ages in nine months of fœtal life. In fact the changes in man during intra uterine life are more wonderful than those after birth.

The following remarks on the abdominal viscera and peritonæum of a fœtus of perhaps four months and a half may be of interest :

Fœtus, male. Five inches long. Fingers and toes distinctly formed. Nails visible. No eyebrows or hair. The external genital organs are just beginning to be distinctly recognizable to decide sex. The rhaphé is closed. The abdomen is very large on account of the large liver. The liver is almost symmetrical, but still the larger lobe is the right. The umbilical vein being cut, the fold of abdominal wall containing the two hypogastric arteries and the urachus is turned down for the best view.

The testicles are descended to the internal inguinal ring. The right testicle, like the right corner of the uterus, does not descend as fast as the left. The sigmoid flexure is three quarters of an inch long. Its mesentery is directly in the middle line, until it was entirely displaced by the growing kidney. The kidney appropriated all of the mesentery of the descending colon so that the descending colon runs along the outer border of the kidney. The bowel is solidly adherent to the kidney. Then we have no descending meso-colon and the only primitive mesentery left on the large bowel is the sigmoid mesentery, which in this fœtus of five inches arises exactly in the middle line of the dorsal abdominal wall. The descending colon is half an inch long. The costo-colic ligament shows distinctly in this fœtus to be the lower left-hand border of the great omentum. The transverse colon is nearly an inch. The omentum is over half an inch from the colon to its lower border. The descending colon is half an inch long. It makes a wide, obtuse angle, unlike the splenic bend, which is a sharp, acute angle. The descending colon runs on the

internal border of the kidney and is tightly adherent to the kidney. It has no mesentery. It may be observed that both ascending and descending colons are more fixed and have a shorter mesentery at their upper ends or at their flexures than they have at their lower. A fact which holds good in adults.

The appendix is half an inch long. It runs parallel to the lower end of the ilium. It has a mesentery. It lies in a spiral form and the fold of peritonæum stretches from the ilium on to it at both its sides. It is so small that the superior and inferior ileo-cæcal fossa can not be distinctly marked out. This fœtus shows very clearly that the ascending colon as it descends appropriates the mesoduodenum for its own covering. The descending colon lies for a quarter of an inch against the front surface of the duodenum and at that point has no peritonæum over it, but the peritonæum is used to cover the ascending colon. As the ascending colon descends it drags the right lower omental border with it out into a conical point. Besides the splenic flexure has become also quite firmly fixed into the (costo-colic ligament) left lower border of the great omentum. The gall-bladder is nearly half an inch long. The stomach has assumed an adult condition. The spleen lies against the left end of the stomach. The pancreas can be seen lying in the great omentum, but it is being uncovered by the dragging of the ascending colon.

The lesser omentum stretches from the liver to the stomach. It is a thin transparent membrane, however, of considerable strength. The whole of the small intestines hang on a very narrow neck and the mesentery crosses the vertebral column and great vessels at a very high point, much higher than in adults.

The jejunum is about twice the size of the colon. In this fœtus of five inches the colon does not show a trace of sacculation, or longitudinal bands or appendicæ epiploicæ. In fact the colon throughout its length is in this fœtus the smallest part of the digestive tract. The upper end of the jejunum is three times the size of the colon. The mesogaster inserts itself in the posterior median line.

The small intestine is fifteen inches long. The large is three inches long. It is as one to five, almost adult relations.

This fœtus is five inches long and about four months old. At this age we may note the following points. The ascending and descending colons have no mesentery, the kidney on each side has appropriated it to cover its rapidly increasing volume. The splenic flexure is acute as it is in adults. The transverse meso-colon is four fifths of an inch. The hepatic angle is obtuse and the cæcum has

descended to the lower border of the left kidney. The colon has no sacculations, bands or appendices epiploicæ. The colon is the smallest part of the digestive tract. The omenta (gastro-hepatic, gastro-colic and gastro-splenic) are definitely formed. A very curious matter in the small intestine of this fœtus is that at some six inches below the beginning of the jejunum the gut widens and retains a large caliber up to three inches from the cæcum, when it rapidly narrows. The liver has just begun to lose its symmetry and is perceptibly large in the right lobe. The point where the round (hepatic) ligament of the liver comes out between the two lobes is exactly at the level of the umbilicus and before the liver begins to perceptibly shrink in one lobe this point extends below the navel. A peculiar, but general feature of the fœtus is, that the descending colon, is, at four months always at the left border of the kidney and with no mesentery, while the ascending colon is at the left border of the right kidney. However, I posted an adult in which the ascending colon lay on the left border of the right kidney, but no doubt that was a fœtal type. The duodenum is being deprived of its mesentery by the ascending colon. The appendix is rapidly approaching adult conditions. The kidney is half an inch long. The mesentery has a higher position than in the adult. The hepato-duodenal ligament is large and prominent. No trace of the fossa duodeno-jejunalis can be made out. The sigmoid mesentery arises directly from the middle line and it is broken by the kidney stealing away the mesentery of the descending colon. No under sigmoid fossa can be found. The abdomen was fully closed at the navel. The rotation of the digestive tract is almost completed. There is no trace of Meckel's diverticulum. The urachus rapidly tapers from the bladder and is quickly lost between the two hypogastric arteries.