

# HD-5: Development of the Endoderm

## Reading assignment:

Larsen 3rd edition: Review Chapter 6: pp. 134—149; Chapter 9, pp. 235-259.

## Learning Objectives:

The basic objective can be summed up easily: know your gut! This includes how it forms, its divisions and how they are distinguished, its derivatives and how they form. Concentrate on the stomach and understand its rotation and the consequences of that rotation. Try to imagine what would happen if something fails, because anything you can correctly imagine probably actually occurs and causes disease. Think of the mesenteries, the liver, the pancreas, and the gall bladder in the context of the rotating stomach. Go on to the midgut and learn the consequences of its prodigious growth and grotesque total of 270° of rotation. Think of where the midgut goes to develop and what it must do to come home. Imagine again the failure of the midgut to do what is expected of it, and try to construct in your mind the hideous defects that arise when the midgut misbehaves. Again, think of what has to happen to the mesenteries as the ascending and descending colon become retroperitoneal. Finally learn about the formation of the hindgut and the partitioning of the cloaca. One last time, give your imagination free rein to envision the consequences of errors. Be sure you know the role, not only of growth in the process of development, but also of death and what happens when death is inadequate.

## Glossary:

**Volvulus:** intestinal obstruction due to a knotting and twisting of the bowel.

**Polyhydramnios:** an excess of amniotic fluid, occurs when fetus cannot swallow amniotic fluid.

**Recanalize:** reopening of an occluded lumen

**Cuddling:** asymmetric growth and rotation

**Mesogastrium:** gut associated mesentery

## Summary:

The gut is formed as a critical byproduct of the folding of the germ disc. The primitive bowel extends from the buccopharyngeal membrane to the cloacal membrane. It is portioned into a foregut, a midgut, and a hindgut. The foregut, which gives rise to the largest number of structures forms the pharynx and its derivatives, the lower respiratory tract, the esophagus, the stomach, the duodenum, proximal to the ampulla of Vater, the liver, the pancreas, and the biliary apparatus. From the stomach on, these structures are supplied by the celiac artery. The midgut is supplied by the superior mesenteric artery, and the hindgut is supplied by the inferior mesenteric artery. These vessels define the segmentation of the bowel. The stomach rotates 90° clockwise as it grows, which has major consequences for the positioning of the mesenteries, the duodenum, bile duct, and

pancreas. The liver and biliary system arise from the hepatic diverticulum, which grows into the ventral mesentery and septum transversum. The hepatic diverticulum divides into a cranial and a caudal division: the cranial forms the liver and the smaller, caudal forms the extrahepatic biliary system. The pancreas arises from dorsal and ventral pancreatic buds. The rotation of the stomach brings the buds together so that they can fuse into a definitive pancreas. The midgut grows rapidly and herniates into the umbilical cord, where it rotates 90° counterclockwise. Upon its return to the abdomen the gut rotates another 180°. The cecum then grows down to the iliac fossa. The hindgut gives rise to the cloaca, which becomes partitioned into an anterior urogenital sinus and a posterior rectum by the growth of Tourneux's and Rathke's folds, which form the urorectal septum. The mouth perforates at about the 4th week and the anus at about the 8th week of development.