ANATOMY OF THE DIGESTIVE SYSTEM

PART II

- Liver
- Gallbladder
- Pancreas
- Peritoneum
- Spleen
- Vessels
- Nerves

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Approximately 1500 g

2.5% of adult body weight

On the right side

Crosses midline toward the left nipple.

Right hypochondrium & upper epigastrium. Extends into left hypochondrium.

1. LIVER

largest gland in the body, second largest organ
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largest gland in the body, second largest organ
Except for fat, all nutrients absorbed from the digestive tract are initially conveyed to the liver by **portal venous system**.
In addition to its many metabolic activities

- Stores glycogen.
- Secretes bile.
  aids in the emulsification of fat.
Bile passes from the liver via the biliary ducts right and left hepatic ducts join to form common hepatic duct that unites with cystic duct to form (common) bile duct.

Liver produces bile continuously; between meals accumulated stored concentrated in the gallbladder.

When food arrives in the duodenum, gallbladder sends concentrated bile through the biliary ducts to the duodenum.
convex diaphragmatic surface anterior, superior, and some posterior relatively flat or even concave visceral surface posteroinferior separated anteriorly by its sharp inferior border that follows the right costal margin.
Visceral surface covered with visceral peritoneum except
- in the fossa for the gallbladder
- at the porta hepatis (gateway to the liver).

**Porta hepatis**

**point of entry into the liver for hepatic arteries portal vein**, and the exit point for hepatic ducts.
ASSOCIATED LIGAMENTS OF THE LIVER

FALCIFORM LIGAMENT
Liver attached to anterior abdominal wall

Right lobe

Left lobe

Diaphragm

Falciform ligament

Gallbladder
Additional folds of peritoneum connect the liver to:

- Stomach: **Hepatogastric ligament**
- Duodenum: **Hepatoduodenal ligament**
- Diaphragm: **Right & left triangular ligaments**

**Anterior & posterior coronary ligaments**
Surrounded by visceral peritoneum except for a small area of the liver against the diaphragm.

**Bare area**

- Coronary ligament
- Falciform ligament
- Left triangular ligament
- Right triangular ligament
- Gastrohepatic ligament

**Labels:**
- R.T.L
- R.C.L
- B.A
divided into right and left lobes by fossae for the gallbladder & inferior vena cava.

quadrate and caudate lobes
**Quadrate lobe**
- left by fissure for ligamentum teres
- right by the fossa for the gallbladder.
- Functionally it is related to the left lobe of the liver.

**Caudate lobe**
- left by the fissure for ligamentum venosum
- right by the groove for the inferior vena cava.
2. GALL BLADDER & THE BILIARY DUCTS

- a pear-shaped sac lying on the visceral surface of the right lobe of the liver in a fossa between the right and quadrate lobes

- rounded end **fundus of gallbladder**

- major part in the fossa **body of gallbladder**
  - which may be against transverse colon & superior part of the duodenum

- narrow part **neck of gallbladder**
In its natural position

- body of the gallbladder lies anterior to superior part of duodenum
- its neck and cystic duct are immediately superior to the duodenum.
The pear-shaped gallbladder can hold up to 50 mL of bile.

The biliary ducts convey bile from the liver to the duodenum.

Bile is produced continuously by the liver and stored and concentrated in the gallbladder, which releases it intermittently when fat enters the duodenum.

Bile emulsifies the fat so that it can be absorbed in the distal intestine.
The bile duct (formerly called the common bile duct) forms by the union of the cystic duct and common hepatic duct. The bile duct descends posterior to the superior part of the duodenum and lies in a groove on the posterior surface of the head of the pancreas.
3. PANCREAS

Lies mostly posterior to the stomach
Extends across the posterior abdominal wall
Duodenum on the right, Spleen on the left
3. PANCREAS

produces:

- Exocrine secretion (pancreatic juice from the acinar cells) that enters the duodenum through the main and accessory pancreatic ducts.

- Endocrine secretions (glucagon & insulin from the pancreatic islets [of Langerhans]) that enter the blood.
3. PANCREAS

(secondarily) retroperitoneal except for a small part of its tail

1. **Head**
2. **Uncinate process**
3. **Neck**
4. **Body**
5. **Tail**

The head of pancreas lies within the C-shaped concavity of the duodenum.

**Uncinate process**

- Projects from the lower part of the head
- passes posterior to the superior mesenteric vessels.
Neck of pancreas anterior to superior mesenteric vessels.

Posterior to the neck of the pancreas superior mesenteric & splenic veins join to form the portal vein.
Tail of pancreas passes between layers of **spleenorenal ligament**.
The main pancreatic duct begins in the tail of the pancreas. It passes to the right through the body of the pancreas. After entering the head of the pancreas, it turns inferiorly. In the lower part of the head of the pancreas, it joins the bile duct.

**hepatopancreatic ampulla (ampulla of Vater)** enters descending (second) part of the duodenum at the major duodenal papilla. Surrounding the ampulla, the sphincter of ampulla (sphincter of Oddi), a collection of smooth muscle.

The accessory pancreatic duct empties into the duodenum just above the major duodenal papilla at the **minor duodenal papilla**.
BILIARY DUCTS

Gallbladder

Right hepatic duct

Left hepatic duct

Common hepatic duct

Cystic duct

Bile duct

Descending part of duodenum

Main pancreatic duct

Needle

Common hepatic duct

Cystic duct

Bile duct

Descending part of duodenum
4. SPLEEN

most vulnerable abdominal organ.

located @ superolateral part of left upper quadrant (LUQ) left hypochondrium

enjoys protection of the inferior thoracic cage.
4. SPLEEN

**connected to**
greater curvature of the stomach by **gastrosplenic ligament**
contains the short gastric and gastro-omental vessels
left kidney by **splenorenal ligament** contains the splenic vessels.
4. SPLEEN

surrounded by visceral peritoneum except in the area of the hilum on the medial surface of the spleen.

**splenic hilum**

entry point for the splenic vessels and occasionally the tail of the pancreas reaches this area.
Participates in the body's defense system as a site of lymphocyte (white blood cell) proliferation and of immune surveillance & response. To accommodate these functions, the spleen is a soft, vascular (sinusoidal) mass with a relatively delicate fibroelastic capsule. The spleen normally contains a large quantity of blood that is expelled periodically into the circulation by the action of the smooth muscle in its capsule and trabeculae.
Covering and Lining Membranes

Parietal peritoneum
Visceral peritoneum

Serous membranes line body cavities closed to the exterior.
Abdominal viscera either suspended in the peritoneal cavity by folds of peritoneum (mesenteries) intraperitoneal or outside the peritoneal cavity. Retroperitoneal: only one surface or part of one surface covered by peritoneum.
**Parietal peritoneum**
innervated by somatic afferents carried in branches of the associated spinal nerves and is therefore sensitive to well-localized pain.

**Visceral peritoneum**
innervated by visceral afferents that accompany autonomic nerves (sympathetic and parasympathetic) back to the central nervous system.
continues inferiorly into the pelvic cavity.

- contains a thin film of peritoneal fluid.
- composed of water, electrolytes, and other substances derived from interstitial fluid in adjacent tissues.
- lubricates peritoneal surfaces, enabling viscera to move over each other without friction, and allowing the movements of digestion.

**Large area**

**Spread of diseases**

Administering certain types of treatment and a number of procedures.
Omental bursa continuous with the greater sac through an opening

**Omental (epiploic) foramen**
divided into

**Greater sac:** begins @ diaphragm. Most of the peritoneal cavity.

**Omental bursa (Lesser sac):** posterior to stomach & liver
Surrounding the omental (epiploic) foramen numerous structures covered with peritoneum.

- portal vein, hepatic artery proper, and bile duct anteriorly
- inferior vena cava posteriorly
- caudate lobe of the liver superiorly
- first part of the duodenum inferiorly.
GREATER OMENTUM

- Attaches to greater curvature of the stomach & first part of the duodenum.
- Drapes inferiorly over transverse colon & coils of the jejunum and ileum.
- Becomes adherent to the peritoneum on the superior surface of the transverse colon & anterior layer of the transverse mesocolon before arriving at the posterior abdominal wall.
Mesenteries

peritoneal folds that attach viscera to the posterior abdominal wall.

allow some movement and provide a conduit for vessels, nerves, and lymphatics to reach the viscera

Mesentery

associated with parts of small intestine

Transverse mesocolon

associated with transverse colon

Sigmoid mesocolon

associated with sigmoid colon
from lesser curvature of the stomach & first part of the duodenum to inferior surface of the liver.
divided into:
medial hepatogastric ligament
lateral hepatoduodenal ligament.
PERITONEAL LIGAMENTS

consist of two layers of peritoneum connect two organs to each other or attach an organ to the body wall may form part of an omentum. usually named after the structures being connected.

For example,

**splenorenal ligament** connects the left kidney to the spleen and **gastrophrenic ligament** connects the stomach to the diaphragm.
**Portal vein** final common pathway for the transport of venous blood from the spleen, pancreas, gallbladder, and the abdominal part of the gastrointestinal tract.

formed by union of **splenic vein** & **superior mesenteric vein** posterior to the neck of the pancreas.
Arterial blood is supplied mainly by the coeliac artery to the stomach, pancreas, spleen and liver and by the mesenteric arteries to the intestines.
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The duodenum is supplied by branches of the superior mesenteric artery and those of the coeliac trunk.

The jejunum and ileum are supplied by the branches of the superior mesenteric artery.
7. VESSELS & NERVES OF THE GASTROINTESTINAL SYSTEM

**ASCENDING COLON**
several branches from the superior mesenteric artery such as right colic artery, ileocolic artery, etc.

**TRANSVERSE COLON**
branches from the superior mesenteric artery and left colic artery; a branch of the inferior mesenteric artery.

descending colon.

Sigmoidal arteries from inferior mesenteric artery.
The arterial supply to the rectum and anal canal from **superior to inferior** branches from:

- inferior mesenteric artery
- internal iliac artery
- internal pudendal artery (a branch of the internal iliac artery).
7. VESSELS & NERVES OF THE GASTROINTESTINAL SYSTEM
Venous blood drains from the stomach, pancreas and spleen via the hepatic portal vein into the liver, where the products of digestion undergo further processing and detoxification.

Blood from the oesophagus and rectum (middle & inferior parts) does not go through the liver but drains directly into the venous system.
7. VESSELS & NERVES OF THE GASTROINTESTINAL SYSTEM

**superior mesenteric vein** drains blood from small intestine, cecum, ascending colon, and transverse colon.

**inferior mesenteric vein** drains blood from rectum, sigmoid colon, descending colon, and splenic flexure.
7. VESSELS & NERVES OF THE GASTROINTESTINAL SYSTEM

**inferior mesenteric vein**

begins as the superior rectal vein and ascends, receiving tributaries from the sigmoid veins and the left colic vein.

**Inf. & middle rectal veins**

**Internal iliac vein**
**Foregut:** anterior part of the alimentary canal, from mouth to duodenum @ entrance of the bile duct.

**Midgut:** from distal half of 2\(^{nd}\) part of duodenum, to proximal two-thirds of the transverse colon.

**Hindgut:** distal third of the transverse colon and the splenic flexure, the descending colon, sigmoid colon, and rectum.
Abdominal viscera are innervated by both extrinsic and intrinsic components of the nervous system: **extrinsic innervation** receiving motor impulses from, and sending sensory information to, the central nervous system; **intrinsic innervation** regulation of digestive tract activities by a generally self-sufficient network of sensory and motor neurons (enteric nervous system).
send sensory information back to the central nervous system through **visceral afferent fibers** and receive motor impulses from the central nervous system through **visceral efferent fibers**. Visceral efferent fibers are part of sympathetic and parasympathetic parts of the autonomic division of the PNS.
posterior and anterior roots of the spinal cord
spinal nerves
sympathetic trunks
splanchnic nerves carrying sympathetic fibers
(thoracic, lumbar, and sacral)
parasympathetic pelvic prevertebral plexus and related ganglia vagus nerves [X]
**sympathetic system**
reduces blood flow to the gut and decrease secretions, motility and contractions.

**parasympathetic system**
leads to an increase in motility and secretion within the tract and relaxation of the gut sphincters.
important components in the innervation of the abdominal viscera

pass from sympathetic trunk or sympathetic ganglia associated with the trunk, to **prevertebral plexus and ganglia** anterior to the **abdominal aorta**
two different types

type of visceral efferent fiber they are carrying

**thoracic, lumbar, and sacral**

**splanchnic nerves**

carry preganglionic sympathetic fibers from sympathetic trunk to ganglia in the prevertebral plexus, and also visceral afferent fibers

**pelvic splanchnic nerves**

**(parasympathetic root)**

carry preganglionic parasympathetic fibers from anterior rami of S2, S3, and S4 spinal nerves to an extension of the prevertebral plexus in the pelvis (**inferior hypogastric plexus or pelvic plexus**).
3 major divisions of the abdominal prevertebral plexus & associated ganglia

- Celiac plexus
- Aortic plexus
- Superior hypogastric plexus
3 thoracic splanchnic nerves pass from sympathetic ganglia along the sympathetic trunk in the thorax to the prevertebral plexus and ganglia associated with the abdominal aorta in the abdomen:

- **greater splanchnic nerve** travels to the celiac ganglion in the abdomen, a prevertebral ganglion associated with the celiac trunk.
- **lesser splanchnic nerve** travels to the aorticorenal ganglion.
- **least splanchnic nerve** travels to the renal plexus.
**greater splanchnic nerve** travels to the celiac ganglion in the abdomen, a prevertebral ganglion associated with the celiac trunk.

**lesser splanchnic nerve** travels to the aorticorenal ganglion.

**least splanchnic nerve** travels to the renal plexus.
The abdominal prevertebral plexus receives:

- preganglionic parasympathetic and visceral afferent fibers from the vagus nerves [X];
- preganglionic sympathetic and visceral afferent fibers from the thoracic and lumbar splanchnic nerves;
- preganglionic parasympathetic fibers from the pelvic splanchnic nerves.
- Division of the visceral part of the nervous system
- A local neuronal circuit in the wall of the gastrointestinal tract.
- Consists of motor and sensory neurons organized into two interconnected plexuses.
- Associated nerve fibers that pass between the plexuses and from the plexuses to the adjacent tissue.