Development of Digestive System

Development of head and tail processes, and ventral body folds transforms splanchnopleure into 3major divisions: *foregut, hindgut, & midgut.*

- *Endoderm becomes epithelium lining of the digestive tract*
- *Splanchnic mesoderm forms connective* tissue and smooth muscle components and stomadeum (mouth & some salivary glands-parotid, zygomatic, labial & buccal).
- Foregut becomes pharynx, esophagus, stomach, cranial duodenum, and liver and pancreas.
- Midgut becomes the remaining small intestines, cecum, ascending colon, and part of the transverse colon.
- Hindgut becomes transverse and descending colon and a cloaca which forms the rectum and most of the anal canal.

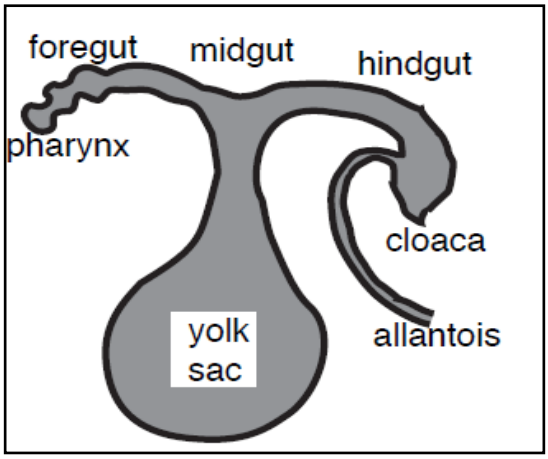


Fig.1 Major Parts of the embryonic digestive tract

Pharynx

• The adult pharynx is a common respiratory-digestive chamber.

• Initially, the pharynx is closed cranially by an oropharyngeal membrane that must degenerate to allow:

- Pharynx to communicate with oral and nasal cavity outgrowths;
- Migration of tongue muscle from the pharynx into the oral cavity.

• Pharyngeal pouches appear during development and give rise to several adult structures, two of which retain continuity with the pharyngeal cavity: auditory tube and fossa of the palatine tonsil.

• A midline evagination of the foor of the pharynx gives rise to the larynx, trachea and lungs.

Esophagus

- The esophagus develops from foregut, caudal to the pharynx.
- Its principal morphogenic development is elongation.

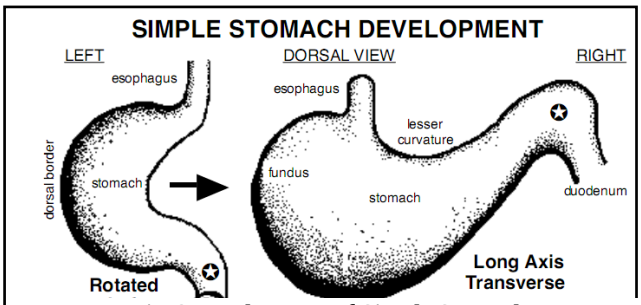


Fig. 2 Development of Simple Stomach

Stomach (simple stomach)

- Most domestic mammals have a simple stomach; in contrast, ruminants have a complex stomach with multiple compartments.
- The simple stomach develops from a tubular segment of foregut that undergoes the following morphogenic changes:
  - The tube becomes convex dorsally (future greater curvature) and concave ventrally (future lesser curvature).
  - The tube rotates 90° to the left (dorsal faces left & ventral faces right)
  - The long axis becomes transverse as liver growth pushes the cranial end of the stomach to the left side
  - Increased growth of the greater curvature produces a fundus region;

• Endoderm forms the epithelium lining the stomach and differentiates into different cells types.

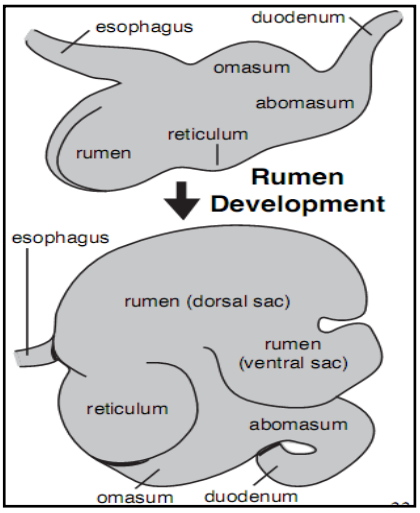


Fig.3 Development of compound stomach

Ruminant stomach

The adult ruminant stomach consists of three compartments lined by stratified squamous epithelium (rumen, reticulum, and omasum) and one glandular compartment (abomasum).

• The early development of the ruminant stomach is the same as the simple stomach; subsequently:

• the rumen develops as an expansion of the fundus

• the reticulum arises as a caudoventral pocket of the developing rumen

• the omasum develops as a bulge along the lesser curvature.

• the abomasum develops from rest of the stomach

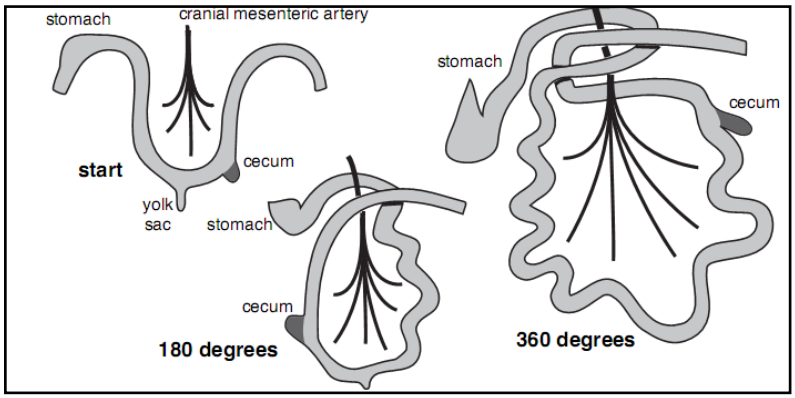


Fig. 4 Development of intestine

Intestinal tract

Along with general tubular elongation, the following morphogenic events occur:

- where the yolk sac is attached, the midgut to form an elongate loop that herniates through the umbilicus
- the elongating loop rotates 360° around the right vitelline artery (adult cranial mesenteric artery),
- the rotation is clockwise as viewed dorsally
- The caudal limb of the loop develops a diverticulum, the future cecum.

Cloaca

The hindgut terminates in a cloaca, i.e., a chamber that communicates with digestive, urinary and genital systems:

- The caudal wall of the cloaca (cloacal membrane) is endoderm apposed to surface ectoderm
- The allantois evaginates from the hindgut at the cranial end of the cloaca
- The cloaca persists in adult birds, reptiles, & amphibians

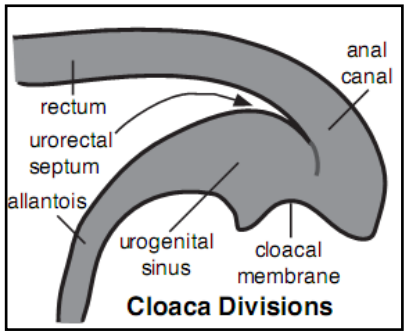


Fig.5 Cloacal divisions

Rectum:

The rectum is formed when a mesenchyme partition (urorectal septum) divides the cloaca into dorsal and ventral chambers:

- The dorsal chamber, which is continuous with the hindgut, becomes the rectum and most of the anal canal, including a temporary anal membrane.
- The ventral chamber, the urogenital sinus, is continuous with the allantois. The urinary bladder and urethra develop from the proximal allantois and urogenital sinus.

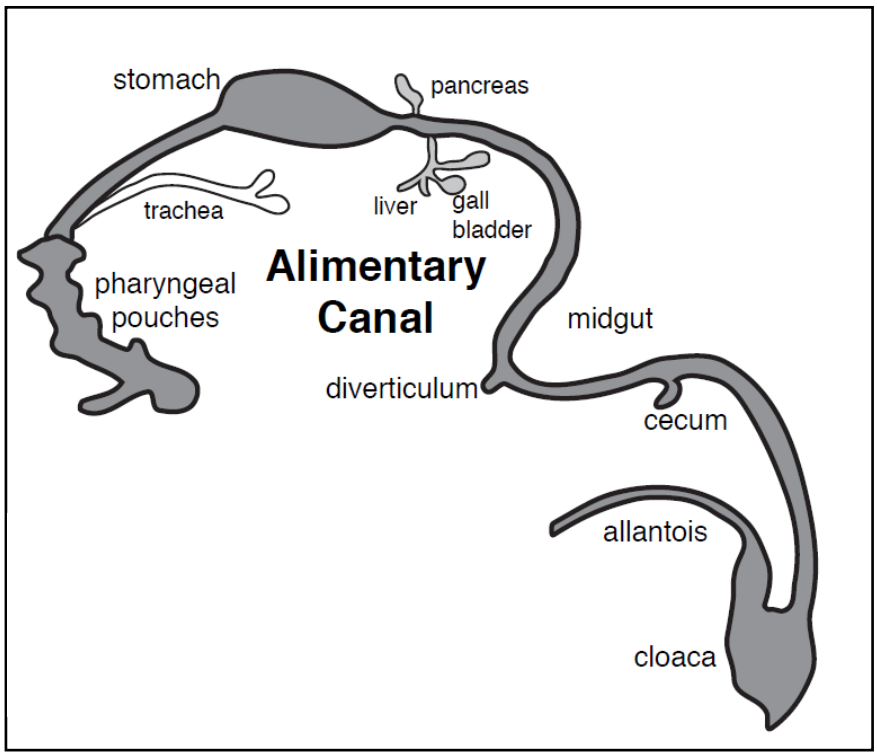


Fig. 6 Development of alimentary canal