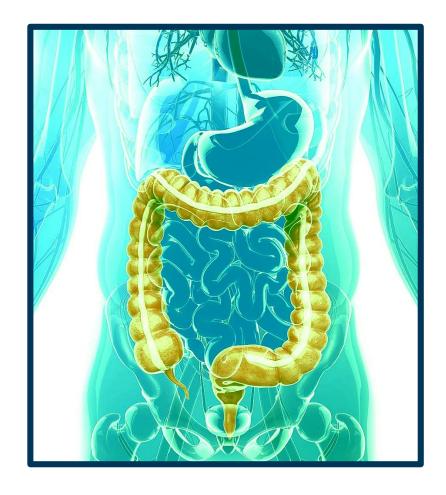
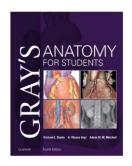
Gastrointestinal tract general anatomy,
oesophagus, stomach,
small and large intestine

doc. Lada Eberlova, MD, PhD lada.eberlova@lfp.cuni.cz



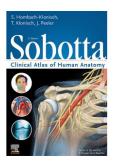




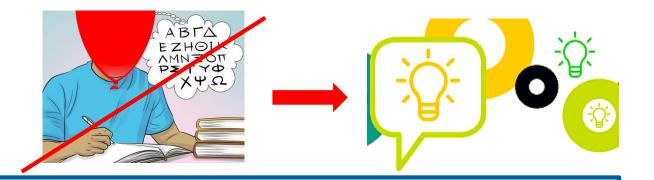








Introduction, ie. What is this good for?!



Dear students, colleagues,

This study material is a supporting aid to our anatomy practicals, its goal is to understand and consolidate the discussed matter, clinical implications including. Knowledge practice is based on supplementary questions and tasks, you can check your answers on the next slide/s.

I wish you good luck and joy from new knowledge,

Lada Eberlova

The following pictograms will accompany you:



to recall or remember



clinical notes



to be completed

Recommendation: Find the most effective way of learning that works for you. Study regularly, most often every day, and discuss the matter with your mates. Do not be afraid to ask so that SDA is not SAD when the time comes...



Learning goals



i.e. What do you FINALLY need to know?

- Knowledge demands for the spot test/s
- Knowledge requests for the final exam (oral!)

Digestive system

...

General anatomy of the digestive tube

Oesophagus

Stomach

Small intestine

Large intestine

Peritoneal duplications: mesentery, mesocolon, mesappendix

...

HOLLOW ORGAN

From:

To:

Where:

Parts (gross anatomy):

Layers (basic histology):

Function:

Relation to the peritoneum (if in abdomen or pelvis):

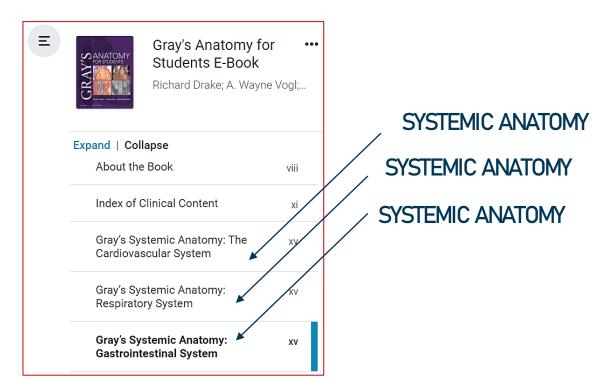
Organ syntopy (relation to the surroundings):

Blood supply, innervation, lymphatic drainage

GastroIntestinal Tract (GIT) Anatomy

The GIT extends from the mouth to the anus and is subdivided structurally and functionally into several organs that specialize in processing ingested food.

- The alimentary tract: the mouth, pharynx, esophagus, stomach, small and large intestines, rectum and anus.
- Accessory organs: salivary glands, liver, gallbladder, and pancreas.



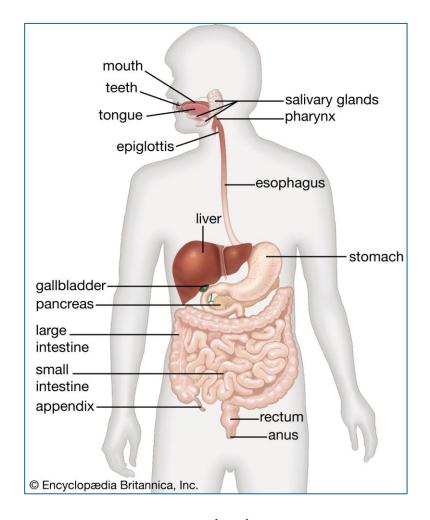


Fig. Gastrointestinal tract (GIT) and accessory glands

Hollow organs, description algorithm

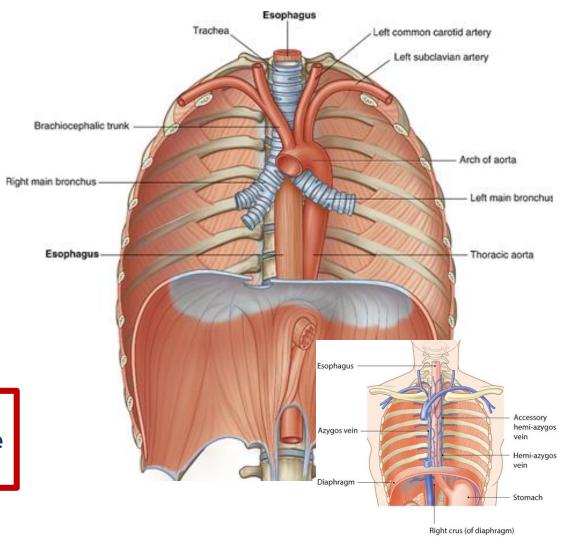
- From:
- To:
- Where:
- Parts:
- Layers:
- Function:
- Relation to the serosa:
- Organs syntopy (relation to the surroundings):
- Blood supply, innervation, lymph drainage



Revision

Try on your own: considering the algorithm, describe the TRACHEA and MAIN BRONCHI

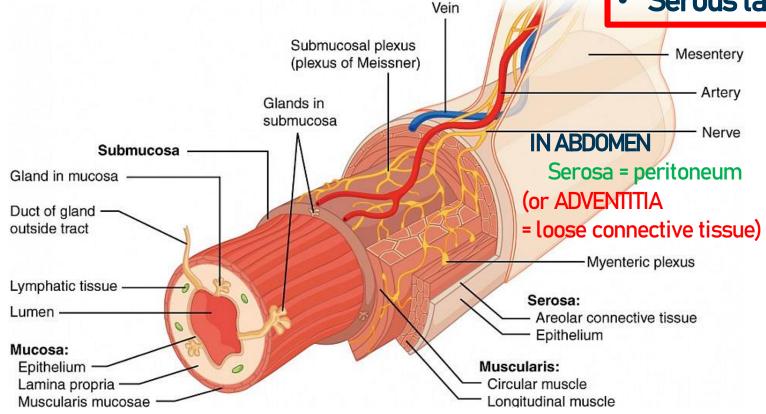




General anatomy of the digestive tube 4 LAYERS:

The wall of the digestive tract has **four layers** (tunics):

- Mucosa
- Submucosa
- Muscular layer
- Serous layer (serosa) OR adventitia



FUNCTION - STRUCTURE

General anatomy of the digestive tube - 4 LAYERS:

1. MUCOSA - the innermost tunic of the wall, lines the <u>lumen</u>. It consists of **epithelium**: stratified squamous (orally, aborally), or simple columnar. Underlying loose connective tissue layer called lamina propria, and a thin layer of smooth muscle called the muscularis of mucosa.

In certain regions:

- mucosa formes folds that increase the surface area
- certain cells in the mucosa secrete <u>mucus</u>, <u>digestive enzymes</u>, and hormones
- ducts from other glands pass through the mucosa to the lumen. In the mouth and anus, where thickness for protection against abrasion is needed, the epithelium is stratified **squamous**; the <u>stomach</u> and intestines have a thin **simple** columnar epithelial layer for secretion and absorption
- 2. <u>SUBMUCOSA</u> is a thicker layer of loose connective tissue that surrounds the mucosa. It contains blood vessels, lymphatic vessels, and nerves (the submucosus autonomic plexus). In **certain regions**, glands may be embedded.

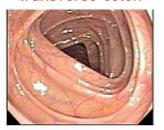




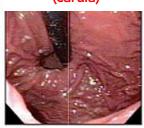
stomach (pylorus)



transverse colon



stomach (cardia)



duodenum



sigmoid colon

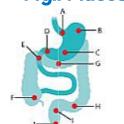




stomach (body)

coecum

Fig.: Mucosa – endoscopy of GIT Endoscopy and colonoscopy showing



different parts of the gastrointestinal tract.

- Cardiac crifice and fundus of stomach-retroflexed view.
- D. Pylorus of storrach and pyloric sphincter
- F. Cecum showing appendiceal opening.
- G. Transverse colon

General anatomy of the digestive tube - 4 LAYERS:

3. MUSCULAR TUNIC

! striated or smooth

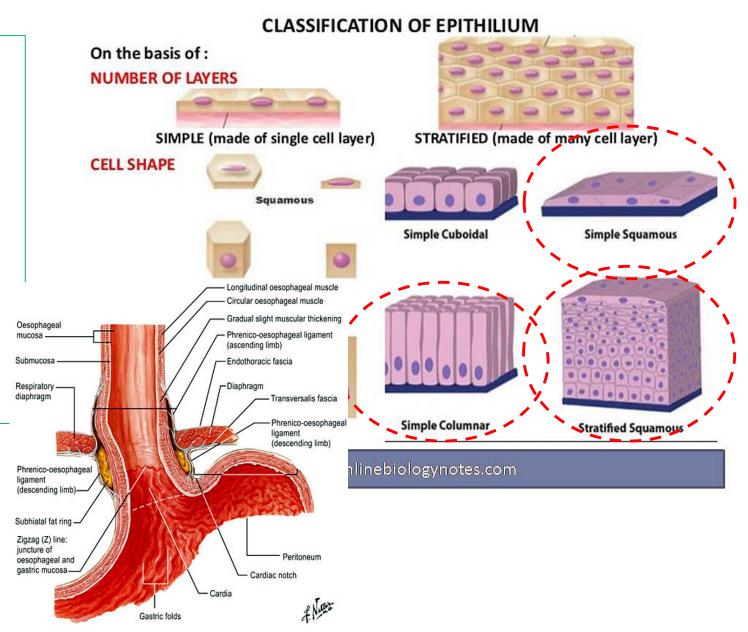
The smooth muscle responsible for movements of the digestive tract is arranged in two layers: inner circular layer, outer longitudinal layer. The autonomic myenteric plexus is between the two muscle layers.

4. SEROSA or ADVENTITIA

Above the diaphragm, the outermost layer of the digestive tract is formed by adventitia (= loose connective tissue). Below the diaphragm, it is either adventitia or serosa (ie. peritoneum).



Autonomic plexus?! Serosa?



Autonomic nervous plexus

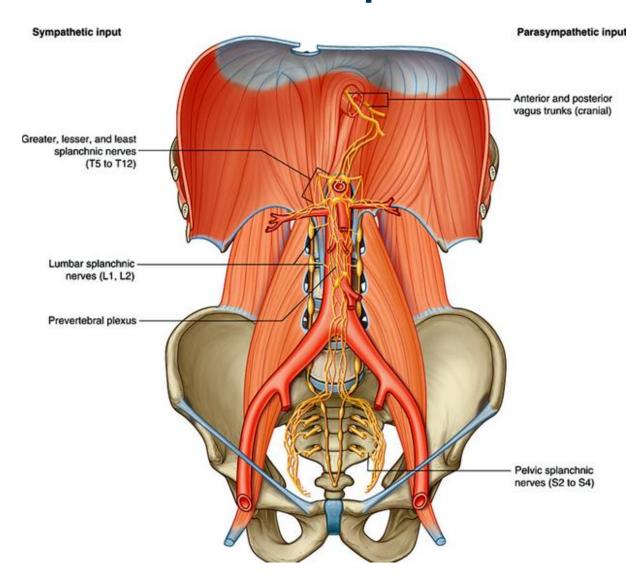
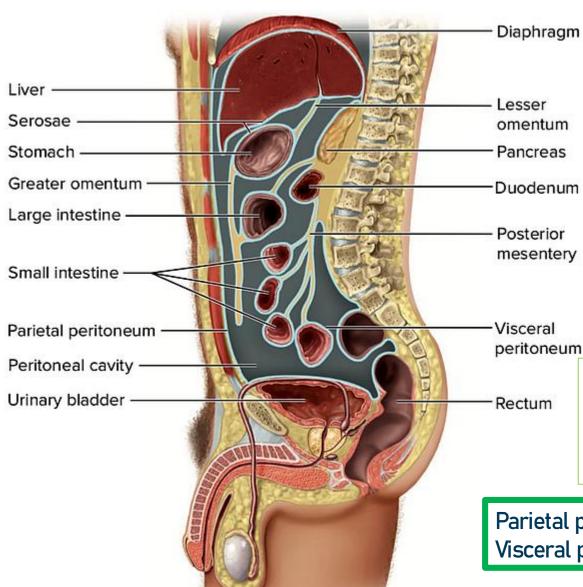
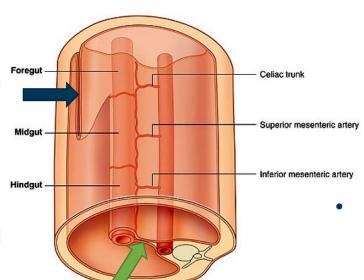
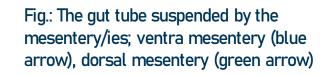


Fig.: Prevertebral plexus with sympathetic, parasympathetic, and visceral sensory components.

PERITONEUM Parietal, visceral









- Ventral (anterior) mesentery for proximal regions of the gut tube
- Dorsal (posterior) mesentery along the entire length of the system

The abdominal (partly the pelvic) cavity is lined by the peritoneum, which consists of an epithelial-like single layer of cells (the mesothelium) together with a supportive layer of connective tissue. Peritoneum is similar to the pleura and pericardium in the thorax.

Parietal peritoneum lines the abdominal wall. Visceral peritoneum covers organs.

Demo video, from the 12th min:

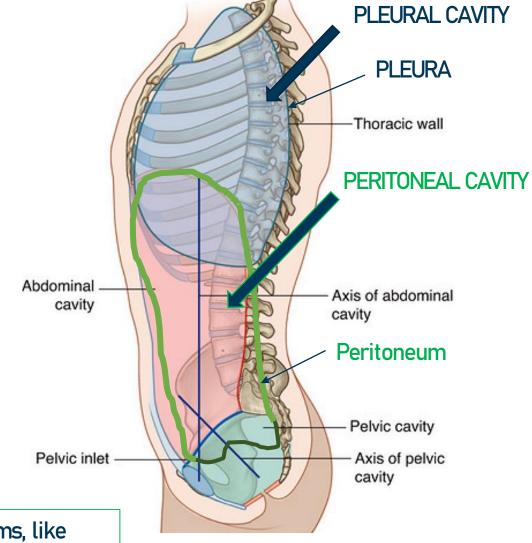
PERITONEAL CAVITY



Intraperitoneal structures (ie. structures found in the peritoneal cavity), such as some organs of the gastrointestinal system (eg. stomach, jejunoileum, transverse colon), are suspended from = connected with the abdominal wall by mes-enteries, and are covered by the peritoneum from all sides.

Retroperitoneal structures include eg. the pancreas, duodenum, kidneys, and ureters, are located between the peritoneum and the posterior abdominal wall. The parietal peritoneum runs over them from in front.

The **mesoperitoneal organs** are covered partly, from three sides (eg. ascensing and descending colon, gallbladder







Irritation of the peritoneum is connected with specific symptoms, like sharp, localized pain or higher production of the peritoneal fluid. Rupture of the GI tract threatens the patient with acute sepsis and death. Innervation: intercostal nerves

OESOPHAGUS

- From: laryngopharynx (C6)
- **To**: cardia (stomach)
- Where: neck, mediastinum, abdomen
- Parts: cervical, mediastinal, abdominal
- Layers: 4 change of epithelia and musculature
- Function: transportive
- Relation to the serosa: abdominal part is covered by the peritoneum
- Organs syntopy: behind the trachea (main bronchi), in front on the right side of the aorta; oesophageal hiatus (muscular diaphragm) level T10

Blood supply, innervation, lymph drainage:

Several **arteries** — the subclavian artery, thoracic aorta, inferior phrenic artery, and the left gastric artery.

Venous drainage of the thoracic esophagus is to the **azygos** venous system, the short abdominal esophagus drains to the hepatic **portal** venous system. This forms clinically very important **portal-systemic anastomoses**.

Lymphatic drainage: <u>upper third</u>: deep cervical lymph nodes (LNN); <u>middle third</u>: posterior mediastinal LNN; <u>lower third</u>: left gastric and celiac LNN

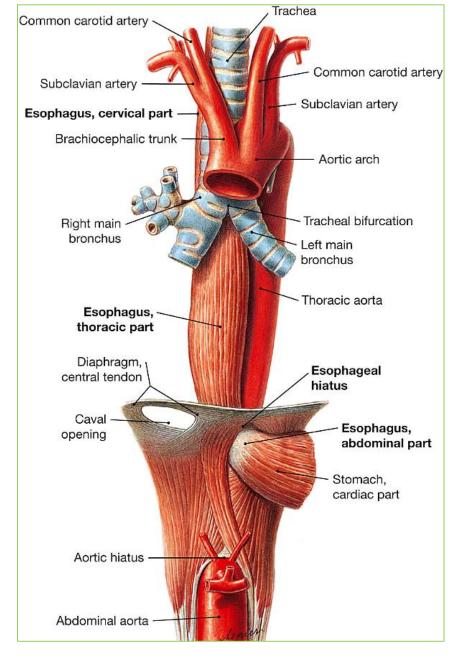


Fig.: Esophagus, trachea, and thoracic aorta

PERITONEAL CAVITY

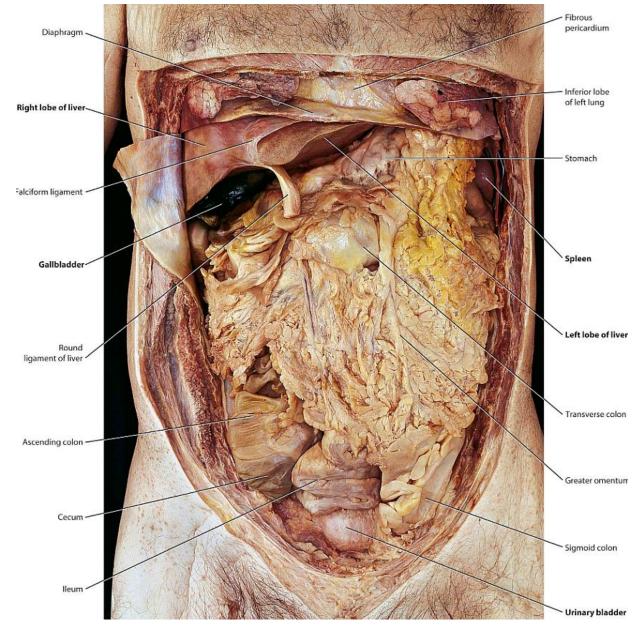


Fig. Abdominal organs — superficial structures

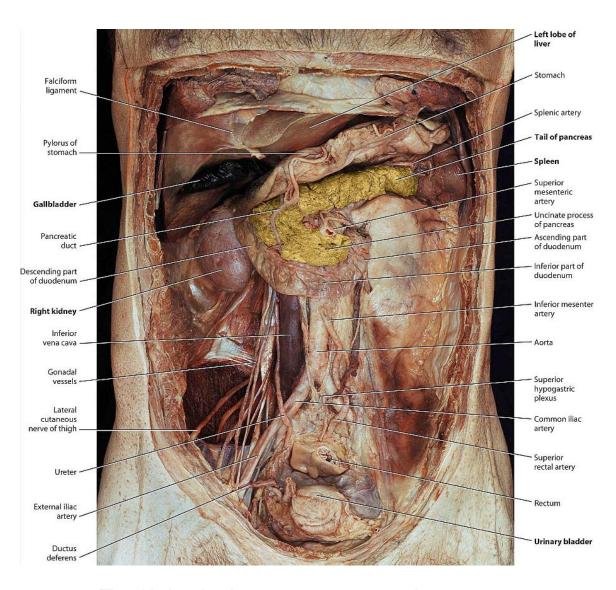


Fig. Abdominal organs — retroperitoneum

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ABDOMINAL PORTIONS OF OESOPHAGUS

The esophagus is 25 cm long and is organized in three parts: the cervical part (5–8 cm), thoracic part (cca 16 cm), abdominal part (1–4 cm). The abdominal esophagus joins the stomach at the **esophagogastric (lower) sphincter**, which prevents regurgitation (= REFLUX) of stomach contents into the esophagus.

Anatomical constrictions:

1. Cervical constriction:

Level of C6, at the pharyngoesophageal junction caused by cricopharyngeus muscle (upper sphincter)

- 2. Thoracic (bronchoaortic) constriction:
- Level of T4/T5, bronchoaortic constriction by arch of aorta Level of T5, crossed by left main bronchus
- 3. Diaphragmatic constriction:

Level of T10, esophageal hiatus

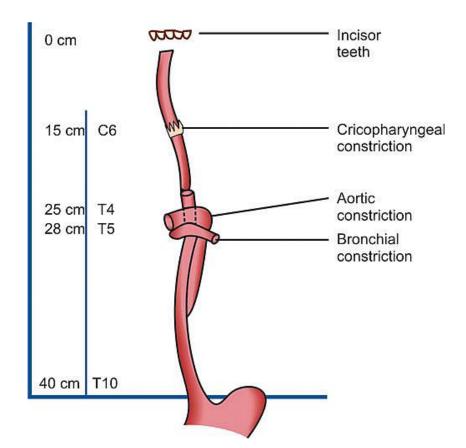


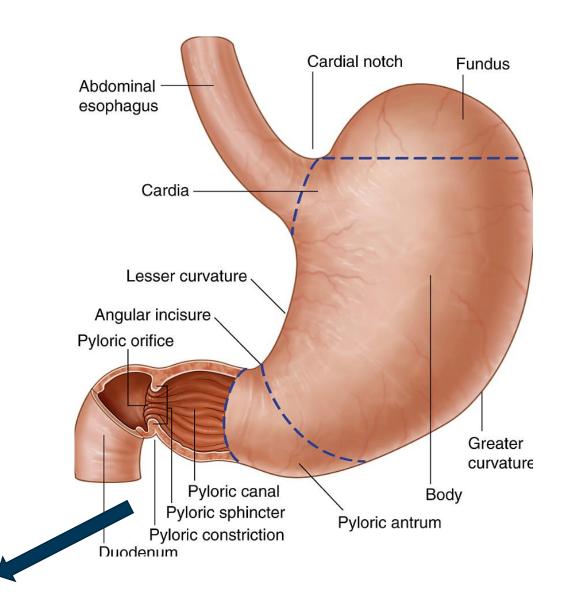
Fig.: Oesophageal constrictions

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STOMACH

- From: oesophagus
- To: duodenal bulbus
- Where: abdomen left hypochondrium and epigastric regions
- Parts: cardia, fundus, body, and pylorus; greater and lesser curvature; cardiac notch, angular incisure
- Layers: 4 notice the 3 layers of the muscular tunic
- Function: secretes digestive enzymes (eg. pepsin) –
 digestion down proteins and starches; breaks down
 large food particles into smaller pieces; hydrochloric
 acid immunobarrier, digestion
- Relation to the serosa: entirely intraperitoneal
- Organs syntopy: see the next slide

The pyloric part is the distal, funnel-like part of the stomach. Its proximal part, the pyloric **antrum**, leads into the narrow **pyloric canal** and **pyloric sphincter**, which controls the release of stomach contents into the duodenum (small intestine).



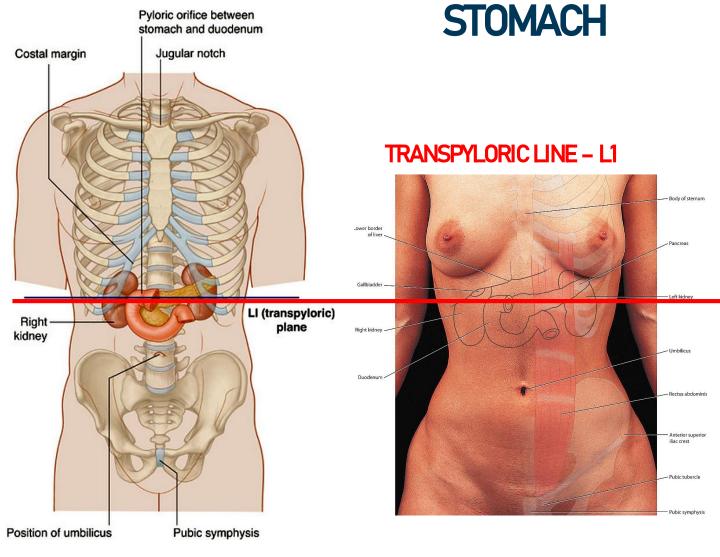
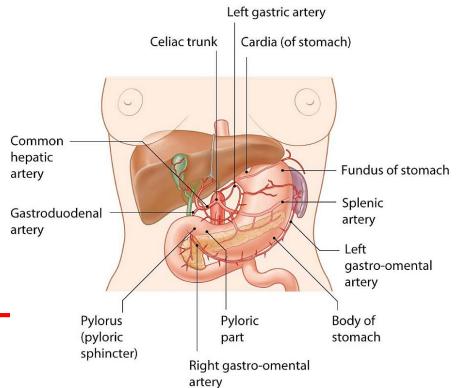


Fig. Abdomen—surface anatomy. Transpyloric line – L1 = 9th costal cartilages



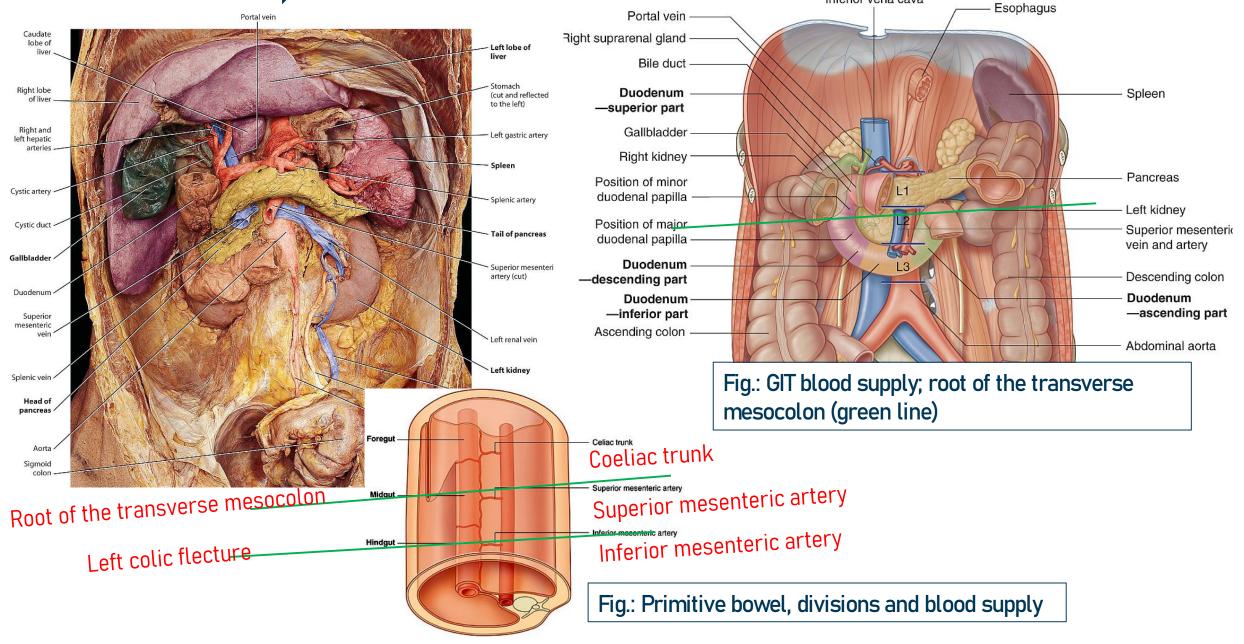
Arterial supply: celiac trunk and its branches—the left gastric, splenic, and common hepatic arteries. Venous drainage: portal vein.

Lymphatic drainage: celiac nodes, and node groups adjacent to the spleen and pankreas.

Sensory and autonomic (parasympathetic and sympathetic) innervation of the stomach is provided by the celiac plexus.

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SMALL INTESTINE, arteries



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Inferior vena cava

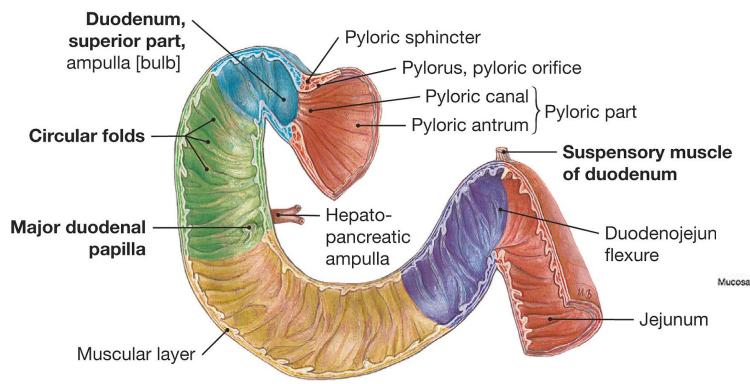
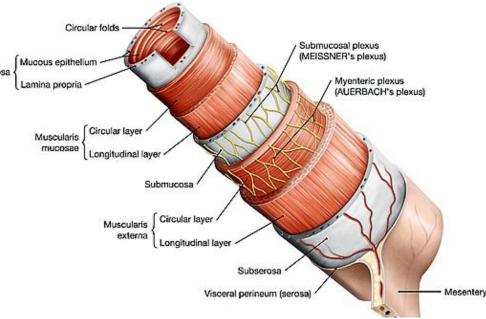


Fig.: Duodenum, frontal section; anterior view. The inner relief of the duodenum shows circular mucosal folds (KERCKRING's folds) similar to other parts of the small intestine. The descending part contains the major duodenal papilla (ampulla of VATER) at the entrance of the pancreatic duct (duct of WRSUNG) and the common bile duct (ductus choledochus), both of which usually merge to form the hepatopancreatic ampulla with its sphincter of ODDI.

SMALL INTESTINE, DUODENUM

The small intestine is the longest part of the gastrointestinal tract and extends from the pyloric orifice of the stomach to the ileocecal opening. It is approximately 6 to 7 m long with a narrowing diameter from beginning to end, consists of the duodenum, the jejunum, and the ileum.



SMALL INTESTINE

Resorption surface increased: microvilli, villi, circular folds

choledochus eviorious Pars superior dunden Picar circulares intestini tenuis (Kerckring folds) Ductus pancreation accessoriu Paoilla duodeni Para descendens duodeni duodenojejunalis Ductus pancredous Papilla duodeni major superior (pupilla of Vater) Stratum. longitudnule Tunica nuscularis circulare Para horizontalis Submocous duodeni

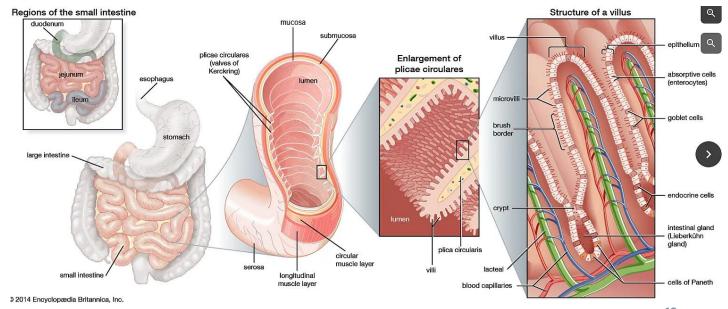
CF: Cholelithiasis, pancreatitis and/or jaundice

Microvilli, villi, circular folds

SMALL INTESTINE, DUODENUM

The superior part of the duodenum passes toward the right side of the abdomen from the pylorus. The descending part passes inferiorly to the right of vertebra L2. The hepatic and pancreatic ducts open into the duodenal lumen at the midpoint of the descending section through the major duodenal papilla and minor duodenal papilla. This is important clinically because damage to or pathology involving this part of the duodenum prevents hepatic and pancreatic secretions from entering the digestive system and thus inhibits digestion.

L2: duodenal window



SMALL INTESTINE, DUODENUM

The duodenojejunal junction is attached to the aorta near the origin of the superior mesenteric artery by a peritoneal fold, and some muscle fibers from the diaphragm (suspensory muscle of duodenum), together referred to as ligament of TREITZ. It passes posterior to the pancreas and anterior to the left renal vein. It serves as landmark for the duodenojejunal junction and can be associated with a barrier for endoscopic catheter advancement.

! Into the descending duodenum open the common bile and the pancreatic ducts!

Structure/Function

Developmental Origin	Parts of the Duodenum	Blood Supply	Lymphatic Drainage	
Foregut	Superior	Arteries: Celiac trunk: right gastric and right gastro-epiploic artery. Veins: directly into hepatic portal vein. portal vein		
	Descending , superior to major duodenal papilla	Arteries: Celiac trunk: superior pancreaticoduodenal artery (from gastroduodenal artery). Veins: superior pancreaticoduodenal vein via gastroduodenal vein into hepatic portal vein. portal vein	Celiac nodes	
Midgut	Descending, inferior to major duodenal papilla	Arteries: Superior mesenteric artery (SMA): inferior pancreaticoduodenal artery.	Superior mesenteric nodes	
	Horizontal Ascending	Veins: inferior pancreaticoduodenal vein via superior mesenteric vein into hepatic portal vein. portal vein		

Lymphatic drainage is to the lymph node group near the head of the pancreas.

MR enterography
T2, weighted imaging

Liver

Stomach

Pancreas

Jejunum

Mesentery

lleum

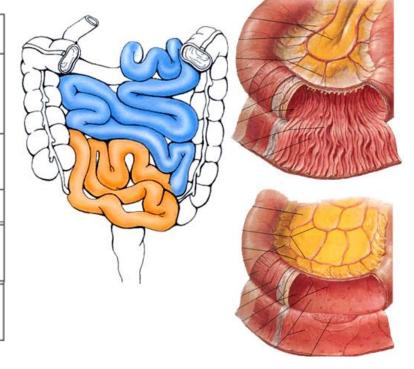
Urinary bladder

SMALL INTESTINE, JEJUNOILEUM

Villi, small and large intestine https://www.britannica.com/science/small-intestine

Features of the Jejunum and Ileum

Jejunum		Ileum
Length (fraction of combined 3-5 m total)	2/5	3/5
Location	Umbilical region, below left side of transverse mesocolon	Pubic region and groin; usually extends into pelvis
Diameter	2-4 cm	2-3 cm
Vasa recta (small mesenteric vessels)	Long	Short Lymphatic aggregates
Mucosal circular folds (plicae circulares)	Larger, numerous, closely set	Smaller, widely separated to absent distally



Blood supply: superior mesenteric artery

Venous drainage: portal vein

Lymph nodes: mesenterial

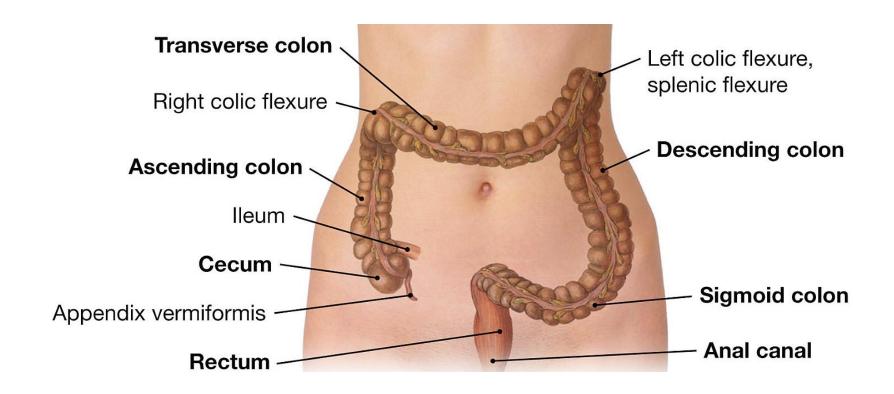
Innervation: splanchnic nerves, CN X

The ileum joins the large intestine at the ileocecal fold, a sphincter-less valve through which the bolus of food passes into the first part of the large intestine—the cecum.

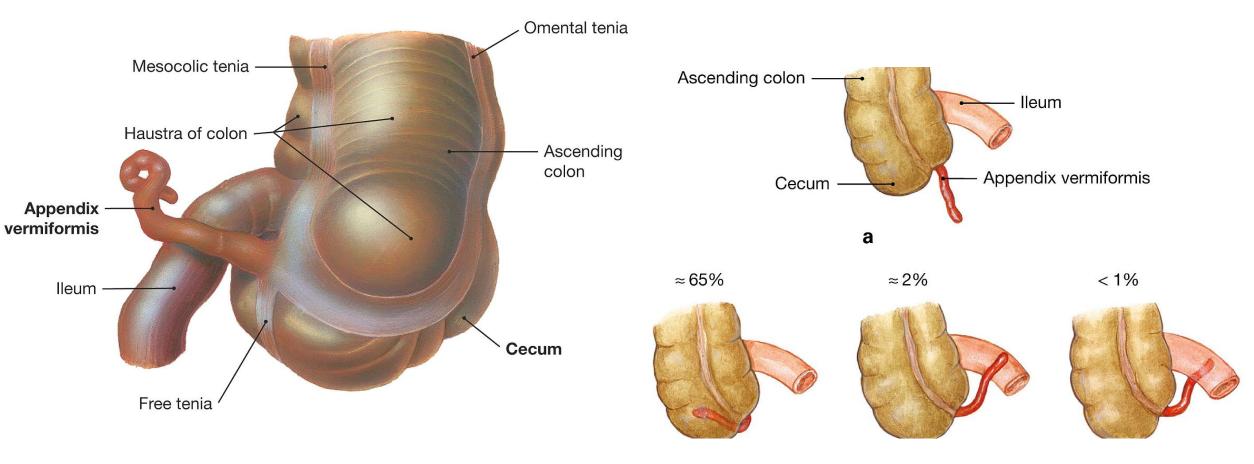
LARGE INTESTINE

The large intestine (large bowel) extends from the ileocecal fold to the anus and is approximately 1.5 m long. It consists of the **cecum**, **appendix**, **colon** (which has four parts — ascending, transverse, descending, and sigmoid colon), **rectum**, and **anal canal**. Parts are intraperitoneal (caecum, appendix; transverse and sigmoid colon, upper rectum); others are mesoperitoneal (ascending and descending colon) or subperitoneal (lower rectum and anus).

Distinctive features:
semilunar folds
taeniae
epiploic appendices
haustra



LARGE INTESTINE



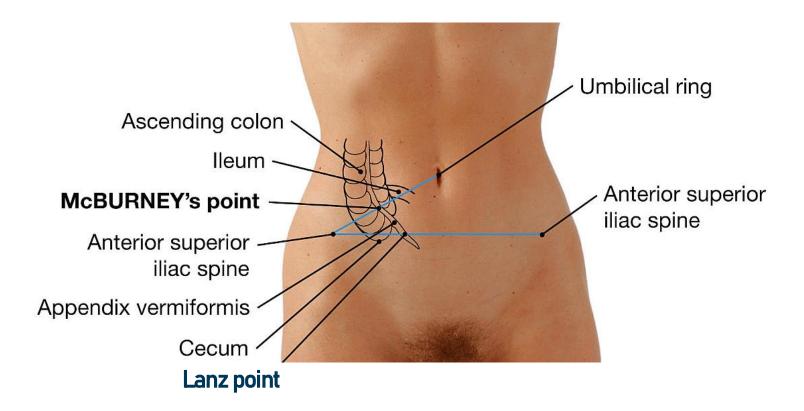
Distinctive features:

semilunar folds taeniae epiploic appendices haustra

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Vermiform appendix

INTRAPERITONEALI



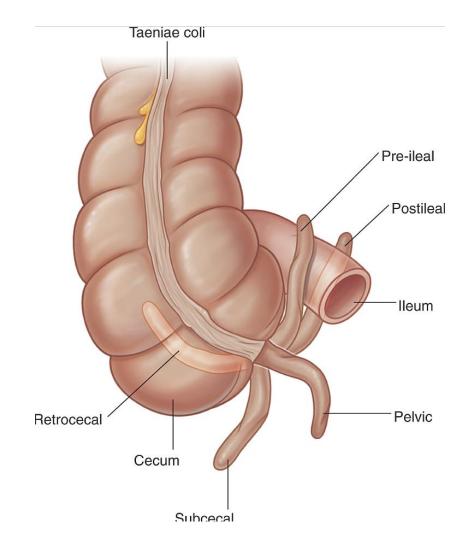
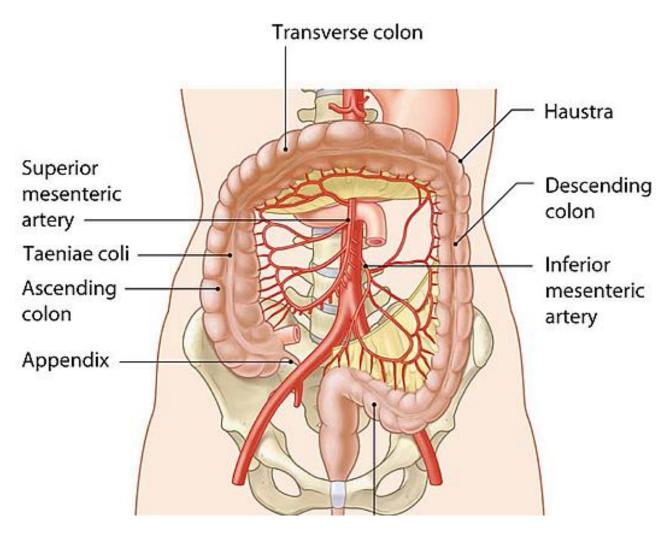
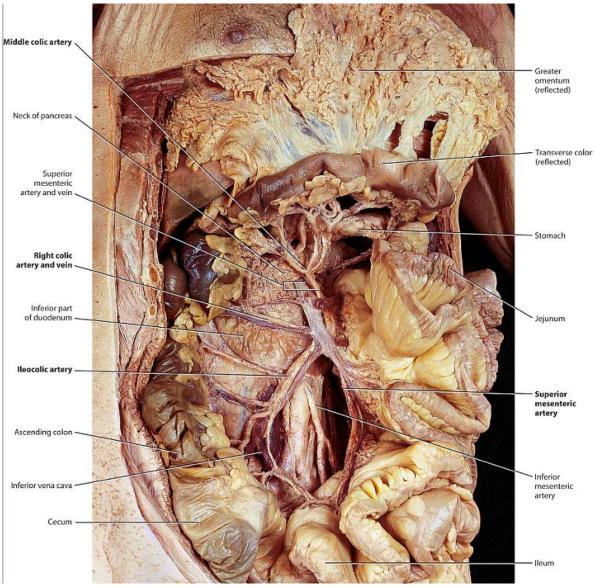


Fig.: Vermiform appendix, possible positions

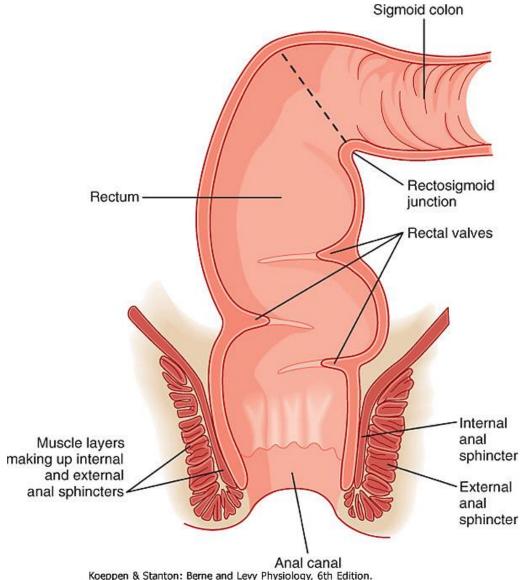
LARGE INTESTINE

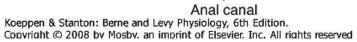


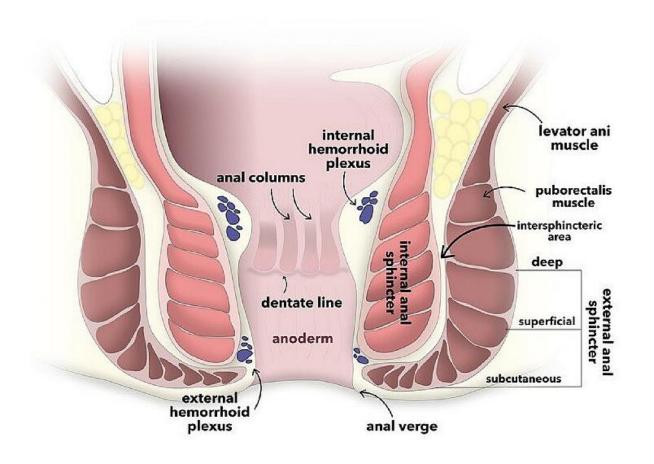


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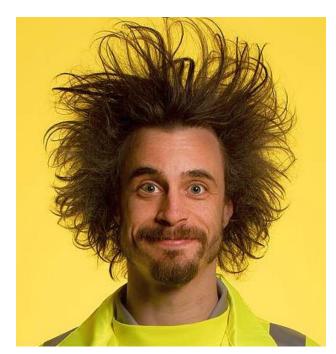
RECTUM











One more time?! Try our video!