Digestive System

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Digestive System: Overview

The alimentary canal or gastrointestinal (GI) tract digests and absorbs food.

Alimentary canal – mouth, pharynx, esophagus, stomach, small intestine, and large intestine.

Accessory digestive organs – teeth, tongue, gallbladder, salivary glands, liver, and pancreas.
Mouth (ORAL CAVITY)

- Oral or buccal cavity:
  - Is bounded by lips, cheeks, palate, and tongue
  - Has the oral orifice as its anterior opening
  - Is continuous with the oropharynx posteriorly

- To withstand abrasions:
  - The mouth is lined with stratified squamous epithelium
  - The gums, hard palate, and dorsum of the tongue are slightly keratinized
A sagittal section showing the major components forming the boundaries of the oral cavity.

**Superior Boundary of the Oral Cavity**
- Hard palate
- Soft palate

**Pharyngeal tonsil**

**Posterior Boundary of the Oral Cavity**
- Uvula
- Palatine tonsil
- Root of the tongue
- Lingual tonsil

**Anterior and Lateral Boundary of the Oral Cavity**
- Labium, or lip
- Cheek
- Body of the tongue

**Inferior Boundary of the Oral Cavity**
- The geniohyoid and mylohyoid muscles supporting the floor of the mouth
Lips and Cheeks

- Have a core of skeletal muscles
  - Lips: orbicularis oris
  - Cheeks: buccinators
- Vestibule – bounded by the lips and cheeks externally and teeth and gums internally
- Oral cavity proper– area that lies within the teeth and gums
- Labial frenulum – median fold that joins the internal aspect of each lip to the gum
Oral cavity

A sagittal section of the oral cavity
Lips and Cheeks

- Superior lip (pulled upward)
- Superior labial frenum
- Gingivae
- Palatoglossal fold
- Fauces
- Palatopharyngeal fold
- Hard palate
- Soft palate
- Uvula
- Cheek
- Palatine tonsil
- Tongue (lifted up)
- Lingual frenum
- Molars
- Premolars
- Canine
- Incisors
- Opening of duct of submandibular gland
- Gingivae
- Inferior labial frenum
- Inferior lip (pulled down)
- Vestibule
Palate

- **Hard palate** – underlain by palatine bones and palatine processes of the maxillae
  - Assists the tongue in chewing
  - Slightly corrugated on either side of the raphe (midline ridge)

- **Soft palate** – mobile fold formed mostly of skeletal muscle
  - Closes off the nasopharynx during swallowing
  - Uvula projects downward from its free edge

- **Palatoglossal and palatopharyngeal arches** form the borders of the fauces
Tongue

- Occupies the floor of the mouth and fills the oral cavity when mouth is closed
- Functions include:
  ◦ Gripping and repositioning food during chewing
  ◦ Mixing food with saliva and forming the bolus
  ◦ Initiation of swallowing, and speech
- Intrinsic muscles change the shape of the tongue
- Extrinsic muscles alter the tongue’s position
- Lingual frenulum secures the tongue to the floor of the mouth
Superior surface bears three types of papillae

- Filiform – give the tongue roughness and provide friction
- Fungiform – scattered widely over the tongue and give it a reddish hue
- Circumvallate – V-shaped row in back of tongue

Sulcus terminalis – groove that separates the tongue into two areas:

- Anterior 2/3 residing in the oral cavity
- Posterior third residing in the oropharynx
Salivary Glands

- Produce and secrete saliva that:
  - Cleanses the mouth
  - Moistens and dissolves food chemicals
  - Aids in bolus formation
  - Contains enzymes that breakdown starch

- Three pairs of extrinsic glands — parotid, submandibular, and sublingual

- Intrinsic salivary glands (buccal glands) — scattered throughout the oral mucosa
(a) Lateral view with left mandibular body and ramus removed
Salivary Glands

- **Parotid** – lies anterior to the ear between the masseter muscle and skin
  - Parotid duct – opens into the vestibule next to the second upper molar
- **Submandibular** – lies along the medial aspect of the mandibular body
  - Its ducts open at the base of the lingual frenulum
- **Sublingual** – lies anterior to the submandibular gland under the tongue
  - It opens via 10-12 ducts into the floor of the mouth
Tooth Structure

- Enamel
- Dentin
- Dentinal tubules
- Pulp cavity (contains blood vessels and nerves)
- Gingiva (gum)
- Cementum
- Root canal
- Periodontal ligament
- Apical foramen
- Bone
Pharynx

- From the mouth, the oro- and laryngopharynx allow passage of:
  - Food and fluids to the esophagus
  - Air to the trachea
- Lined with stratified squamous epithelium and mucus glands
- Has two skeletal muscle layers
  - Inner longitudinal
  - Outer pharyngeal constrictors
Esophagus

- Muscular tube going from the laryngopharynx to the stomach
- Travels through the mediastinum and pierces the diaphragm
- Joins the stomach at the cardiac orifice
**Esophageal Characteristics**

- Esophageal mucosa – nonkeratinized stratified squamous epithelium
- The empty esophagus is folded longitudinally and flattens when food is present
- Glands secrete mucus as a bolus moves through the esophagus
- Muscularis changes from skeletal (superiorly) to smooth muscle (inferiorly)
Stomach

- Chemical breakdown of proteins begins and food is converted to chyme
- Cardiac region – surrounds the cardiac orifice
- Fundus – dome-shaped region beneath the diaphragm
- Body – midportion of the stomach
- Pyloric region – made up of the antrum and canal which terminates at the pylorus
- The pylorus is continuous with the duodenum through the pyloric sphincter
Stomach

Cardia
Fundus
Esophagus
Serosa
Muscularis externa
- longitudinal layer
- circular layer
- oblique layer
Body
Rugae of mucosa
Lesser curvature
Greater curvature
Pylorus
Duodenum
Pyloric sphincter (valve)
Pyloric canal
Pyloric antrum
Stomach

- Greater curvature – entire extent of the convex lateral surface
- Lesser curvature – concave medial surface
- Lesser omentum – runs from the liver to the lesser curvature
- Greater omentum – drapes inferiorly from the greater curvature to the small intestine
- Nerve supply – sympathetic and parasympathetic fibers of the autonomic nervous system
- Blood supply – celiac trunk, and corresponding veins (part of the hepatic portal system)
Small Intestine: Gross Anatomy

- Runs from pyloric sphincter to the ileocecal valve
- Has three subdivisions: duodenum, jejunum, and ileum
- The bile duct and main pancreatic duct:
  - Join the duodenum at the hepatopancreatic ampulla
  - Are controlled by the sphincter of Oddi
- The jejunum extends from the duodenum to the ileum
- The ileum joins the large intestine at the ileocecal valve
Large Intestine

- Has three unique features:
  - Teniae coli – three bands of longitudinal smooth muscle in its muscularis
  - Haustra – pocketlike sacs caused by the tone of the teniae coli
  - Epiploic appendages – fat-filled pouches of visceral peritoneum

- Is subdivided into the cecum, appendix, colon, rectum, and anal canal

- The saclike cecum:
  - Lies below the ileocecal valve in the right iliac fossa
  - Contains a wormlike vermiform appendix
Large Intestine

- Right colic (hepatic) flexure
- Transverse colon
- Superior mesenteric artery
- Haustrum
- Ascending colon
- Ileum
- Ileoceleal valve
- Cecum
- Vermiform appendix
- Rectum
- Anal canal
- External anal sphincter
- Left colic (splenic) flexure
- Transverse mesocolon
- Epiplioic appendages
- Descending colon
- Cut edge of mesentery
- Teniae coli
- Sigmoid colon
Colon

• Has distinct regions: ascending colon, hepatic flexure, transverse colon, splenic flexure, descending colon, and sigmoid colon
• The transverse and sigmoid portions are anchored via mesenteries called mesocolons
• The sigmoid colon joins the rectum
• The anal canal, the last segment of the large intestine, opens to the exterior at the anus
Three valves of the rectum stop feces from being passed with gas.

The anus has two sphincters:
- Internal anal sphincter composed of smooth muscle
- External anal sphincter composed of skeletal muscle

These sphincters are closed except during defecation.
Mesenteries of Digestive Organs

Figure 24.30d
Mesenteries of Digestive Organs

Figure 24.30b
Mesenteries of Digestive Organs

- Greater omentum
- Transverse colon
- Transverse mesocolon
- Descending colon
- Jejunum
- Mesentery
- Sigmoid mesocolon
- Sigmoid colon
- Ileum

Figure 24.30c
Accessory Organs

- Liver
- Pancreas
- spleen
- Gall bladder
Liver

- The largest gland in the body
- Superficially has four lobes – right, left, caudate, and quadrate
- The falciform ligament:
  - Separates the right and left lobes anteriorly
  - Suspends the liver from the diaphragm and anterior abdominal wall
- The ligamentum teres:
  - Is a remnant of the fetal umbilical vein
  - Runs along the free edge of the falciform ligament
The Liver Superior surface

- Right lobe
- Coronary ligament
- Left lobe
- Falciform ligament
- Round ligament (ligamentum teres)
- Gallbladder

(c) Anterior (parietal) surface
Surfaces of the Liver

(b) Anterior surface

(c) Posterior surface
Liver: Associated Structures

- The lesser omentum anchors the liver to the stomach
- The hepatic blood vessels enter the liver at the porta hepatis
- The gallbladder rests in a recess on the inferior surface of the right lobe
- Bile leaves the liver via
  - Bile ducts which fuse into the common hepatic duct
  - The common hepatic duct fuses with the cystic duct
  - These two ducts form the bile duct
Liver: Associated Structures

- Gallbladder
- Right and left hepatic ducts of liver
- Common hepatic duct
- Bile duct and sphincter
- Cystic duct
- Duodenum
- Hepatopancreatic ampulla and sphincter
- Accessory pancreatic duct
- Pancreas
- Jejunum
- Main pancreatic duct and sphincter
- Mucosa with folds
- Major duodenal papilla
The Gallbladder
Pancreas

- **Location**
  - Lies deep to the greater curvature of the stomach
  - The head is encircled by the duodenum and the tail abuts the spleen

- **Exocrine function**
  - Secretes pancreatic juice which breaks down all categories of foodstuff
  - Acini (clusters of secretory cells) contain zymogen granules with digestive enzymes

- **The pancreas also has an endocrine function** – release of insulin and glucagon
The Pancreas
Spleen location and parts

- Hepatoduodenal ligament
- Hepatogastric ligament
- Lesser omentum
- Lesser curvature
- Esophagus
- Cardia
- Diaphragm
- Liver
- Gallbladder
- Duodenum
- Right kidney
- Hepatic flexure of colon
- Right gastroepiploic artery
- Spleen
- Left gastroepiploic artery
- Splenic flexure of colon
- Greater curvature
- Greater omentum

(a) Stomach, anterior view
Spleen