



BIO 004 · HUMAN ANATOMY · SOLANO COMMUNITY COLLEGE

Week 5 Course Notes.

Digestive System

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The Alimentary Canal

The Digestive System, the Alimentary Canal

A reference for the alimentary canal video and lab. This page covers the wall of the digestive tube, the peritoneum, and the regions of the canal from the mouth to the anus, with the named features of the stomach and the intestines. The focus is on the structures and the job each one does.

- BY THE END**
1. Distinguish the alimentary canal from the accessory organs and name the four layers of its wall.
 2. Trace the pathway of food from the mouth to the anus.
 3. Identify the named features of the stomach, small intestine, and large intestine.

The Alimentary Canal, an Overview

The digestive system has two groups of organs. The alimentary canal is the continuous tube that food travels through; the accessory organs sit alongside it and empty their secretions in. This page covers the canal.

Digestive system	the organs that take in food and eliminate waste; the alimentary canal plus the accessory organs	Accessory organs	the teeth, tongue, salivary glands, liver, gallbladder, and pancreas; covered on their own sheet
Alimentary canal	the gastrointestinal tract; a continuous muscular tube from the mouth to the anus	Lumen	the open interior space of the tube, continuous with the outside world at the mouth and anus
Organs of the canal	the mouth, most of the pharynx, the esophagus, the stomach, the small intestine, and the large intestine	Length	about 16 to 23 feet in a living person, longer once muscle tone is lost

The Wall of the Alimentary Canal

From the lower esophagus to the anal canal, the wall of the tube is built from the same four layers, deep to superficial. Compare them.

LAYER	WHAT IT CONTAINS
Mucosa	the inner lining; an epithelium in contact with food, the lamina propria of areolar connective tissue beneath it, and a thin muscularis mucosae
Submucosa	areolar connective tissue with blood and lymphatic vessels, and the submucosal nerve plexus
Muscularis	usually an inner circular and an outer longitudinal layer of smooth muscle, with the myenteric nerve plexus between them
Serosa	the outermost layer; a serous membrane, also called the visceral peritoneum, replaced by a fibrous adventitia on the esophagus

Two nerve networks in the wall make up the enteric nervous system, the nerve supply of the gut.

Submucosal plexus	the nerve network in the submucosa that controls the secretions of the gut	Myenteric plexus	the nerve network between the muscle layers that controls the movement of the gut
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The Peritoneum

The peritoneum is the large serous membrane of the abdomen. Its folds anchor the digestive organs and carry their vessels and nerves.

Parietal peritoneum	the layer that lines the wall of the abdominal cavity	Peritoneal cavity	the slim, fluid-filled space between the parietal and visceral layers
Visceral peritoneum	the layer that covers the organs; it is the serosa of those organs	Retroperitoneal organs	organs behind the peritoneum, not within its cavity; the kidneys, pancreas, duodenum, and parts of the colon

Five large folds of peritoneum weave among the organs. Compare what each one connects.

FOLD	WHAT IT CONNECTS
Greater omentum	the largest fold; a fatty apron hanging from the stomach over the intestines
Lesser omentum	connects the stomach and duodenum to the liver, and carries vessels to the liver

FOLD	WHAT IT CONNECTS
Falciform ligament	attaches the liver to the anterior abdominal wall and the diaphragm
Mesentery	a fan-shaped fold binding the jejunum and ileum to the posterior abdominal wall
Mesocolon	binds the transverse and sigmoid colon to the posterior abdominal wall

The Mouth, Pharynx, and Esophagus

Food enters at the mouth, is swallowed through the pharynx, and travels the esophagus to the stomach.

Oral cavity	the mouth; bounded by the cheeks, the lips, the palate, and the tongue	Palatine and lingual tonsils	lymphatic tissue between the palatal arches and at the base of the tongue
Hard palate	the bony anterior roof of the mouth, formed by the maxillae and palatine bones	Pharynx	the funnel-shaped passage with three regions: the nasopharynx, oropharynx, and laryngopharynx
Soft palate	the muscular posterior roof of the mouth	Esophagus	the collapsible muscular tube, about 10 inches long, that carries food from the laryngopharynx to the stomach
Uvula	the finger-like projection of the soft palate that closes off the nasopharynx during swallowing	Esophageal hiatus	the opening in the diaphragm that the esophagus passes through
Fauces	the opening from the mouth into the oropharynx	Upper and lower esophageal sphincters	the rings of muscle that guard the top and bottom of the esophagus; the lower is also called the cardiac sphincter

The Stomach

The stomach is a J-shaped widening of the tube below the diaphragm. It is a mixing chamber and a holding reservoir.

Cardia	the region that surrounds the opening from the esophagus	Greater curvature	the convex inferior border of the stomach
Fundus	the rounded portion that bulges above and to the left of the cardia	Rugae	the folds of the inner stomach lining that flatten as the stomach fills
Body	the large central portion of the stomach	Gastric pits and glands	the pits in the stomach lining that lead to the gastric glands, the secreting glands of the stomach
Pyloric part	the region that connects the body to the duodenum; it has the pyloric antrum, pyloric canal, and pylorus	Muscularis of the stomach	three layers of smooth muscle, an inner oblique, a middle circular, and an outer longitudinal; one more than the rest of the tube
Pyloric sphincter	the ring of smooth muscle between the pylorus and the duodenum		
Lesser curvature	the concave superior border of the stomach		

The Small Intestine

The small intestine is the long, coiled region where most absorption happens. Its lining is folded again and again to expand the surface area.

Duodenum	the first and shortest region, about 12 inches, curving from the pyloric sphincter; mostly retroperitoneal	Circular folds	the plicae circulares; permanent ridges of the mucosa and submucosa that increase surface area
Jejunum	the middle region, about 3 feet long	Villi	finger-like projections of the mucosa that give the lining a velvety look and greatly increase surface area
Ileum	the longest region, about 6 feet, joining the large intestine at the ileocecal sphincter	Lacteal	the lymphatic capillary inside each villus that absorbs dietary fats
Ileocecal sphincter	the valve of smooth muscle where the ileum meets the large intestine		

Microvilli	the microscopic projections of the absorptive cells that form the brush border
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The Large Intestine

The large intestine is the wider, final region of the canal. It absorbs water and forms and stores the feces.

Cecum	the pouch at the start of the large intestine, just below the ileocecal valve	Internal and external anal sphincters	the involuntary smooth muscle and voluntary skeletal muscle that guard the anus
Vermiform appendix	the narrow, worm-like tube of lymphatic tissue attached to the cecum	Teniae coli	three thickened bands of longitudinal muscle running the length of the colon
Colon	the long portion with four parts: the ascending, transverse, descending, and sigmoid colon	Haustra	the pouches that give the colon its puckered appearance, formed by the teniae coli
Rectum	the straight portion, about 6 inches, anterior to the sacrum and coccyx	Omental appendices	small fat-filled pouches of peritoneum attached to the teniae coli
Anal canal	the last 2 to 3 cm of the tract, ending at the anus		

The Pathway of Food

Food moves through the alimentary canal in one direction, through each region in turn.

- 1 **Mouth** food is taken in, chewed, and mixed with saliva
- 2 **Pharynx** the swallowed food passes through the oropharynx and laryngopharynx
- 3 **Esophagus** muscular contractions carry the food down to the stomach
- 4 **Stomach** food is churned and held as it becomes a liquid
- 5 **Small intestine** the duodenum, jejunum, and ileum, where most absorption occurs
- 6 **Large intestine** the cecum, colon, rectum, and anal canal, where water is absorbed and feces form
- 7 **Anus** the feces are eliminated

Common Disorders of the Alimentary Canal

Compare the common disorders of the canal by the structure each one affects.

DISORDER	WHAT IT IS
Gastroesophageal reflux disease (GERD)	stomach contents flow back up through a weak lower esophageal sphincter and irritate the esophagus
Hiatal hernia	part of the stomach pushes up through the esophageal hiatus of the diaphragm
Peptic ulcer	an eroded sore in the wall of the stomach or duodenum
Appendicitis	inflammation of the vermiform appendix; rupture can spread infection to the peritoneum
Diverticulosis	small pouches that bulge outward through weak spots in the colon wall
Inflammatory bowel disease	chronic inflammation of the intestinal wall, as in Crohn disease and ulcerative colitis
Hemorrhoids	swollen, dilated veins in the wall of the anal canal and rectum
Colorectal cancer	a malignant tumor of the colon or rectum

The location of a problem names the symptom

Because each region of the canal has its own job, where a problem sits predicts what the patient feels. A weak **lower esophageal sphincter** brings heartburn behind the breastbone; an inflamed **appendix** brings pain to the lower right abdomen.

The four-layer wall explains how a problem deepens. A **peptic ulcer** begins in the mucosa, and the danger is that it erodes through the submucosa and muscularis. If it reaches the serosa and perforates, the contents of the lumen spill into the peritoneal cavity.

Study questions

Work on answering these in writing, in your own words. They are the questions to bring to class, and good practice for the reasoning the exams ask for.

1. Name the four layers of the gut wall from the lumen outward, and state the tissue that dominates each.
2. Compare the stomach, small intestine, and large intestine by one structural feature each that suits its job.
3. Trace a bite of food through every named segment of the alimentary canal in order, mouth to anus.
4. Where are the major sphincters of the alimentary canal, and what does each one separate?

The Accessory Digestive Organs

Accessory Organs of Digestion

A reference for the accessory digestive organs video and lab. This page covers the teeth and tongue, the salivary glands, the liver, the gallbladder and the path of bile, and the pancreas. The focus is on the structures and the job each one does.

- BY THE END**
1. Name the six accessory digestive organs and the role of each.
 2. Identify the structures of the liver, gallbladder, and pancreas.
 3. Trace the path of bile from the liver to the small intestine.

The Accessory Organs, an Overview

The accessory digestive organs are not part of the food tube itself. The teeth and tongue work on food in the mouth; the rest add secretions to the canal through ducts.

Accessory digestive organs	the teeth, tongue, salivary glands, liver, gallbladder, and pancreas	Glandular accessory organs	the salivary glands, liver, and pancreas, which produce secretions delivered through ducts
Teeth and tongue	the accessory organs that make direct contact with food in the mouth	Storage organ	the gallbladder, which stores and concentrates bile until it is needed

The Teeth and Tongue

The teeth and the tongue prepare food in the mouth, breaking it down and moving it for chewing and swallowing.

Teeth	the accessory organs that cut and grind food during chewing	Intrinsic tongue muscles	muscles within the tongue that alter its shape and size for speech and swallowing
Tongue	a digestive organ of skeletal muscle covered with mucous membrane; it forms the floor of the mouth	Lingual frenulum	the midline fold of mucous membrane anchoring the tongue to the floor of the mouth
Extrinsic tongue muscles	muscles that originate outside the tongue and move it side to side and in and out	Papillae	the projections on the tongue surface that carry taste buds and aid the grip on food
		Lingual glands	small glands in the tongue that secrete mucus and watery fluid

The Salivary Glands

Saliva keeps the mouth moist, cleanses it, and begins the breakdown of food. Three large pairs of glands produce most of it. Compare them.

GLAND	LOCATION		
Parotid glands	anterior and inferior to the ears, between the skin and the masseter muscle; the duct opens by the second upper molar		
Submandibular glands	in the floor of the mouth, along the inner side of the mandible; the ducts open near the lingual frenulum		
Sublingual glands	beneath the tongue, above the submandibular glands; the ducts open onto the floor of the mouth		
Minor salivary glands	small labial, buccal, palatal, and lingual glands scattered through the lining of the mouth	Saliva	the watery secretion that moistens, cleanses, and lubricates food and begins its breakdown

The Liver

The liver is the largest gland in the body. It sits below the diaphragm, mostly in the upper right abdomen, and it makes bile.

Liver	the large gland below the diaphragm; it produces bile	Quadrate and caudate lobes	two smaller lobes on the posterior and inferior surface
Right and left lobes	the two principal lobes of the liver, separated by the falciform ligament		

Falciform ligament	the fold of peritoneum that suspends the liver from the anterior abdominal wall and diaphragm	Hepatic sinusoids	the wide, leaky capillaries that run between the plates of hepatocytes
Ligamentum teres	the round ligament; a fibrous cord in the free edge of the falciform ligament, a remnant of the fetal umbilical vein	Bile canaliculi	the tiny channels between hepatocytes that collect the bile they make
Hepatocytes	the functional cells of the liver, arranged in plates called hepatic laminae	Portal triad	the trio found at the corner of each liver lobule: a bile duct, a branch of the hepatic artery, and a branch of the hepatic portal vein

The Gallbladder and the Path of Bile

The gallbladder is a small sac on the underside of the liver that stores bile. Bile travels a branching set of ducts to reach the small intestine.

Gallbladder	the pear-shaped sac on the posterior surface of the liver that stores and concentrates bile	Common bile duct	the duct formed where the common hepatic duct and the cystic duct join
Fundus, body, and neck	the three regions of the gallbladder, from the broad inferior end to the tapered superior end	Hepatopancreatic ampulla	the ampulla of Vater, the short widened duct where the bile duct and pancreatic duct meet before the duodenum
Cystic duct	the duct that carries bile to and from the gallbladder		

Bile drains away from the liver cells along a path of widening ducts to reach the duodenum.

- 1 **Bile canaliculi** tiny channels between hepatocytes collect the bile
- 2 **Hepatic ducts** the bile is gathered into the right and left hepatic ducts, which merge into the common hepatic duct
- 3 **Cystic duct and gallbladder** bile may detour into the gallbladder for storage through the cystic duct
- 4 **Common bile duct** the common hepatic and cystic ducts join to form the common bile duct
- 5 **Hepatopancreatic ampulla** the common bile duct joins the pancreatic duct at the ampulla
- 6 **Duodenum** bile enters the small intestine at the major duodenal papilla, past the sphincter of Oddi

The Pancreas

The pancreas lies behind the stomach. It is both an exocrine gland, secreting into the duodenum, and an endocrine gland.

Pancreas	the gland posterior to the stomach, retroperitoneal in position	Major duodenal papilla	the raised opening in the duodenal lining where the hepatopancreatic ampulla delivers bile and pancreatic juice
Head, body, and tail	the three regions of the pancreas, from the wide end in the curve of the duodenum to the tapered end	Sphincter of Oddi	the muscular ring that controls flow through the hepatopancreatic ampulla into the duodenum
Pancreatic duct	the main duct, also called the duct of Wirsung; it joins the common bile duct	Acini	the exocrine clusters of the pancreas that produce pancreatic juice; about 99 percent of the gland
Accessory duct	the smaller duct, also called the duct of Santorini, that empties separately into the duodenum	Pancreatic islets	the endocrine clusters of the pancreas that produce hormones; about 1 percent of the gland

Common Disorders of the Accessory Organs

Compare the common disorders of the accessory organs by the structure each one affects.

DISORDER	WHAT IT IS
Gallstones	hardened deposits that form in the gallbladder and can block the bile ducts

DISORDER	WHAT IT IS
Cholecystitis	inflammation of the gallbladder, often caused by a blocking gallstone
Hepatitis	inflammation of the liver, commonly from a viral infection
Cirrhosis	the replacement of healthy liver tissue with scar tissue, with loss of liver function
Jaundice	a yellowing of the skin and eyes from a buildup of bilirubin, often from liver or bile duct disease
Pancreatitis	inflammation of the pancreas
Mumps	a viral infection that inflames and enlarges the parotid glands

Shared ducts, shared problems

The **bile duct** and the **pancreatic duct** meet at the hepatopancreatic ampulla before they reach the duodenum. Because they share that final passage, a **gallstone** lodged at the ampulla can block bile and pancreatic juice at once, which is one way gallstones trigger pancreatitis.

The liver's blood supply is unusual. It receives nutrient-rich blood from the **hepatic portal vein** as well as oxygenated blood from the hepatic artery. That heavy blood flow filters the body's nutrients, but it also makes the liver a common site for cancer to spread to.

Study questions

Work on answering these in writing, in your own words. They are the questions to bring to class, and good practice for the reasoning the exams ask for.

1. Trace the path of bile from where it is made to where it enters the duodenum, naming each duct it passes through.
2. The pancreas has both an exocrine and an endocrine role. Name the structure responsible for each and where its product goes.
3. Why does the liver receive blood from two different sources? Name them and state what each one delivers.
4. After a gallbladder is removed, bile still reaches the intestine. Explain how, using the duct anatomy.