

THE GASTROINTESTINAL TRACT

The alimentary system, also referred to as the gastrointestinal system, has three main functions. The first function begins at the mouth, where the animal swallows the food and the food travels to the stomach to begin the process of digestion. The second function is the absorption of nutrients, which takes place in the intestines. The third function of the gastrointestinal system is the elimination of waste from the anus. In this chapter we will trace the flow of food through the gastrointestinal (GI) tract, learn about the various structures involved, and learn their individual functions.



The Pathway of Food

Figure 4.1 shows a summary of the path that food takes through the gastrointestinal tract. Keep in mind that the process of digestion is very complex. We have simplified the anatomy and physiology for introductory learning purposes.

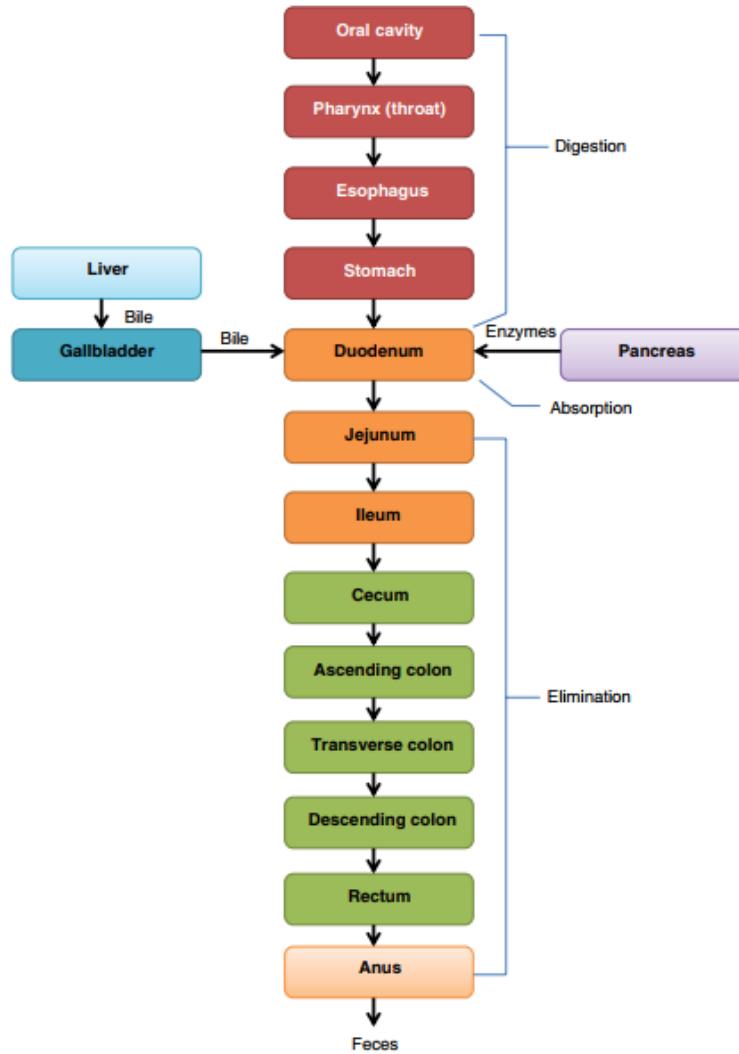


Figure 4.1 The pathway of food through the gastrointestinal tract.

The Oral Cavity

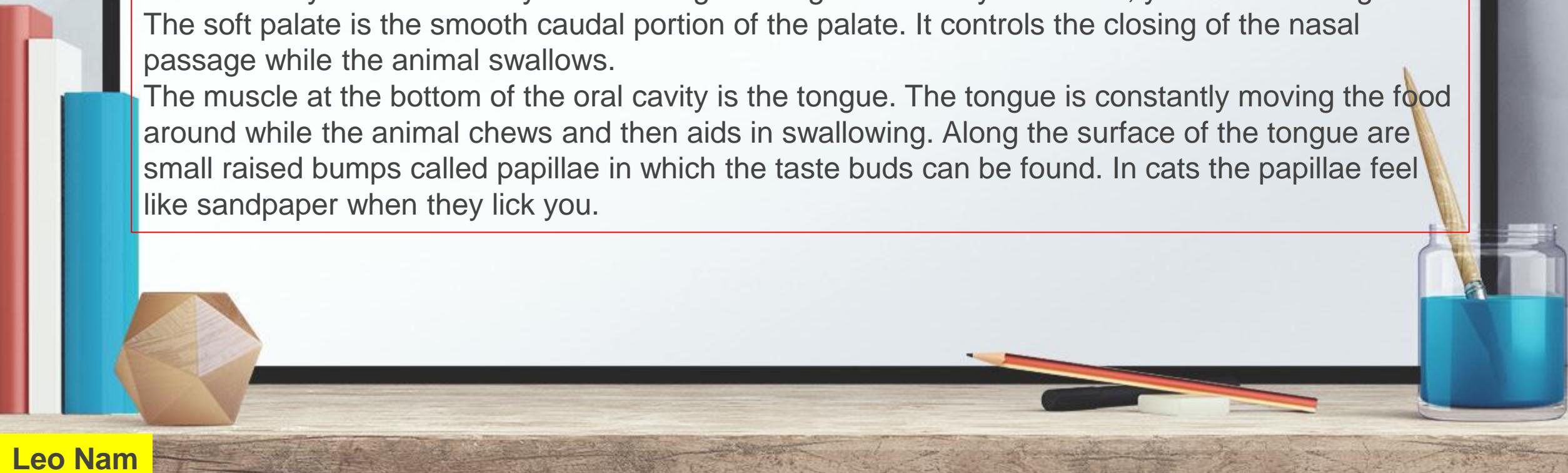
The pathway of food through the gastrointestinal system begins at the oral cavity, which consists of the lips, mouth, cheeks, teeth, tongue, and salivary glands.

Once food enters the mouth, the function of digestion begins. While the teeth are chewing the food, the salivary glands are releasing saliva to begin the digestive process.

The roof of the mouth is termed the palate and is actually divided into two parts, the hard palate and the soft palate. The hard palate of animals resembles that of humans in that they have ridges on their hard palate called rugae which help increase the surface area for absorption and secretion. If you were to run your own tongue along the roof of your mouth, you'd feel the rugae.

The soft palate is the smooth caudal portion of the palate. It controls the closing of the nasal passage while the animal swallows.

The muscle at the bottom of the oral cavity is the tongue. The tongue is constantly moving the food around while the animal chews and then aids in swallowing. Along the surface of the tongue are small raised bumps called papillae in which the taste buds can be found. In cats the papillae feel like sandpaper when they lick you.



The Oral Cavity

The arrangement of the teeth in the mouth is referred to as dentition or an arcade. Just as with humans, animals have a temporary set of teeth and a permanent set of teeth. For example, in dogs think of it as having puppy teeth and adult teeth. The temporary dentition is referred to as deciduous dentition.

Deciduous dentition isn't necessarily the same as the permanent dentition in some animals. When animals reach a certain age, it's important to check for any retained temporary teeth that were not shed because then they'll need to be pulled (Figure 4.2).



Figure 4.2 Retained deciduous canine tooth next to the permanent canine tooth.



There are four different groups of teeth that are divided based on shape and function. The number of each group of teeth differs in each species, but the function is the same.

Incisor	Abbreviated “I,” these teeth are used for shearing and grooming. They are named based on their function, which is to cut or incise.
Canine	Abbreviated “C,” these teeth have a tearing function. They are commonly called fangs in some animals. In humans we commonly call them cuspids, which means tapered teeth.
Premolar	Abbreviated “P” or “PM,” these teeth have a tearing and grinding function. In humans, these are called bicuspids since they have two projections.
Molar	Abbreviated “M,” these teeth have a grinding function.

Table 4.1 Formula.

Dogs	$2\left[I\frac{3}{3} + C\frac{1}{1} + PM\frac{4}{4} + M\frac{2}{3}\right] = 42$
Cats	$2\left[I\frac{3}{3} + C\frac{1}{1} + PM\frac{3}{2} + M\frac{1}{1}\right] = 30$
Horses	$2\left[I\frac{3}{3} + C\frac{1}{1} + PM\frac{3-4}{3} + M\frac{3}{3}\right] = 40 - 42$
Cattle, sheep, goats	$2\left[I\frac{0}{3} + C\frac{0}{1} + PM\frac{3}{3} + M\frac{3}{3}\right] = 32$
Pigs	$2\left[I\frac{3}{3} + C\frac{1}{1} + PM\frac{4}{4} + M\frac{3}{3}\right] = 44$
Humans	$2\left[I\frac{2}{2} + C\frac{1}{1} + PM\frac{2}{2} + M\frac{3}{3}\right] = 32$
Llamas	$2\left[I\frac{1}{3} + C\frac{1}{1} + PM\frac{2}{1} + M\frac{3}{2-3}\right] = 28 - 30$
Ferrets	$2\left[I\frac{3}{3} + C\frac{2}{2} + PM\frac{4}{3} + M\frac{1}{2}\right] = 40$
Rabbits	$2\left[I\frac{2}{1} + C\frac{0}{0} + PM\frac{3}{2} + M\frac{3}{3}\right] = 28$
Guinea pigs	$2\left[I\frac{1}{1} + C\frac{0}{0} + PM\frac{1}{1} + M\frac{3}{3}\right] = 20$
Chinchillas	$2\left[I\frac{1}{1} + C\frac{0}{0} + PM\frac{1}{1} + M\frac{3}{3}\right] = 20$
Gerbils	$2\left[I\frac{1}{1} + C\frac{0}{0} + PM\frac{0}{0} + M\frac{3}{3}\right] = 16$
Hamsters	$2\left[I\frac{1}{1} + C\frac{0}{0} + PM\frac{0}{0} + M\frac{3}{3}\right] = 16$
Mice, rats	$2\left[I\frac{1}{1} + C\frac{0}{0} + PM\frac{0}{0} + M\frac{3}{3}\right] = 16$

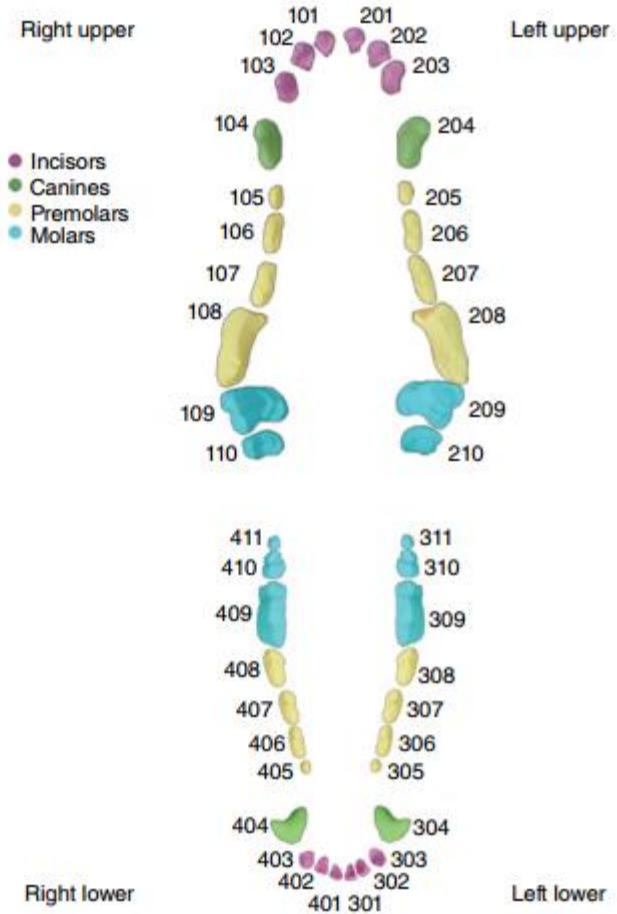


Figure 4.3 Canine dentition with the triadan system.

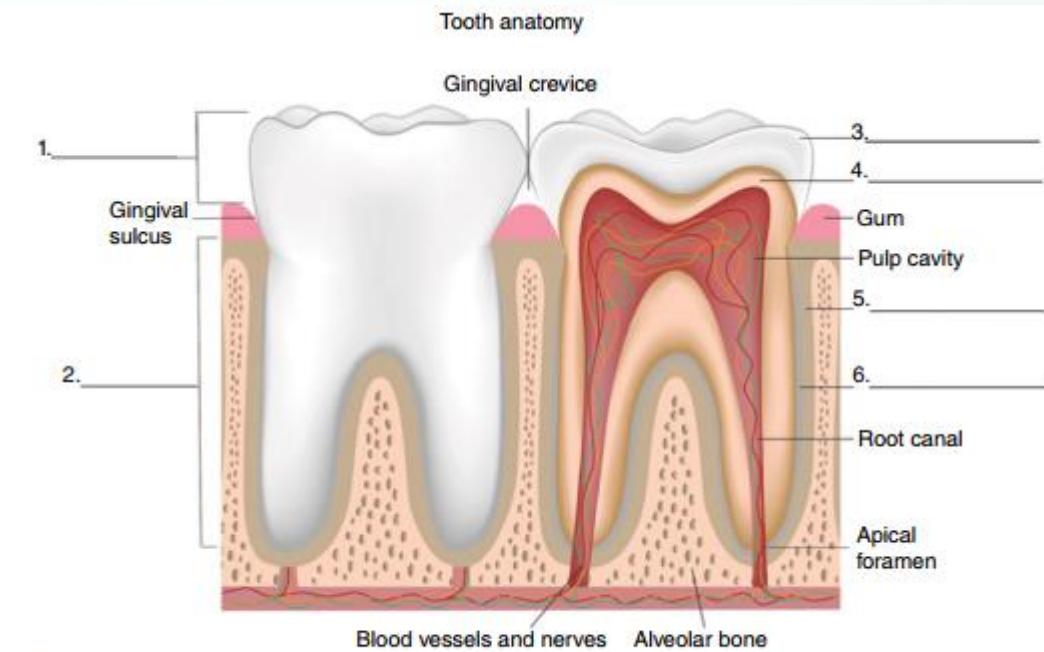


Figure 4.4 Anatomy of the tooth. Source: Courtesy of shutterstock/Alila Sao Mai.

Table 4.2 Tooth anatomy.

Alveolus	Tooth socket; alveolar bone.
Crown (1)	Portion of the tooth above the gum line; supragingival portion of the tooth.
Root (2)	Portion of the tooth below the gum line; subgingival portion of the tooth.
Enamel (3)	White, hard, outer covering of the tooth that protects the crown; the hardest substance in the body.
Dentin (dentine) (4)	Hard tissue of teeth between the enamel and pulp cavity.
Gingiva (gums)	Mucous membranes surrounding the teeth and lining the mouth.
Gingival sulcus	Area between the tooth and gums.
Pulp cavity	Sensitive cavity in the tooth containing blood supply and nerves.
Periodontal ligament (5)	Connective tissue that connects the tooth to the alveolar bone.
Cementum (6)	Bone-like connective tissue that covers the root.
Root canal	Portion of the pulp cavity extending from the pulp chamber to the apical foramen (opening at the distal aspect of the tooth).

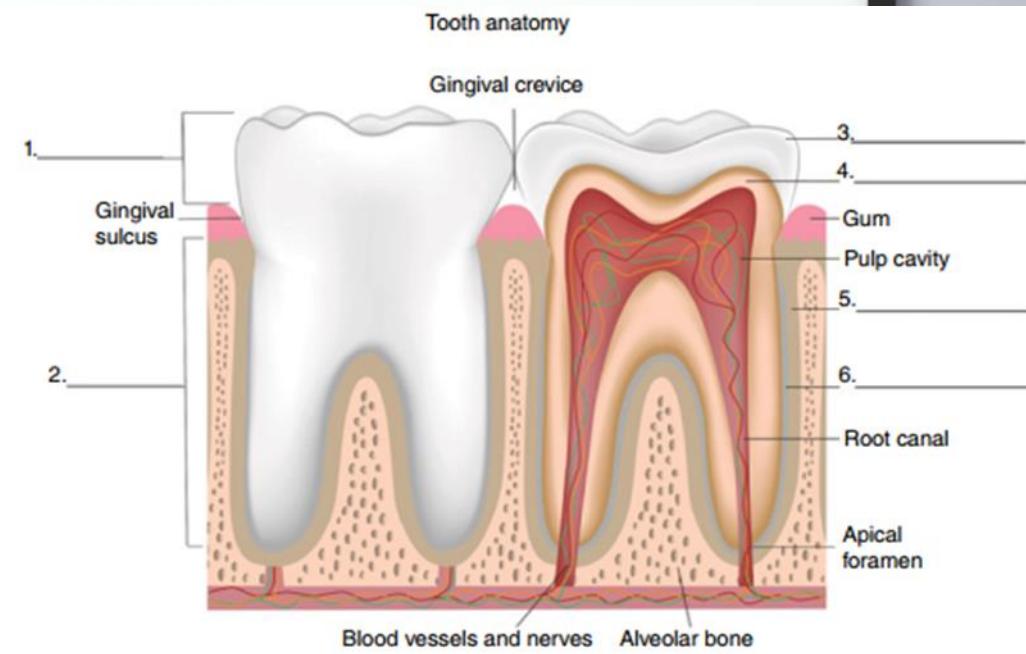


Figure 4.4 Anatomy of the tooth. Source: Courtesy of shutterstock/Alila Sao Mai.

Dental Terminology

Abscess	Localized collection of pus.
Bruxism	Grinding of teeth; common in cattle.
Deciduous teeth	Temporary teeth
Dental calculus	Also known as dental tartar , mineralized plaque that forms on the teeth (Figure 4.5).

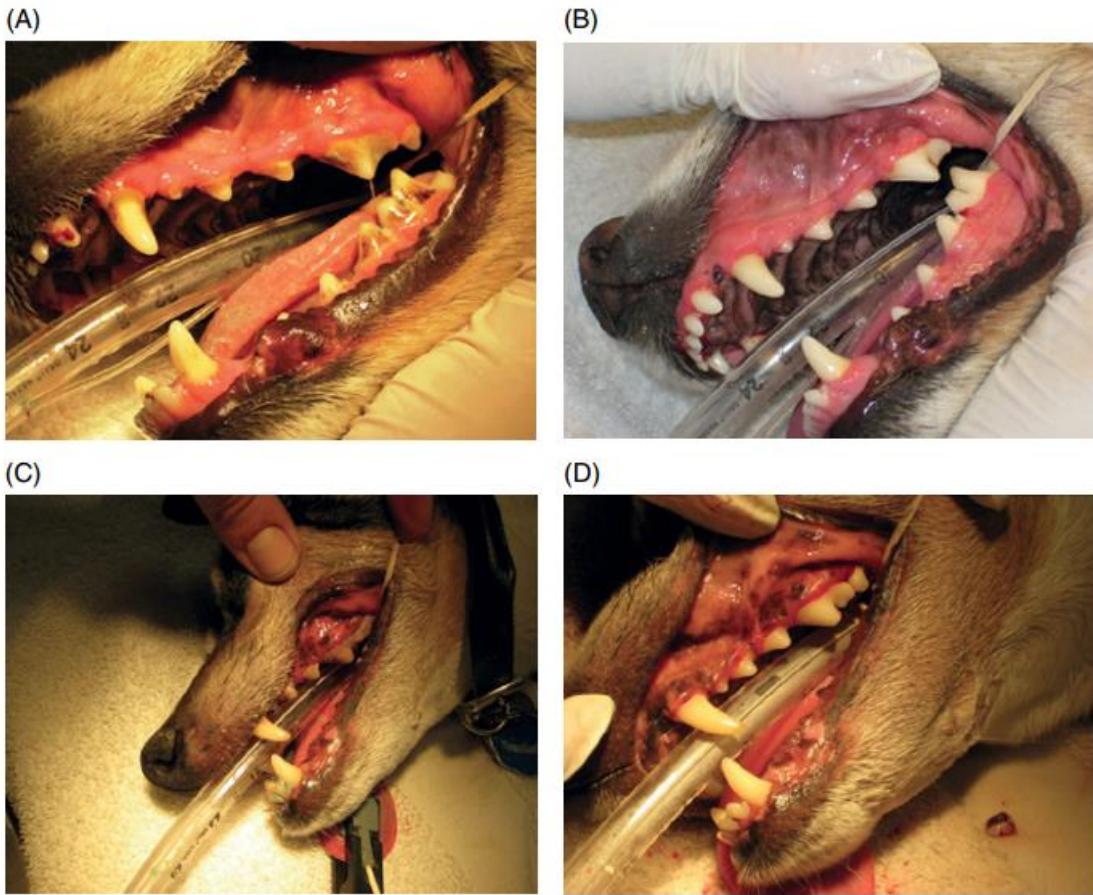


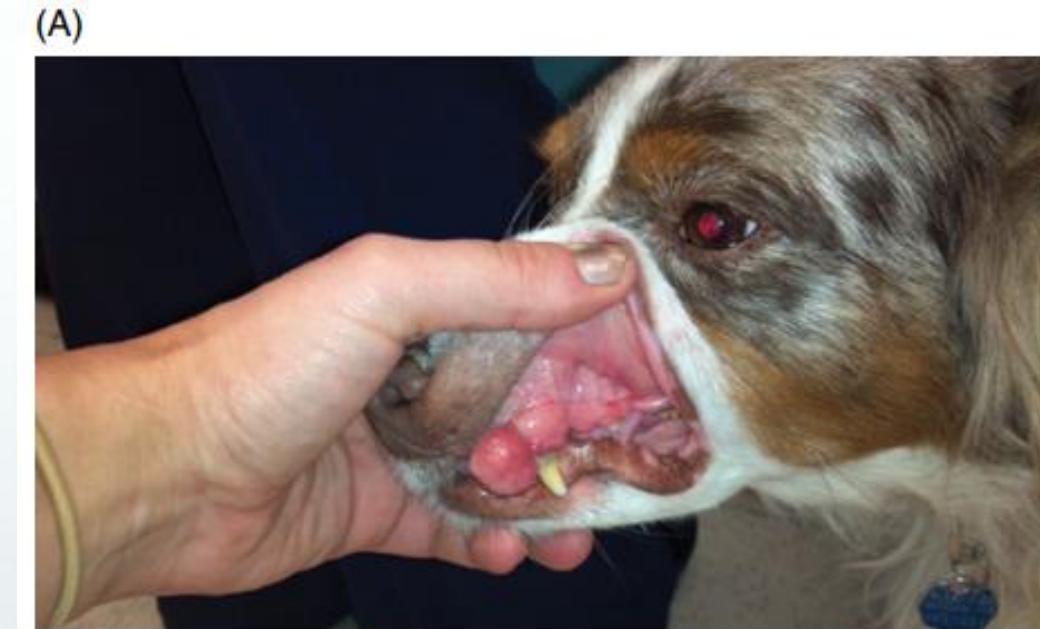
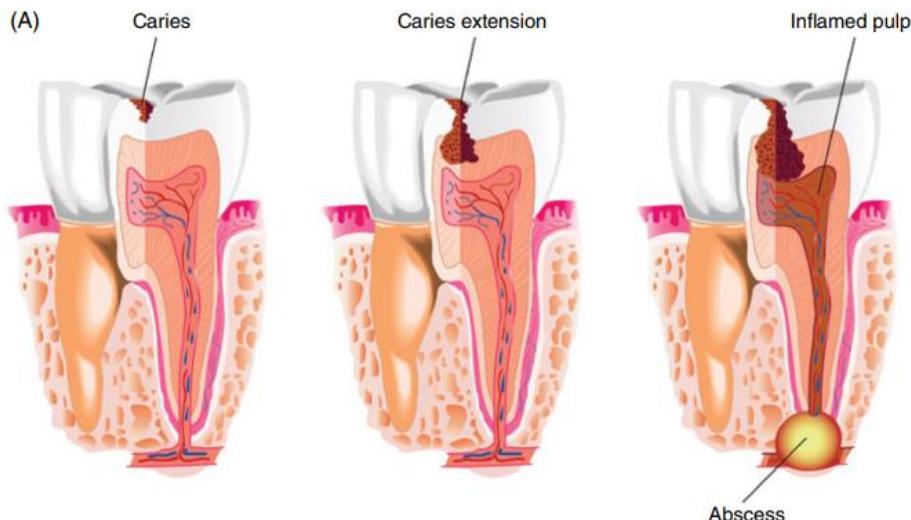
Figure 4.5 (A) Dental calculus. (B) Post dental surgery. (C) Dental calculus. (D) Post dental surgery.
Source: Courtesy of A.K. Taylor, DVM; Microscopy Learning Systems.

Dental Terminology

Dental caries Tooth decay (Figure 4.6).

Dentition The arrangement of teeth. Also known as **arcade**.

Epulis Benign tumor arising from periodontal mucous membranes (Figure 4.9A).



Dental Terminology

Extraction	The act of pulling teeth (Figure 4.7).
Gingival hyperplasia	Excessive development of gums due to increased cell numbers (Figure 4.9E).
Halitosis	Bad breath.
Hard palate	Rostral portion of the roof of the mouth containing rugae.
Malocclusion	Abnormal position of teeth that results in faulty meeting of the teeth or jaws.
Occlusion	Relation of the teeth of both jaws during functional activity.
Oronasal fistula	Abnormal tube-like passageway between the mouth and nose. A fistula is an abnormal tube-like passageway that can occur anywhere on the body (Figure 4.9C).
Palate	Roof of the mouth.



Figure 4.7 (A) Dental procedure. Source: Courtesy of A.K. Traylor, DVM; Microscopy Learning Systems. (B) Extractions. Source: Courtesy of A.K. Traylor, DVM; Microscopy Learning Systems. (C) Sutures in the gingiva post extraction. Source: Courtesy of Amy Johnson, BS, CVT, RLATG.

Dental Terminology

Palatoschisis	Cleft palate (Figure 4.9B).
Papillae	Small, raised bumps on the tongue containing taste buds (Figure 4.8).
Periodontal disease	Inflammation and degeneration of the tissue surrounding and supporting the teeth (bone and gums); also known as periodontitis or pyorrhea.
Plaque	Collection of bacteria, salivary products, and white blood cells that adheres to the surface of the tooth.
Rugae	Ridges on the hard palate and lining the stomach to increase surface area for absorption and secretion (Figure 4.8B).

(B)



Figure 4.8 Papillae on a feline tongue. There are four types of papillae. The group in the front face backward to aid in grooming and help remove flesh from prey. This is why a cat's tongue feels like sandpaper when licking you. Source: Courtesy of shutterstock/Joanna Zaleska.

Dental Terminology

Saliva

Digestive juice produced by salivary glands.

Salivary glands

Glands around the mouth that secrete saliva. There are three major pairs of glands called the **parotid**, **mandibular**, and **sublingual glands**.

Salivary mucocele

Collection of saliva that has leaked out from damaged salivary glands causing masses in the mouth (Figure 4.9D).

Soft palate

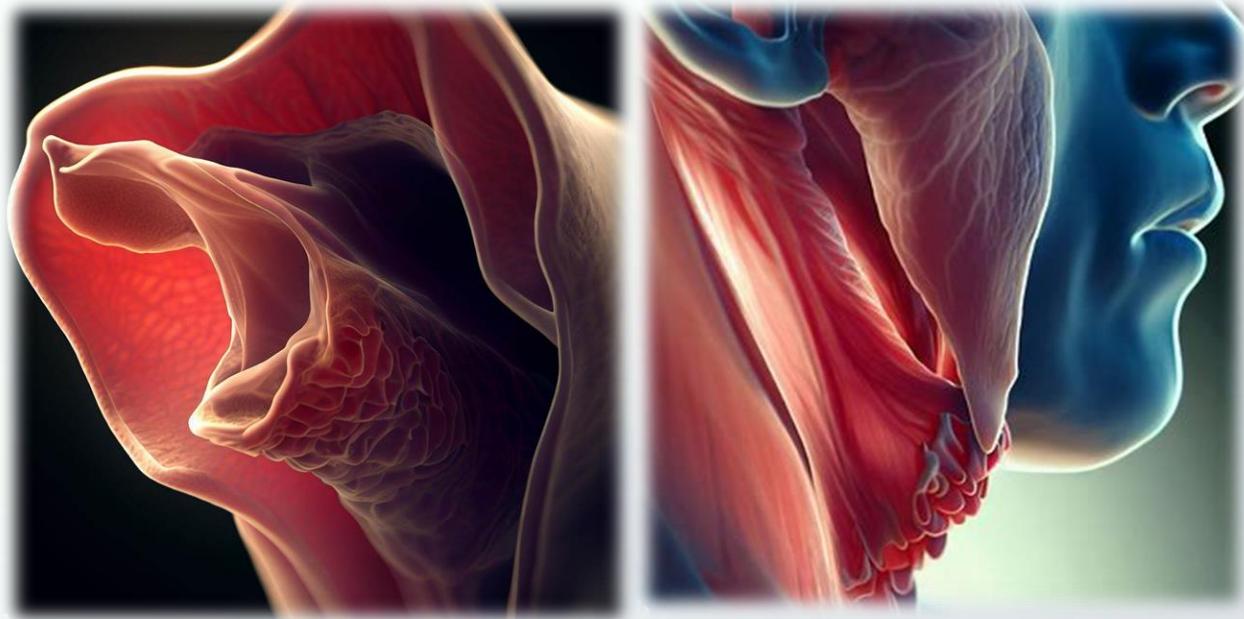
Smooth, caudal portion of the roof of the mouth.

(D)



Pharynx

The pharynx is commonly called the throat. This tube-like passageway connects the oral cavity to the other GI tract locations. It is also responsible for joining the oral cavity to the trachea, which leads to the respiratory tract. As an animal chews its food, a leaf- like piece of cartilage called the epiglottis covers the trachea to prevent that food from “going down the wrong pipe.” When the animal swallows, the epiglottis directs the food where to go. It closes over the trachea to allow the food to proceed to the next structure, the esophagus.



Esophagus

The esophagus is the tube that runs from the pharynx to the stomach. The tube is actually a muscle that contracts to move the food down toward the stomach. This process of wave-like contractions to move the food is called peristalsis (Figure 4.10). It's similar to when people do the wave at a football game

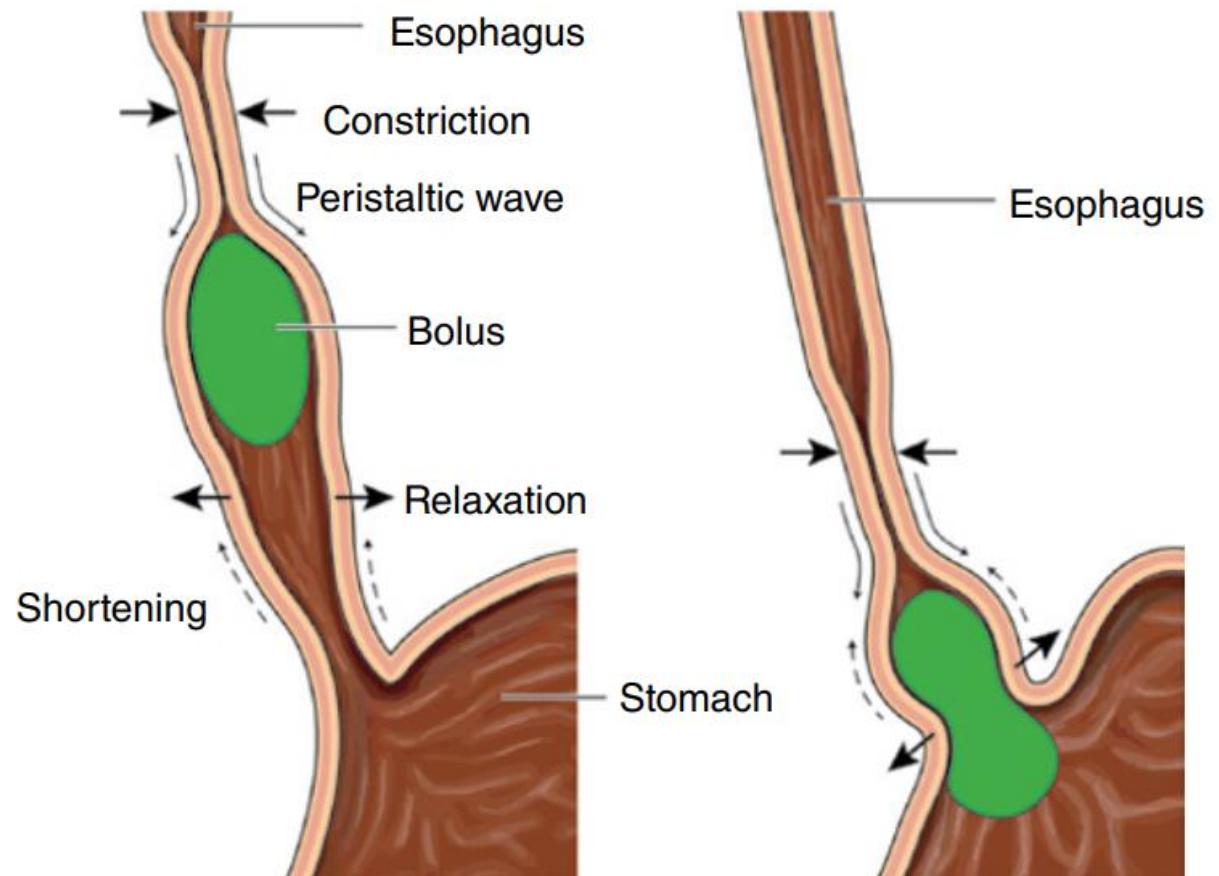


Figure 4.10 Peristalsis. Source: Courtesy of shutterstock/blamb.

Stomach

After the food passes through the esophagus, it enters the stomach through a valve called the cardiac sphincter. Once in the stomach, the food is broken down by digestive enzymes such as hydrochloric acid. Lining the stomach are ridges called rugae that help increase the surface area for absorption and secretion. The rugae lining the stomach are the same as the rugae on the hard palate. After the food is broken down it exits the stomach through another valve called the pyloric sphincter. In veterinary medicine there are two different types of stomachs. Most animal have what is considered a simple stomach or true stomach. Humans also have a simple stomach. The following are the parts of the simple stomach.



Stomach

Body

The main portion of the stomach.

Cardiac sphincter

Valve between the esophagus and stomach.

Fundus

Cranial, rounded portion of the stomach.

Pyloric sphincter

Valve between the stomach and duodenum.

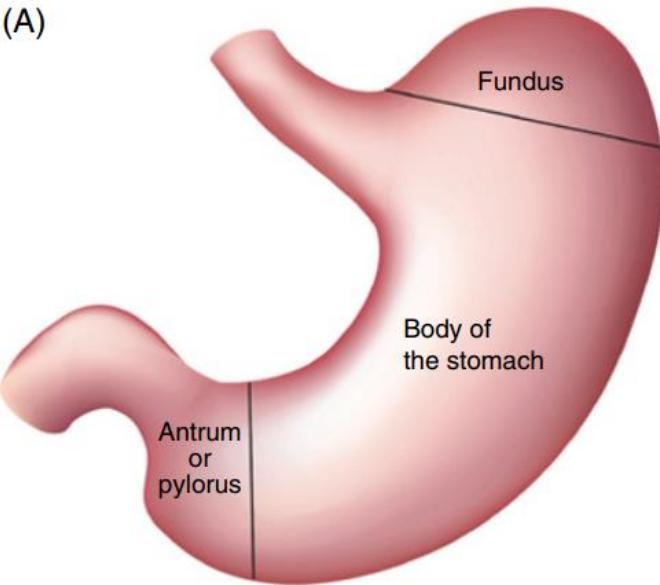
Pylorus (antrum)

Caudal portion of the stomach.

Rugae

Ridges on the hard palate and in the stomach to increase surface area for absorption and secretion.

(A)



(B)

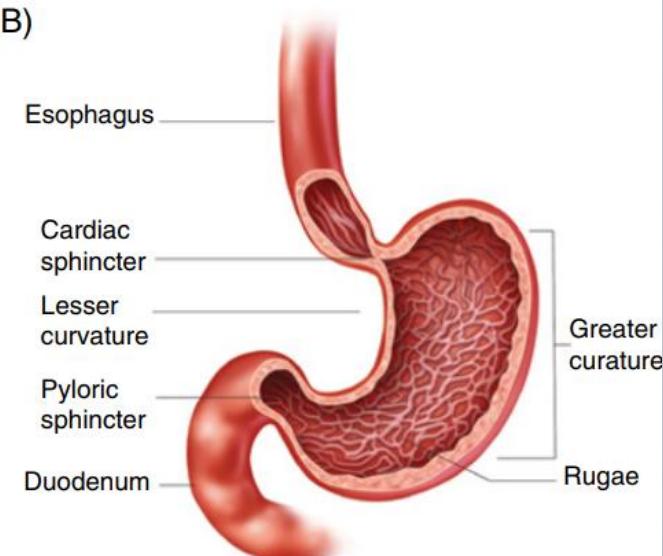
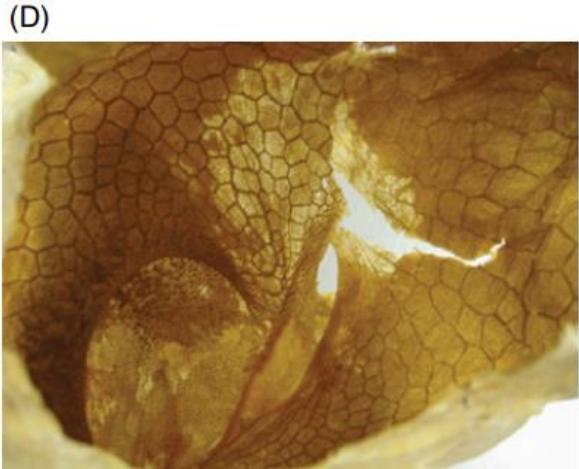
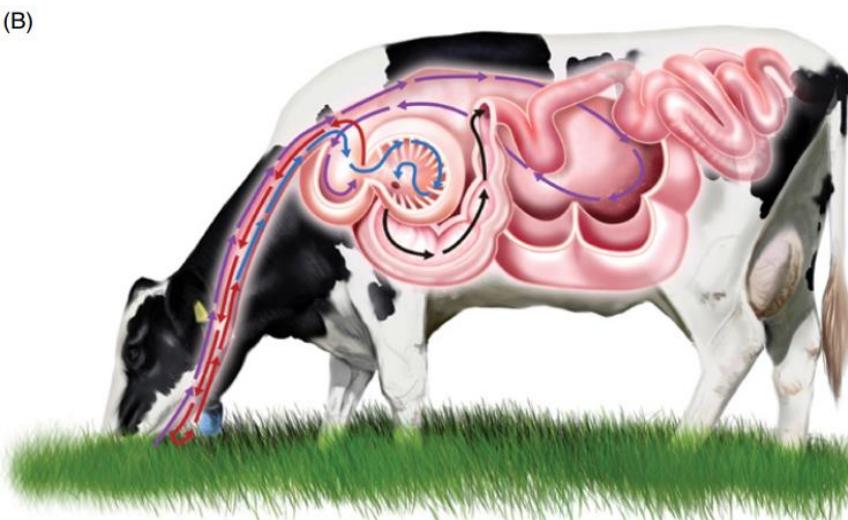
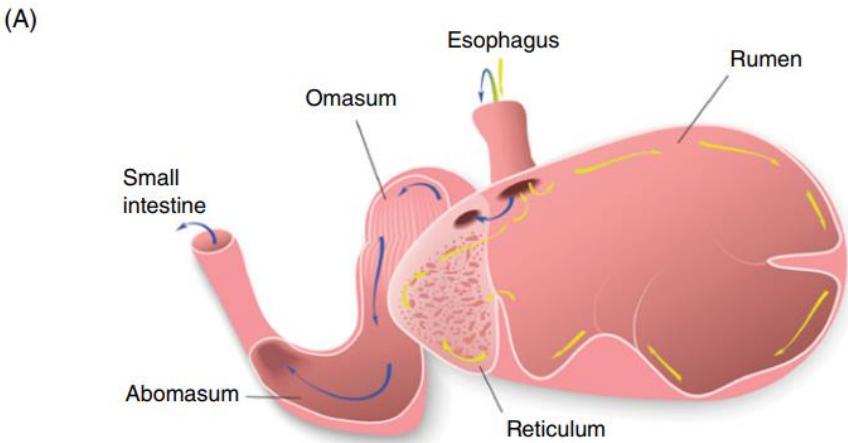


Figure 4.11 Anatomy of the simple stomach. (A) External stomach anatomy. Source: Courtesy of shutterstock/Alila Sao Mai. (B) Internal stomach anatomy and upper GI tract. Source: Courtesy of shutterstock/Lightspring.

Stomach

Each compartment of the ruminant stomach has a specific function (Figure 4.12).

- Rumen** This is the largest compartment of the ruminant stomach, where fermentation takes place. **Fermentation** is the process of breaking down organic compounds into simpler substances. Larger ingesta is broken down in the rumen.
- Reticulum** This small, most cranial portion of the ruminant stomach is lined with mucous membranes in a hexagon pattern. It is commonly called the honeycomb because of its internal appearance. Smaller food particles are collected in the reticulum to be transferred to the omasum.
- Omasum** The third and smallest of the compartments. Inside are folds of tightly packed papillae used for grinding food. It's commonly called the bible because the folds resemble pages in a book. The folds help to increase surface area for absorption of water.
- Abomasum** The fourth and final compartment, which is considered the true stomach. Its function and anatomy resemble that of the true stomach in other mammals. Like small animals and humans, this portion of the stomach contains digestive enzymes and hydrochloric acid to break down food.



Small Intestine

The small intestine is divided into three portions: the duodenum, the jejunum, and the ileum. Lining the inside of the small intestine are small finger-like projections called villi (Figure 4.13). These projections are used to absorb nutrients into the bloodstream. Goblet cells in the villi secrete mucus which will act as a blanket for the lining of the intestines.

The first part of the small intestine is the duodenum. Once food enters the duodenum, the pancreas releases digestive enzymes that further digest the food. Simultaneously, the liver and gallbladder send bile to the duodenum to aid in the breakdown of the food. Once the food has been digested further and the nutrients have been absorbed, the remaining material passes to the second part of the small intestine, the jejunum. Following the jejunum is the third part of the small intestine called the ileum.

The small intestines are anchored to the abdominal wall by a membranous sheet called mesentery (Figure 4.14). The mesentery contains blood vessels, lymph nodes, and nerves that supply the organs of the digestive tract. The mesentery prevents the intestines from entangling.

TECH TIP 4.2 Watch your spelling on ileum. It looks very similar to the ilium of the pelvis.

TECH TIP 4.3 Where's the Appendix?

The appendix is a blind pouch that hangs from the cecum. Most mammals lack an appendix with the exception of humans, apes, and rabbits.

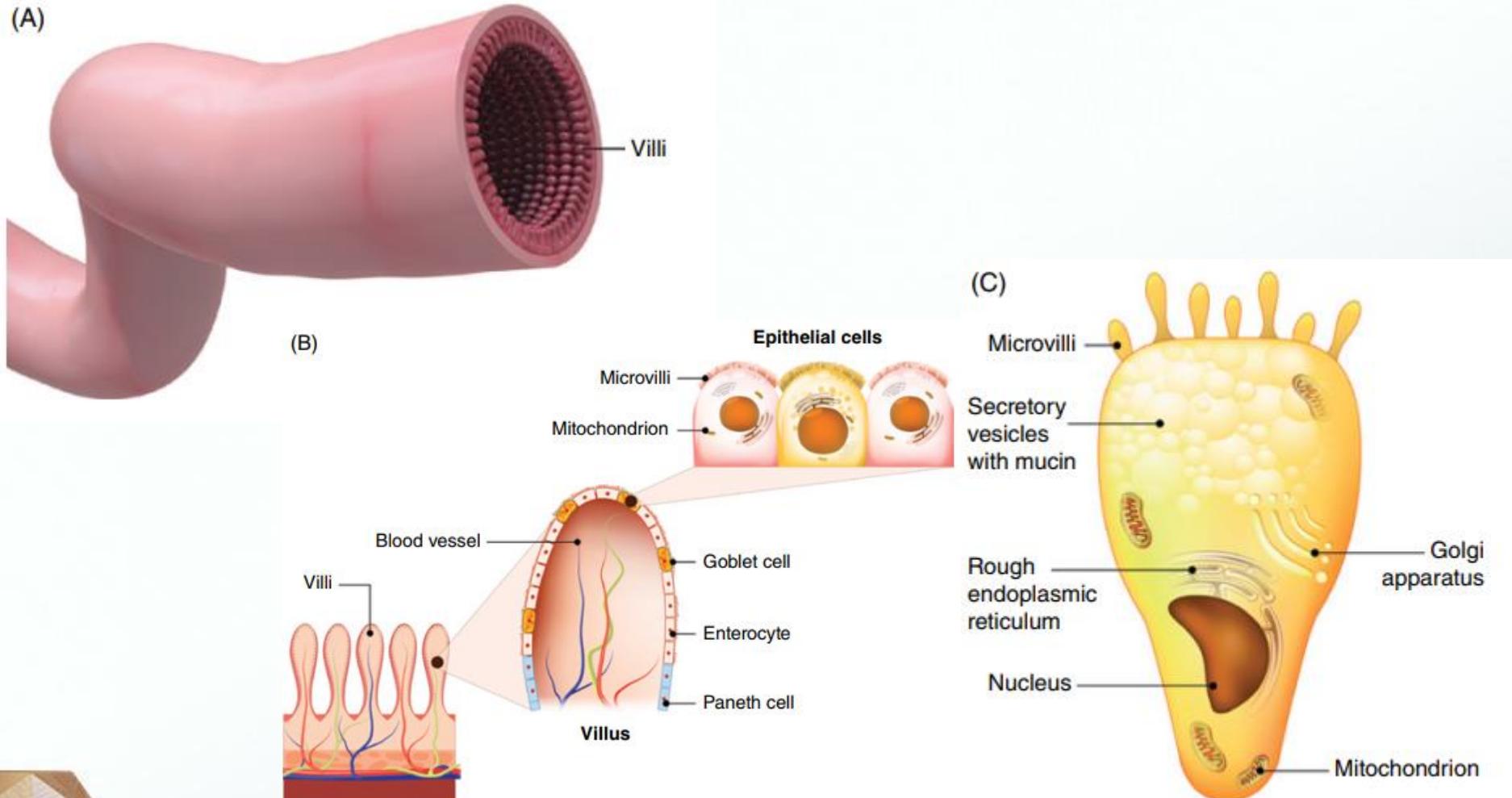


Figure 4.13 (A) Small intestine villi. Source: Courtesy of shutterstock/blamb. (B) Anatomy of an intestinal villus. Source: Courtesy of shutterstock/Designua. (C) Anatomy of a goblet cell. Source: Courtesy of shutterstock/Designua.



Figure 4.14 Mesentery. Source: Courtesy of A.K. Traylor, DVM; Microscopy Learning Systems.



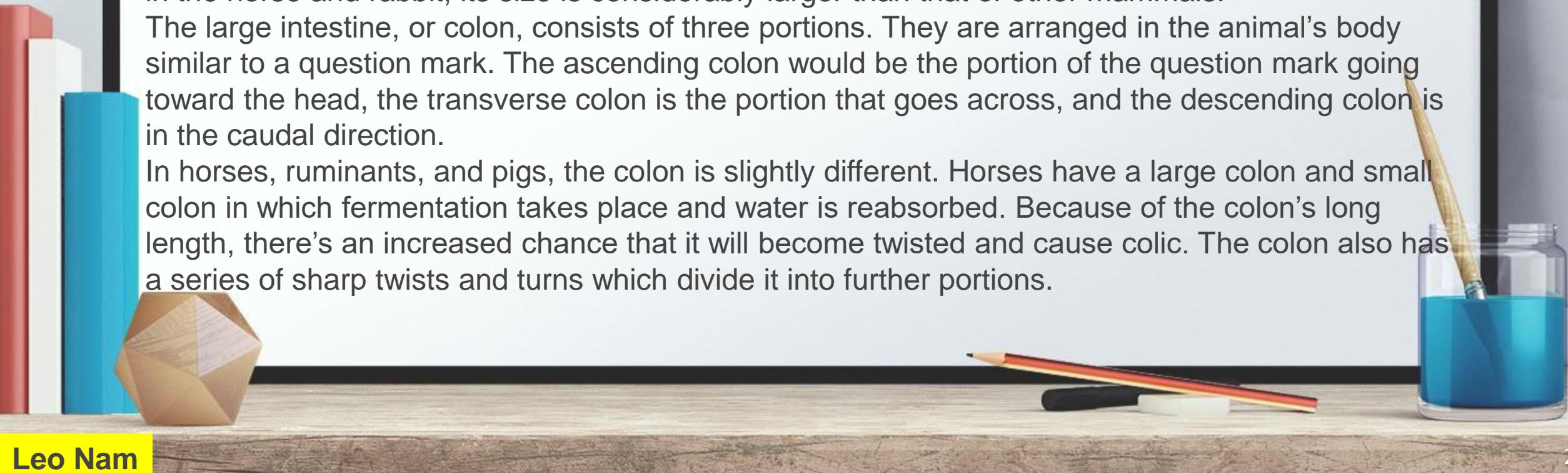
Large Intestine

The large intestine doesn't get its name because of its length, but rather its width. Its diameter is nearly three times that of the small intestine. It consists of the cecum, ascending colon, transverse colon, descending colon, rectum, and anus. Although the large intestine is used for elimination in all species, it has additional functions in herbivores due to their plant-based diets.

The cecum is a small, blind sac where the small and large intestines meet. In horses and rabbits, the cecum plays a major role in digestion. Fermentation takes place in the cecum of horses and rabbits because they have a simple stomach. Because of the significant role that the cecum plays in the horse and rabbit, its size is considerably larger than that of other mammals.

The large intestine, or colon, consists of three portions. They are arranged in the animal's body similar to a question mark. The ascending colon would be the portion of the question mark going toward the head, the transverse colon is the portion that goes across, and the descending colon is in the caudal direction.

In horses, ruminants, and pigs, the colon is slightly different. Horses have a large colon and small colon in which fermentation takes place and water is reabsorbed. Because of the colon's long length, there's an increased chance that it will become twisted and cause colic. The colon also has a series of sharp twists and turns which divide it into further portions.



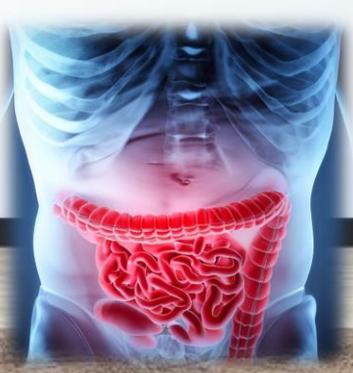
Large Intestine

Ruminants and pigs have an ascending, transverse, and descending colon; however, their ascending colon takes on a spiral arrangement, giving it the name spiral colon.

After passing through the colon, the remaining waste then passes through the anus to the outside of the body.

Prebiotics and probiotics are often used to ensure colon health in animals. In large animals, plant material can be difficult to digest; therefore, prebiotics and probiotics are given to aid in digestion. A prebiotic is a plant fiber that the stomach is unable to digest. Once ingested, this fiber goes to the intestines and nourishes the normal bacteria, or normal flora, in the intestines. A healthy environment of “good bacteria” ensures proper digestion. Probiotics are actually living bacteria administered to increase the population of normal flora.

These two substances can be very helpful in large animal medicine, and they are becoming increasingly popular in small animal medicine. Many veterinarians recommend probiotics to animals with diarrhea depending on the cause. Animals taking antibiotics risk destroying their normal flora with the medication so probiotics might be recommended to prevent this.



Liver and Gallbladder

The liver is the largest organ in the body and has many important functions. Anatomically, the liver is caudal to the diaphragm. Here is a list of the functions of the liver.

1. Synthesizes (produces) bile.
2. Maintains blood sugar by storing excess glucose in the form of glycogen.
3. Synthesizes proteins, including clotting proteins and albumin.
4. Conjugates bilirubin.
5. Detoxifies the blood.
6. Metabolizes drugs.
7. Synthesizes cholesterol.



Liver and Gallbladder

Bile is composed of bilirubin, cholesterol, and bile acids (bile salts). While animals get cholesterol from their diets, their liver also produces cholesterol. The cholesterol is then stored to help produce bile. Once produced, the bile travels from the liver to the gallbladder to be stored. When food reaches the duodenum, the bile in the gallbladder travels to the duodenum via the common bile duct to assist in digestion (Figure 4.15).

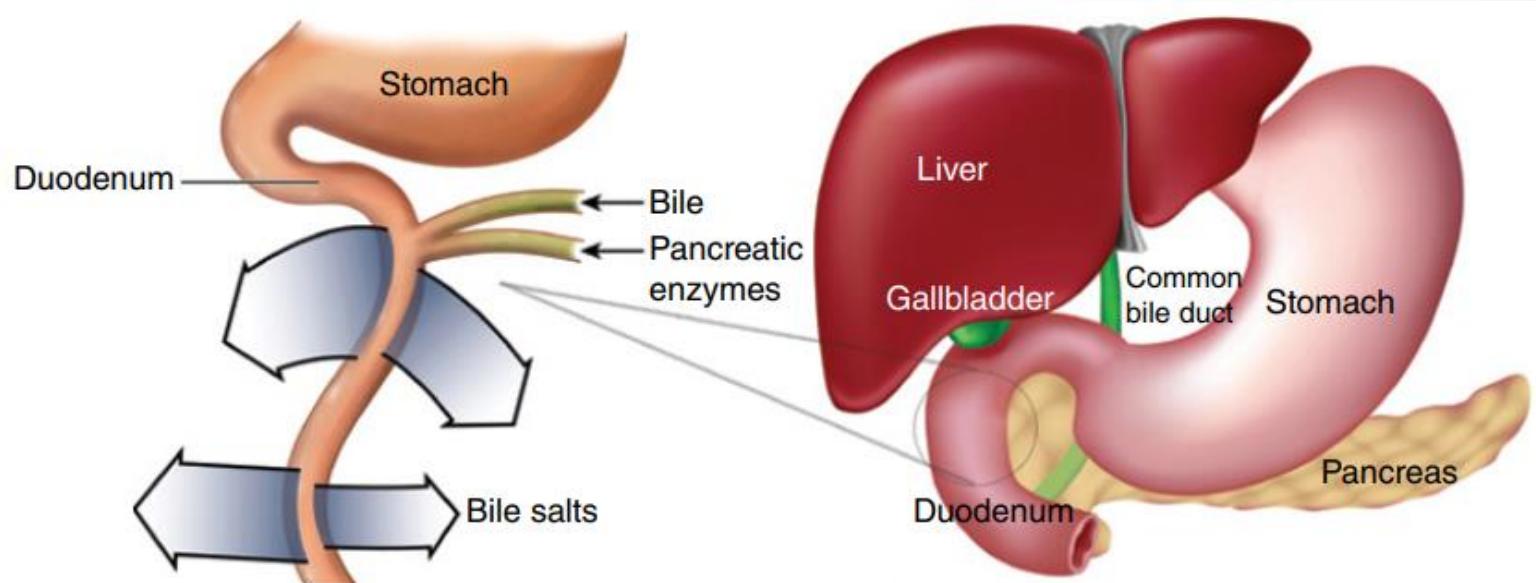


Figure 4.15 The flow of bile and digestive enzymes between the liver, stomach, and pancreas. Source: Courtesy of shutterstock/blamb.

Liver and Gallbladder

Bilirubin is a metabolite of hemoglobin breakdown. Bilirubin travels to liver to become conjugated (water soluble) and is then stored by the liver to be added to bile. Bile salts are used for emulsification (fat breakdown) and are then reabsorbed by the body to be recycled and used again in the future. The bile salts travel back to the liver via the portal vein. The bilirubin and remaining bile are passed in the feces and are what give feces its color.

If bilirubin doesn't leave the body, then it builds up in the blood and tissues, causing a yellowish coloration of the skin and mucous membranes called jaundice. Jaundice is synonymous with the term "icterus," which is the yellowish coloration of the plasma. Many practicing veterinarians and technicians use these two terms interchangeably (Figure 4.16).

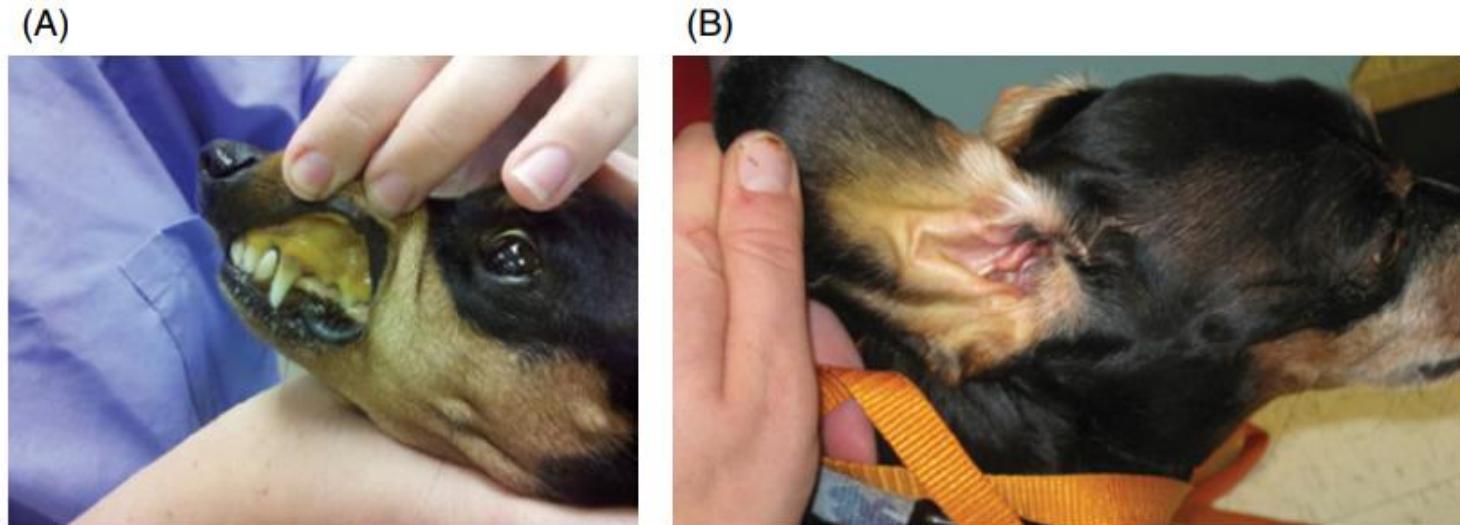
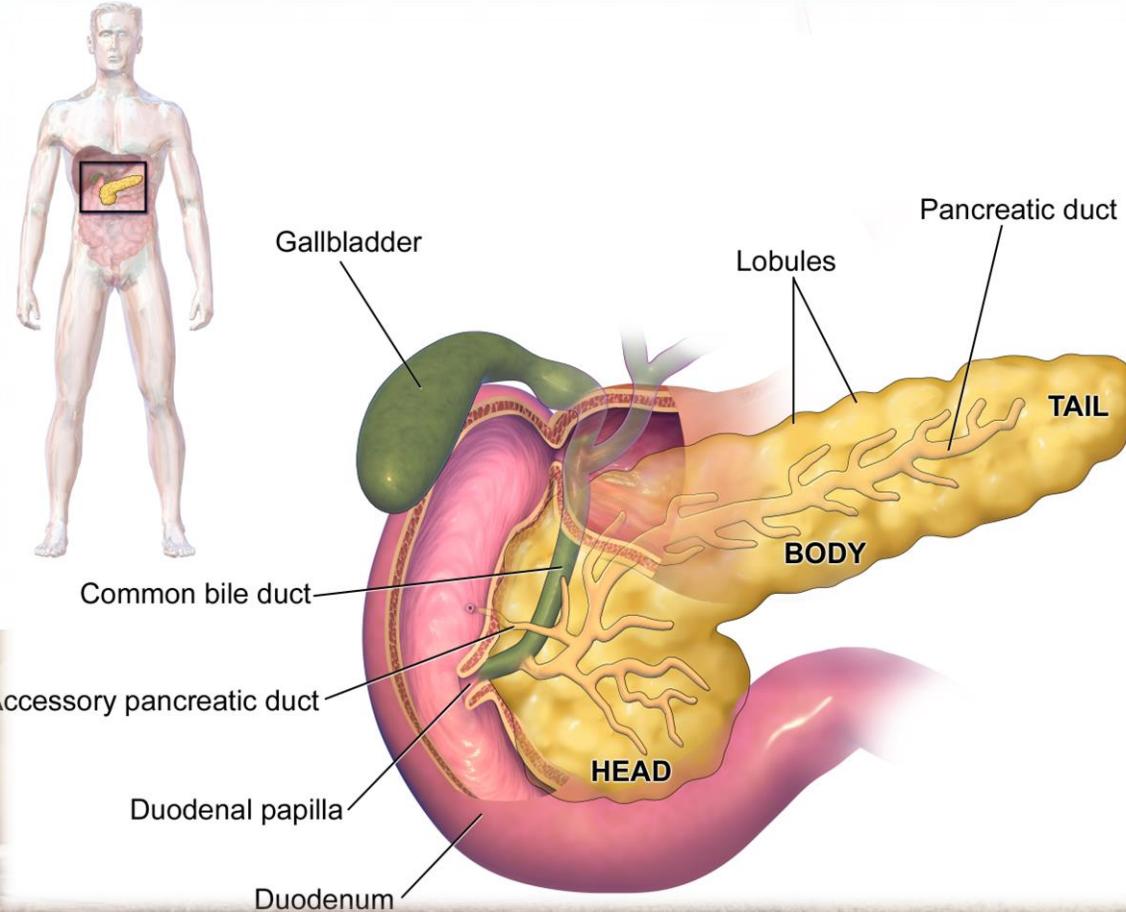


Figure 4.16 Dachshund with jaundice on gingiva and ears. Source: Courtesy of A.K. Traylor, DVM; Microscopy Learning Systems.

Pancreas

The pancreas is both an endocrine and an exocrine organ. Its outward appearance resembles chewed gum. We will discuss the endocrine functions of the pancreas in a later chapter. This chapter will focus on its exocrine functions. The pancreas produces the digestive enzymes amylase, lipase, and trypsin. Amylase is a digestive enzyme that breaks down starch, lipase is an enzyme produced to digest fat, and trypsin is an enzyme that digests protein.



Related Terms

Absorption	Passage of materials through the walls of the intestine into the bloodstream.
Abdominal cavity	Space below, or caudal to, the diaphragm containing organs such as the liver, stomach, and intestines; also known as the abdomen .
Alimentary tract	All organs associated with the passage of food from the mouth to the anus; also known as the gastrointestinal tract .
Amino acids	“Building blocks” of proteins that are produced with the ingestion of protein.
Anal sacs	Pair of sacs between the internal and external anal sphincters. The walls of these sacs are lined with glands that secrete a malodorous material. Normal animals express their anal sacs during defecation for the purposes of territorial marking. Fear may also cause an animal to express its anal sacs (Figure 4.17). Opening from the GI tract to the outside of the body.
Anus	Digestive juice produced in the liver and stored in the gallbladder. Aids in the breakdown of fat (emulsification).
Bile	

(B)



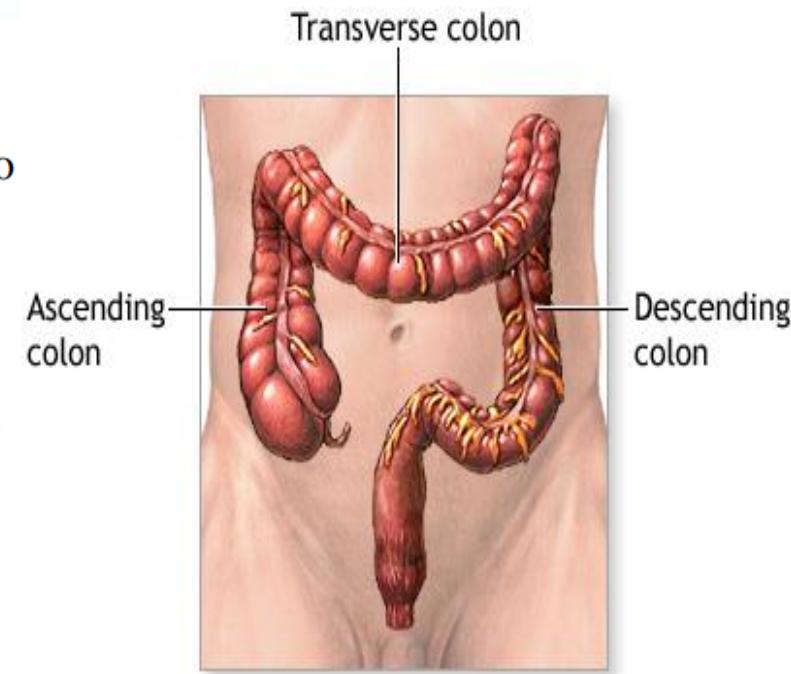
(A)



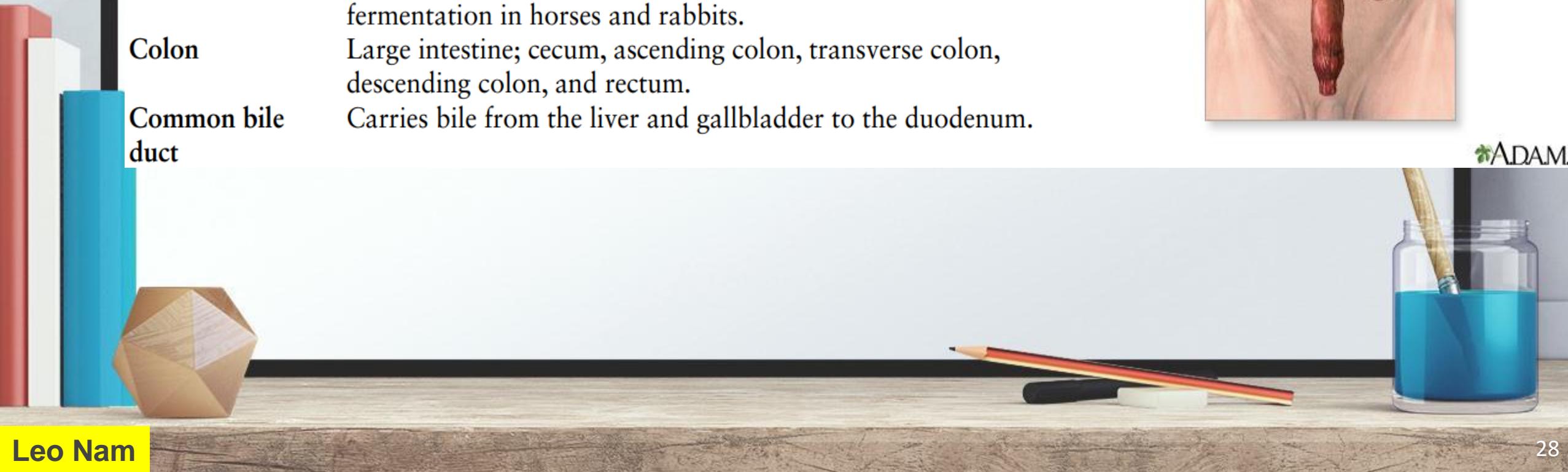
Figure 4.17 (A) Location of anal glands on a Sheltie. The anal glands are located at 4 and 8 o'clock. (B) Anal gland secretion from a dog. Source: Courtesy of Greg Martinez, DVM; www.youtube.com/drgregdvm.

Related Terms

Bilirubin	Metabolite of hemoglobin breakdown; pigment released by the liver in bile.
Bolus	Rounded mass of food. In the case of pharmaceuticals, it refers to the preparation ready to be swallowed.
Bowel	Intestine.
Cardiac sphincter	Ring of muscle fibers at the proximal aspect of the stomach where it joins the esophagus.
Cecum	Small, blind sac where the small and large intestines meet; site of fermentation in horses and rabbits.
Colon	Large intestine; cecum, ascending colon, transverse colon, descending colon, and rectum.
Common bile duct	Carries bile from the liver and gallbladder to the duodenum.



ADAM.



Related Terms

Defecation

Deglutition

Diaphragm

Diverticulum

Duodenum

Emulsification

Enzymes

Epiglottis

Passage of feces from the anus to the outside of the body; **elimination**.

Swallowing.

Thin, muscular partition separating the thoracic and abdominal cavities.

Pouch occurring on the wall of tubular organs of the GI tract.

First part of the small intestine where absorption takes place.

Breakdown of large fat globules into smaller globules.

Chemicals that speed up a reaction.

Leaf-like piece of cartilage over the trachea (windpipe) to prevent aspiration of food (Figure 4.18)

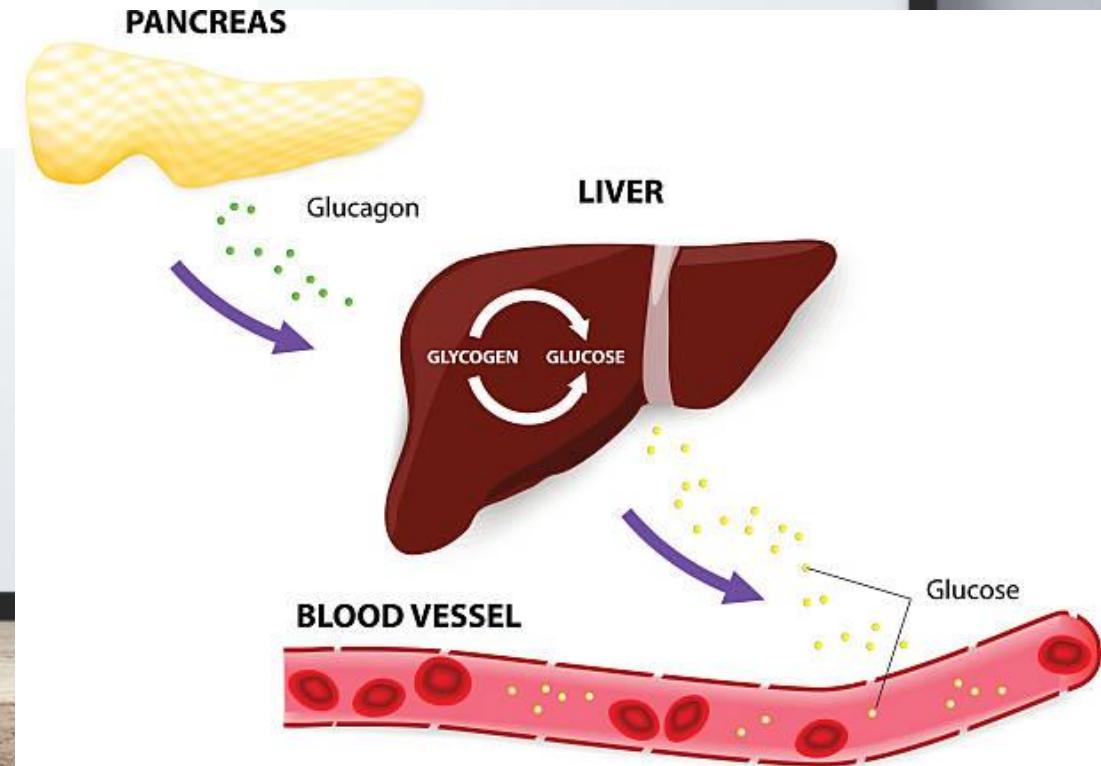


Figure 4.18 Hemostats pulling down the epiglottis. Note the vocal folds behind the epiglottis. Source: Courtesy of Greg Martinez, DVM; www.youtube.com/drgregdvm.



Related Terms

Esophagus	Tube connecting the throat to the stomach.
Feces	Stool; solid wastes.
Flatulence	Presence of gas in the stomach and intestines; flatus.
Gallbladder	Sac under the liver that stores bile.
Glucose	Simple sugar.
Gluconeogenesis	Production of glucose in the liver using fats and proteins.
Glycogen	Form of glucose stored in the liver; starch.
Glycogenolysis	Glycogen is converted back into glucose in the liver when the patient becomes hypoglycemic.
Hydrochloric acid	Produced in the stomach to digest food.



Related Terms

Jejunum	Second part of the small intestine (Figure 4.19).
Labia	Lips; singular is labium .
Liver	Largest organ in the abdomen; responsible for synthesizing protein and bile, maintaining blood sugar, and detoxifying blood.
Lumen	Cavity or channel within a tube.
Mastication	Chewing.
Mesentery	Membranous sheet that holds the organs of the abdominal cavity in place. Contains blood vessels and lymph nodes (Figure 4.19).
Mucosa	Mucous membrane (i.e., intestinal mucosa is defined as mucous membranes of the intestine).
Nutrients	Substances that are necessary for normal body function.



Figure 4.19 Mesentery and jejunum in a dissected cat. Mesenteric vessels are a landmark for identifying jejunum.

Related Terms

Omentum

Fold of peritoneum extending from the greater curvature of the stomach to the other organs in the abdominal cavity. Absorbs excess fluid and adheres to wounds to act as the body's natural band-aid (Figure 4.20).

Pancreas

Organ under the stomach that produces digestive enzymes, insulin, and glucagon.

Parenchyma

Tissue composed of the essential cells of any organ (i.e., liver parenchyma is liver tissue).

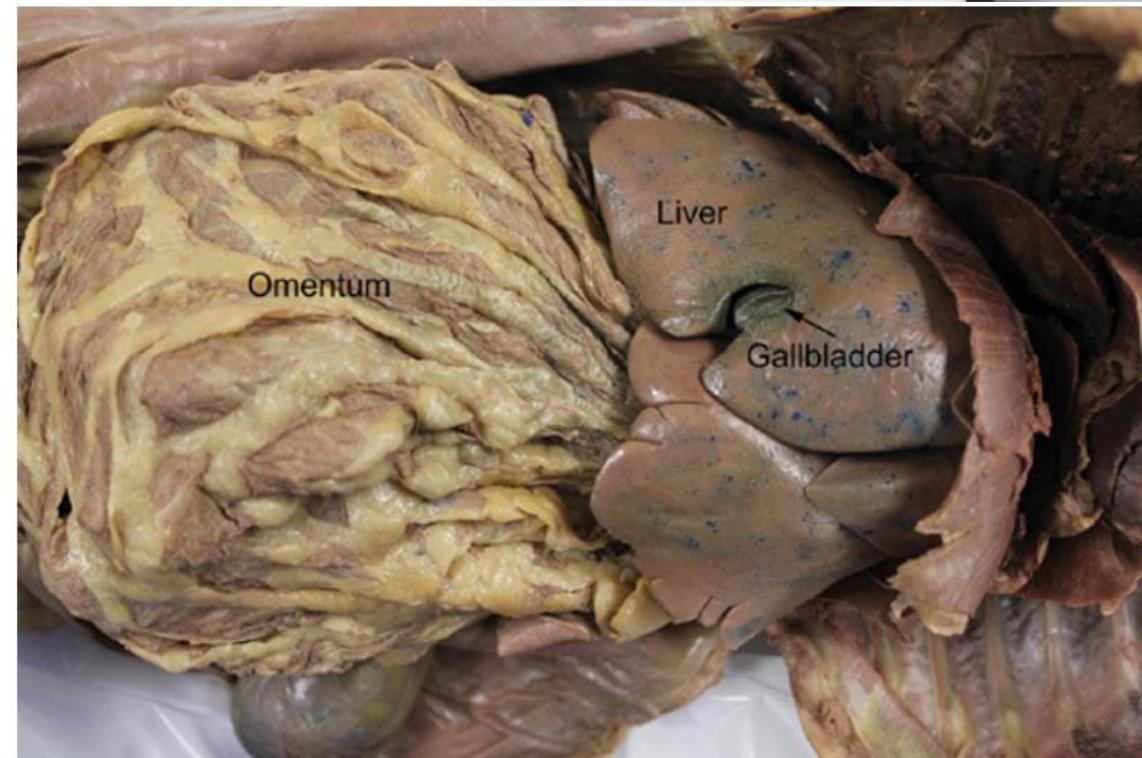


Figure 4.20 Abdominal cavity of a dissected cat showing the omentum, liver, and gallbladder.

Related Terms

Peristalsis

Wave-like contractions of the tubes of the GI tract.

Peritoneum

Membrane surrounding the organs of the abdomen.

Pharynx

Throat.

Pyloric sphincter

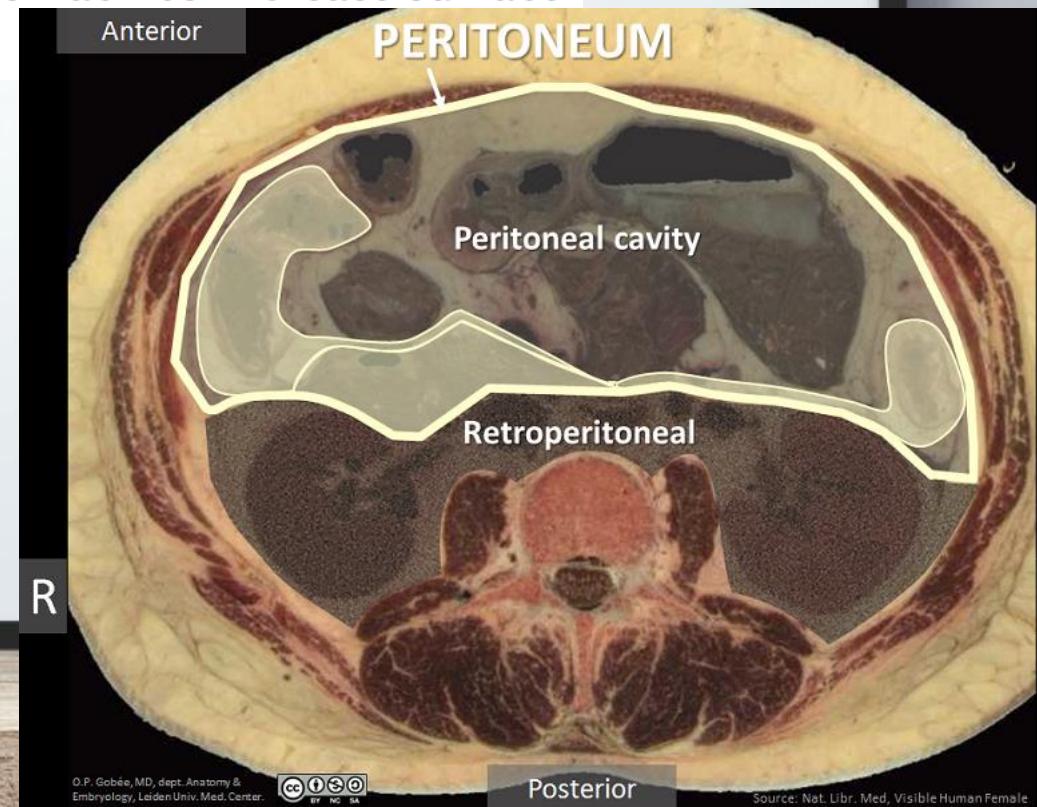
Ring of muscle fibers at the distal end of the stomach where it joins the duodenum.

Rectum

Last portion of the colon.

Rugae

Ridges on the hard palate and in the stomach to increase surface area for absorption and secretion.



Related Terms

Ruminant stomach

Specialized four-compartment stomach consisting of the rumen, reticulum, omasum, and abomasum.

Sphincter

Group of ring-like muscles that can contract in diameter.

Trachea

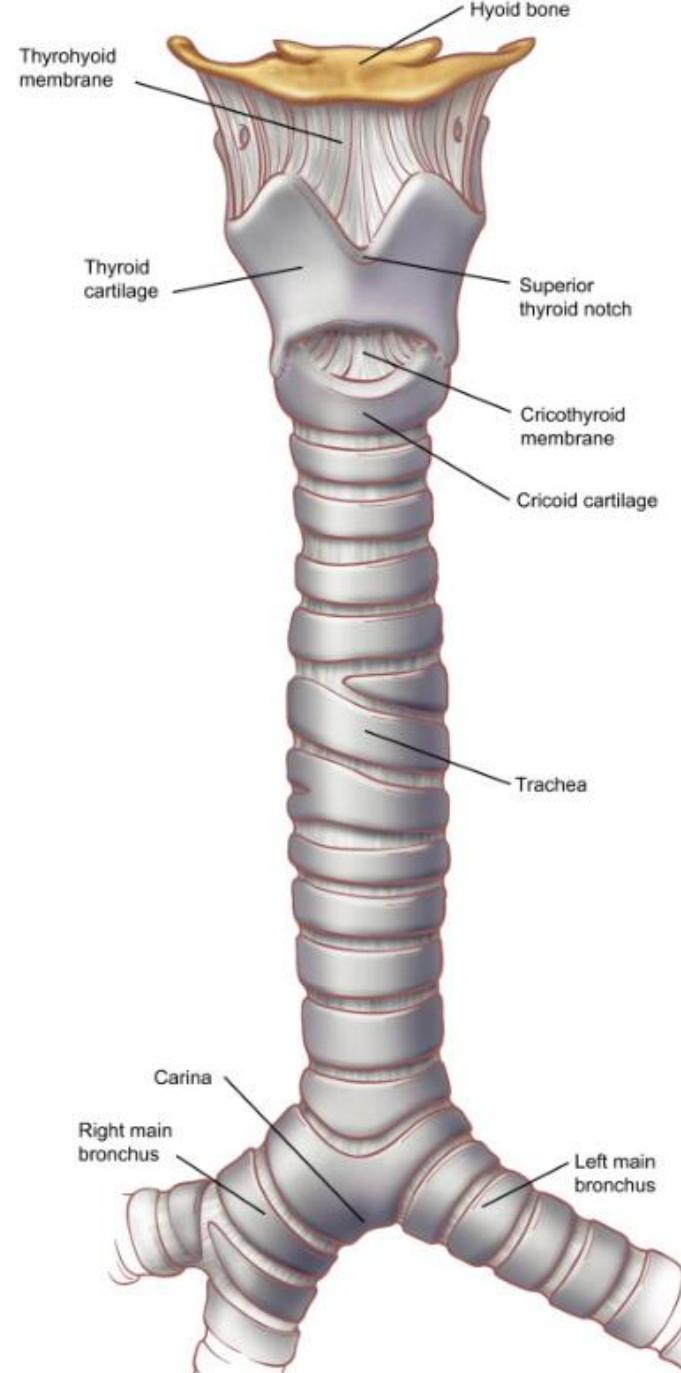
Windpipe.

Tongue

Muscular organ on the floor of the mouth.

Villi

Microscopic, finger-like projections in the walls of the small intestine that absorb nutrients into the bloodstream.



Pathology and Procedures

Achalasia

Inability to relax the smooth muscles of the GI tract; most often associated with the esophagus.

Activated charcoal

Substance administered orally after accidental ingestion of a toxic substance. After inducing vomiting, activated charcoal is administered to coat the lining of the GI tract to prevent further absorption of any remaining toxins (Figure 4.21).



Figure 4.21 Activated charcoal administration.
Source: Courtesy of A.K. Traylor, DVM; Microscopy Learning Systems.



Pathology and Procedures

Anal sacculitis Inflammation of the anal sacs. These sacs are prone to abscesses, blockage, and infections (Figure 4.22).

Anastomosis Surgical connection between two tubes.

Anorexia Lack of appetite.

(A)



(B)

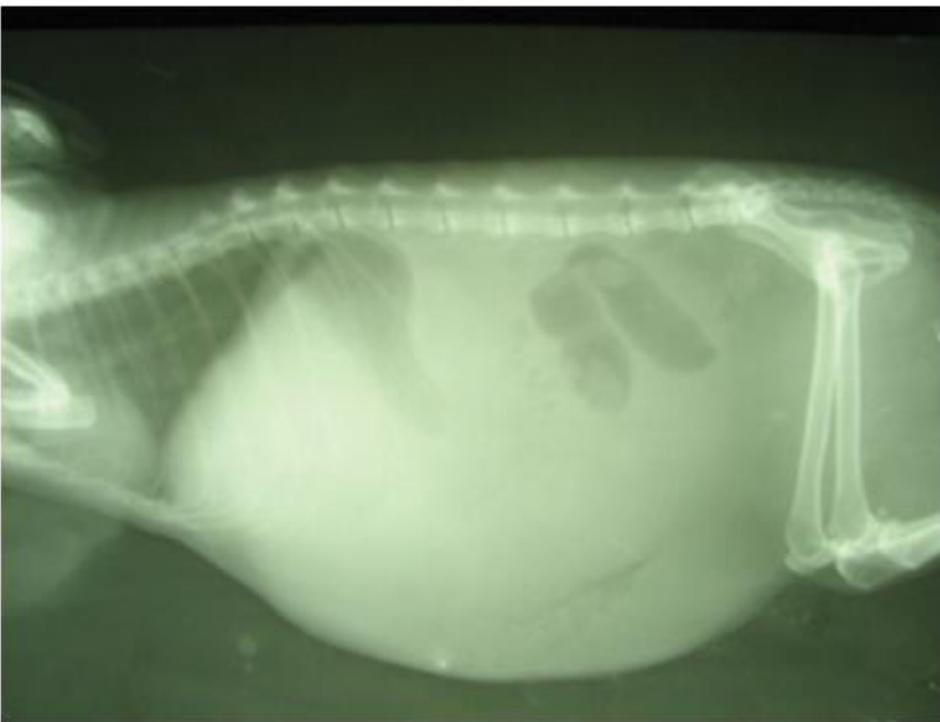


Figure 4.22 (A) Anal gland abscess in a dog. Source: Courtesy of WikiCommons/Joel Mills. (B) Anal gland abscess. Source: Courtesy of Greg Martinez, DVM; www.youtube.com/drgregdvm.

Pathology and Procedures

Antidiarrheal	A substance given to counteract diarrhea.
Antiemetic	Substance given to counteract vomiting.
Ascites	Abnormal accumulation of fluid in the abdomen (Figure 4.23).
Atresia	Closure of a normal body opening (i.e., esophageal atresia).

(A)



(B)



Figure 4.23 (A) Radiograph of a dog with ascites. Source: Courtesy of Beth Romano, AAS, CVT. (B) Ascites in a dog. Source: Courtesy of Kari Walker, BS, CVT, VTS (SAIM).

Pathology and Procedures

- Barium study** Barium test; introduction of contrast material used to evaluate the GI tract. A series of radiographs is then taken to isolate GI tract disorders (Figure 4.24).
- Biopsy** Removal of tissue for microscopic examination.



Figure 4.24 Barium study to find an obstruction. Source: Courtesy of Beth Romano, CVT.

Pathology and Procedures

- Body condition score (BCS)** A method to assess an animal's weight based on outward appearance. Animals are given a score of 1–9, where 5 is considered an ideal weight. A score below 5 is underweight and a score above 5 is considered overweight (Figure 4.25).
- Borborygmus** Rumbling noises caused by the movement of gas or fluid through the GI tract.
- Cachexia** General ill health and malnutrition (Figure 4.28A).



Figure 4.28 (A) Dog with cachexia. Source: Cour

Pathology and Procedures

TECH TIP 4.5 The definition for carcinoma is very similar to sarcoma at first glance, so be careful.

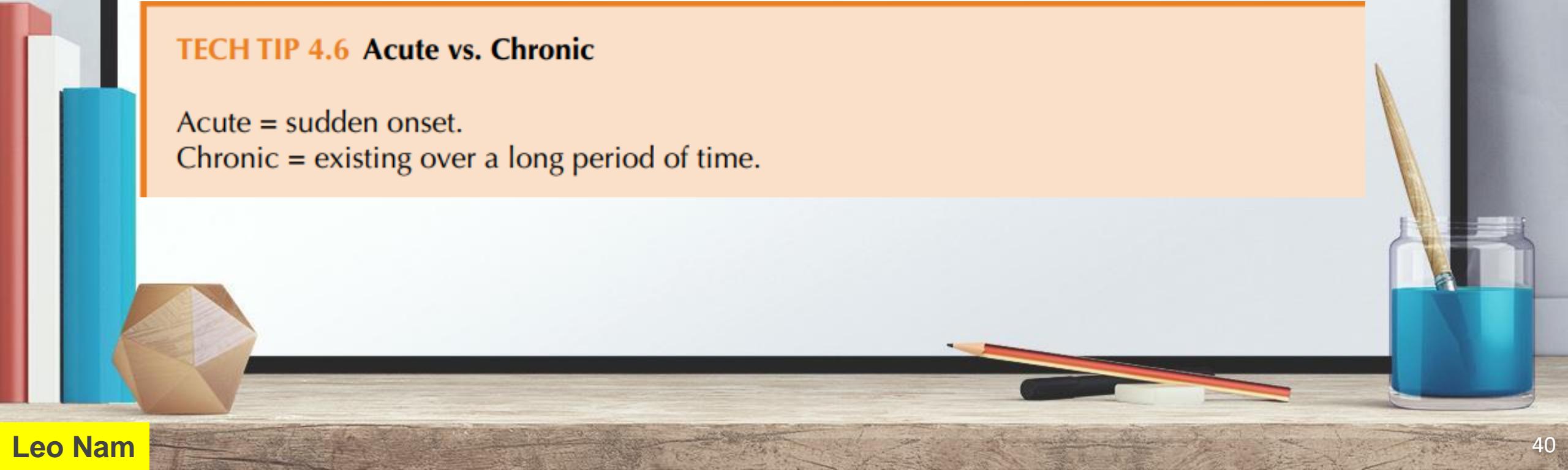
The rules for carcinoma are the same as the rules in Chapter 2 for sarcoma. You insert the organ of issue into the definition of carcinoma. For example, a gastric carcinoma is a malignant tumor of the stomach arising from epithelial tissue.

Remember to use this format: malignant tumor of _____ arising from epithelial tissue.

TECH TIP 4.6 Acute vs. Chronic

Acute = sudden onset.

Chronic = existing over a long period of time.



Pathology and Procedures

- Cirrhosis** Degenerative disease in which the liver cells are replaced with scar tissue (Figure 4.26).
- Colic** Acute abdominal pain.

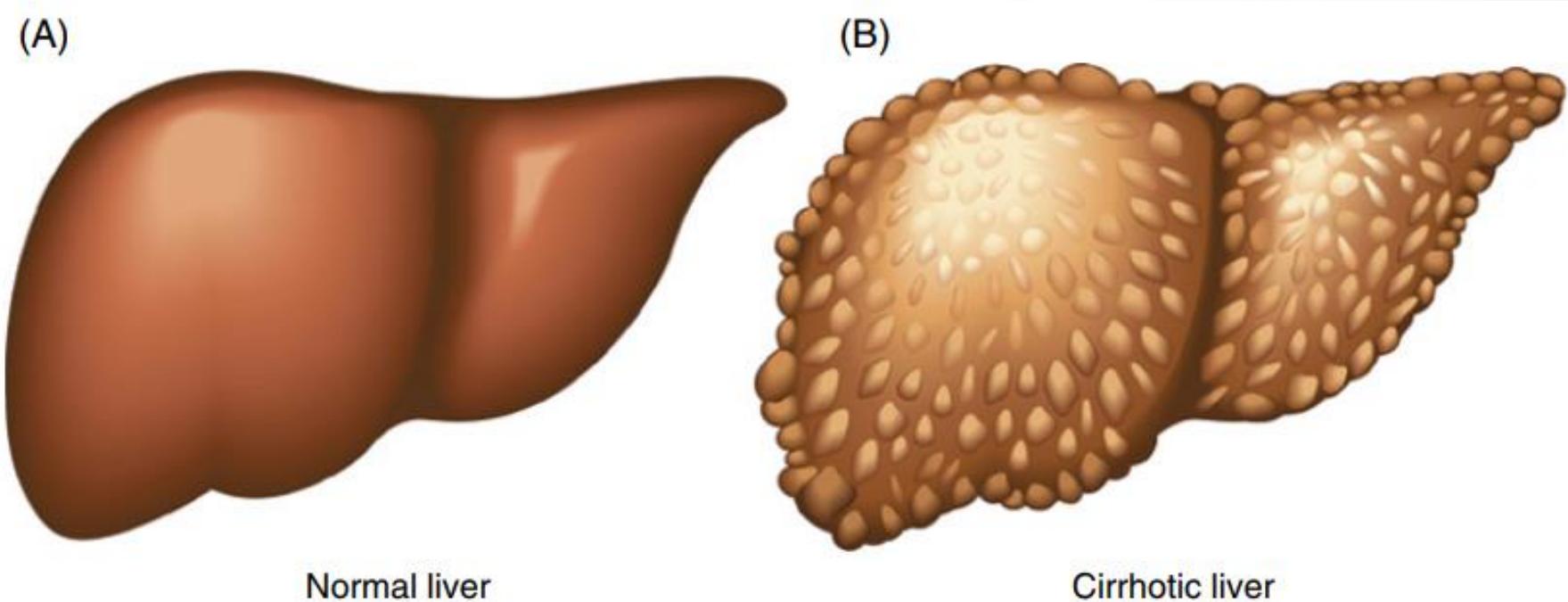


Figure 4.26 Healthy liver versus cirrhosis. Source: Courtesy of shutterstock/Rob3000.

Pathology and Procedures

Constipation

Difficulty passing feces (Figure 4.27).

Coprophagia

Ingestion of feces.

Diarrhea

Rapid movement of feces through the GI tract; loose, watery stool.

Displaced abomasum

Condition in which the abomasum becomes trapped under the rumen. Displacement may be to the left or right side.

Diverticulitis

Inflammation of the diverticulum.

Drench

To give medication in liquid form by mouth and forcing the animal to drink.

Emaciation

Marked wasting or excessive leanness (Figure 4.28B).

Emesis

Vomiting; forcible expulsion of stomach contents through the mouth. The material vomited is termed **vomitus** (Figure 4.29).



Figure 4.27 Radiograph of a constipated dog. Source: Courtesy of Beth Romano, AAS, CVT.



Pathology and Procedures

Emetic

Substance given to produce vomiting (Figure 4.29A).

Enema

Introduction of fluid into the rectum to promote defecation.

Eruption

Gas expelled from the stomach out of the mouth; a belch.

Esophageal

atresia

Closure of the opening of the esophagus. The suffix “-tasia” means opening. When combined with the prefix *a-*, which means no or not, its meaning is reversed to a closure.

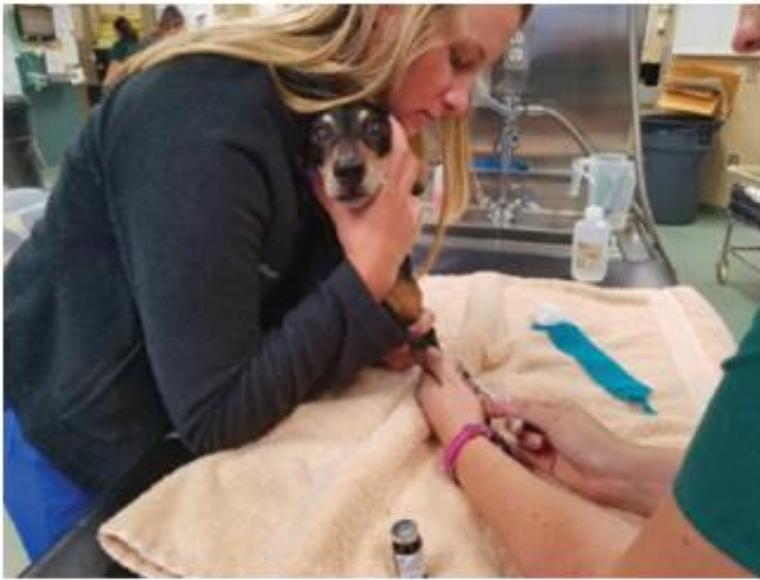
**Esophageal
reflux**

A backward or return flow of stomach contents into the esophagus; also known as **GERD (gastroesophageal reflux disease)**.

Etiology

Study of the cause of disease.

(A)



Pathology and Procedures

Fecal exam

Group of tests used to detect parasites in feces.

Foreign body

Material which finds its way into organs and tissues (Figure 4.30).

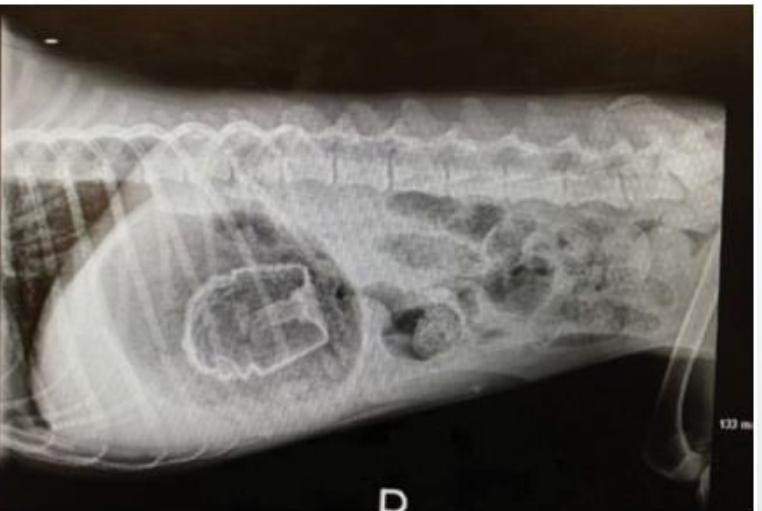
Gastric dilatation

Abnormal condition in which the stomach fills with air and expands. This is a common problem in large breed dogs, particularly the deep-chested breeds.

Gastric dilatation volvulus

Abnormal condition in which the stomach fills with air, expands, and then twists on itself. This is a common problem in large breed dogs, particularly the deep-chested breeds. Commonly called “bloat” (Figure 4.31).

(A)



D

(B)

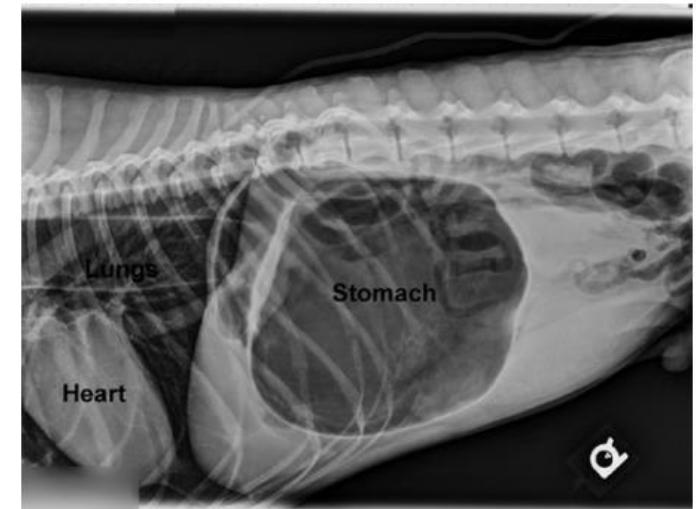


Figure 4.31 Radiograph of gastric dilatation volvulus in a dog. Source: Courtesy of Beth Romano, AAS, CVT.



Figure 4.30 GI foreign bodies. (A) Radiograph of a dog with a GI foreign body. (B) Surgery to remove the foreign body. Note the redness of the intestines. (C) Foreign body removed. Source: (A-C) Courtesy of Judy Zane, CVT. (D) Radiograph of a canine abdomen showing a surgical instrument (hemostat) left in the body after surgery. Source: Courtesy of Stacey Fowler, LVT.

Pathology and Procedures

Gavage

Forced feeding or irrigation through a tube passed into the stomach.

Hematochezia

Bright, red, fresh blood from the rectum.

Hemorrhagic
gastroenteritis

Acute condition in dogs causing vomiting and bloody diarrhea leading to dehydration, heart failure, and eventually death.

Hepatic
lipidosis

Accumulation of fat in the liver that leads to liver damage. Disease typically occurs in cats after a period of anorexia (Figure 4.32).

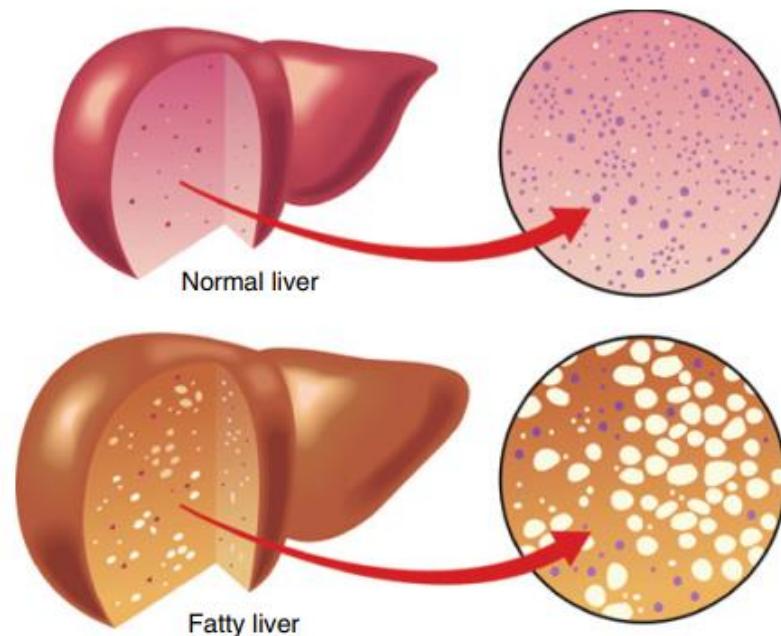


Figure 4.32 Hepatic lipidosis (fatty liver). Source: Courtesy of shutterstock/Rob3000.

Hiatal hernia

Protrusion of a structure, usually the stomach, through the esophageal opening in the diaphragm (Figure 4.33).

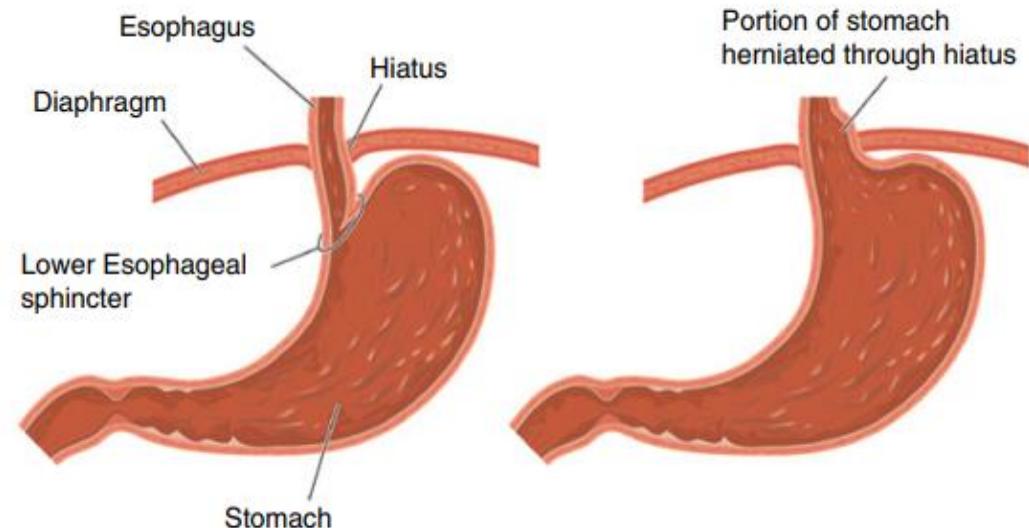


Figure 4.33 Hiatal hernia. Source: Courtesy of shutterstock/blamb.

Pathology and Procedures

Idiopathic	When the cause of disease is neither known nor understood.
Ileus	Failure of peristalsis with obstruction of the intestines.
Inappetence	Lack of appetite.
Incontinence	Inability to control excretory functions (defecation or urination).
Intussusception	Telescoping of the intestines (Figure 4.34).
Jaundice	Yellowish-orange coloration of the skin and mucous membranes due to excessive bilirubin in the blood; synonymous with icterus.
Lethargy	Condition of drowsiness or indifference.
Malabsorption	Impaired absorption of nutrients in the duodenum.

TECH TIP 4.7 Jaundice vs. Icterus

These two terms are often used interchangeably. There is a difference between the two terms, though. Both terms are used to describe a yellowish coloration; the difference is in where the yellow color is.

In jaundice, the yellow color is on the skin and mucous membranes. In icterus, the yellow color is in the plasma of the blood.

Both are caused by excessive levels of bilirubin.

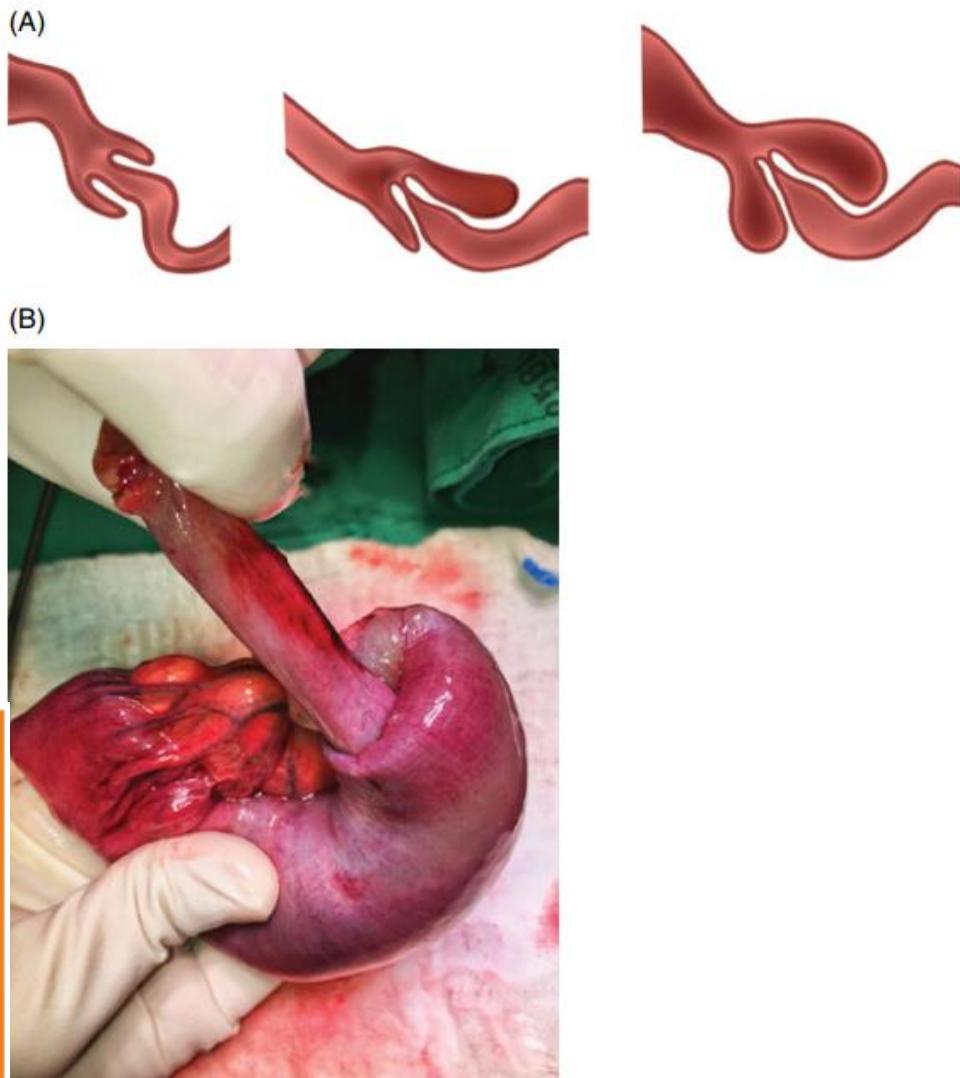


Figure 4.34 Intestinal obstruction caused by intussusception. (A) Stages of intussusception. Source: Courtesy of shutterstock/Artemida-psy. (B) Surgery to correct intussusception. Source: Courtesy of shutterstock/Pthawatc.

Pathology and Procedures

Maldigestion	Inability to digest food due to lack of digestive enzymes. Also known as exocrine pancreatic insufficiency .
Malaise	A vague feeling of bodily discomfort.
Megaesophagus	Enlargement of the esophagus (Figure 4.35).
Megacolon	Enlargement of the colon (Figure 4.35).

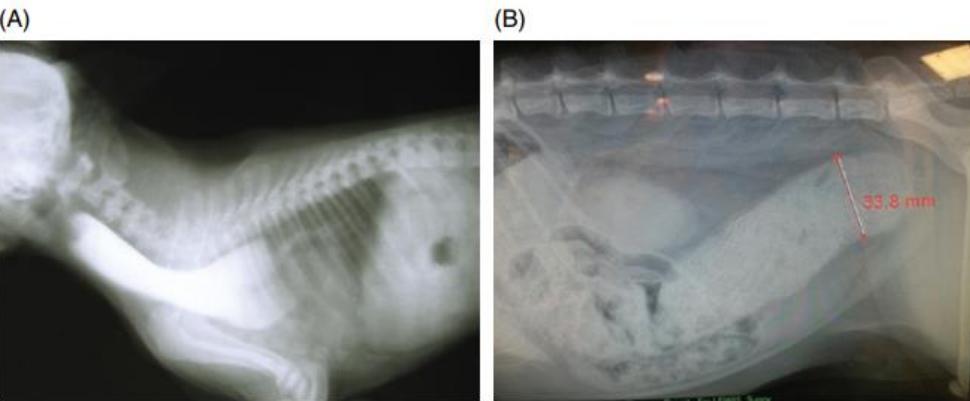


Figure 4.35 (A) Radiograph of megaesophagus. Source: Courtesy of shutterstock/P.Fabian. (B) Radiograph of megacolon. Source: Courtesy of Beth Romano, AAS, CVT. (C) Great Dane pups with megaesophagus using the Bailey Chair to eat. This chair has the animal sit up for 20–30 minutes to allow gravity to work the food down the esophagus. Source: Courtesy of Kimberly Perkovich, CVT, RVT.

TECH TIP 4.8 Melena vs. Hematochezia

Both melena and hematochezia involve blood in the feces. The appearance of the blood is what separates these two terms. If the blood is bright, red, and fresh, then it came from the lower GI tract. If the blood is black and tarry in appearance, then it has been digested in the stomach and duodenum. Using the appropriate term can therefore isolate where in the GI tract the problem may be.



Pathology and Procedures

Melena
Nasogastric intubation
Nausea
Obese
Obstipation
Obstruction

Black tarry stool; blood in feces.
Placement of a tube from the nose to the stomach (Figure 4.36).
Upset stomach and a tendency to vomit.
Excessive fat accumulation in the body (Figure 4.37).
Inability to eliminate.
Complete stoppage or impairment of passage.

(A)



(B)



Figure 4.36 (A) Nasogastric tube in a Husky. Source: Courtesy of A.K. Traylor, DVM; Microscopy Learning Systems. (B) Nasogastric tube in a Golden Retriever. Source: Courtesy of Kari Walker, BS, CVT, VTS (SAIM).

(A)



(B)



(C)



(D)



Figure 4.37 (A) Overweight Weimaraner. Source: Courtesy of A.K. Traylor, DVM; Microscopy Learning Systems. (B) 77-pound Dachshund named Obie. (C) Obie being prepped for surgery to remove excess skin after losing 40 pounds. (D) Obie 40 pounds lighter after a proper diet and exercise. Source: (B-D) Courtesy of Nora Vanatta.

Pathology and Procedures

Orogastric intubation
Palpation
Parenteral
Pica

Placement of a tube from the mouth to the stomach.

Method of examining the internal body by touching and feeling.

Route of administration other than oral.

Eating or licking abnormal substances; a depraved appetite (Figure 4.38).

Figure 4.38 Pica. (A) Radiograph of a canine abdomen showing rocks in the stomach. This Rottweiler would come to the clinic every three months with rocks in its stomach. (B) Radiograph of a dog that frequently ingests nails and screws. Source: Courtesy of Stacey Fowler, LVT. (C) Radiograph of a dog that ingested a rubber ducky. Source: Courtesy of Diane Tonmanikout, CVT.



Pathology and Procedures

Pneumocolon Air in the colon; procedure that places air in the colon as a means of diagnosis (Figure 4.39A).

Portosystemic shunt Condition in which the blood vessels bypass the liver and the blood is not detoxified.

Regurgitate Passive event in which swallowed food is returned to the oral cavity.

Rumen fistula Procedure in which a canula is placed on the side of a cow for access to digestive contents in the rumen. This method allows for ingesta and the cow's digestive tract to be studied (Figure 4.39B).

(A)



(B)



TECH TIP 4.9 Vomiting vs. Regurgitation

Vomiting is a forcible event, whereas regurgitation is a passive event. My students will often think of newborn babies when trying to distinguish these two terms. Newborn babies regurgitate often. They don't even realize that it's happening. It just comes up!



Figure 4.39 (A) Radiograph of pneumocolon. Source: Courtesy of Beth Romano, AAS, CVT. (B) Rumen fistula. Source: Courtesy of Deanna Roberts, BA, AAS, CVT.

Pathology and Procedures

Scours	Diarrhea in livestock (Figure 4.40).
Shunt	To bypass or divert.
Spasm	Sudden, involuntary contraction.
Stasis	Stopping or controlling.
Steatorrhea	Fat in feces.
Stenosis	Tightening, narrowing, or stricture.
Stoma	An incised opening that is kept open for drainage and other purposes.

TECH TIP 4.10 Suffixes Used as Terms

Some suffixes can be used as separate terms. Examples include:

- Emesis
- Spasm
- Stasis
- Stenosis

Their meanings are still the same as when they are used as suffixes.

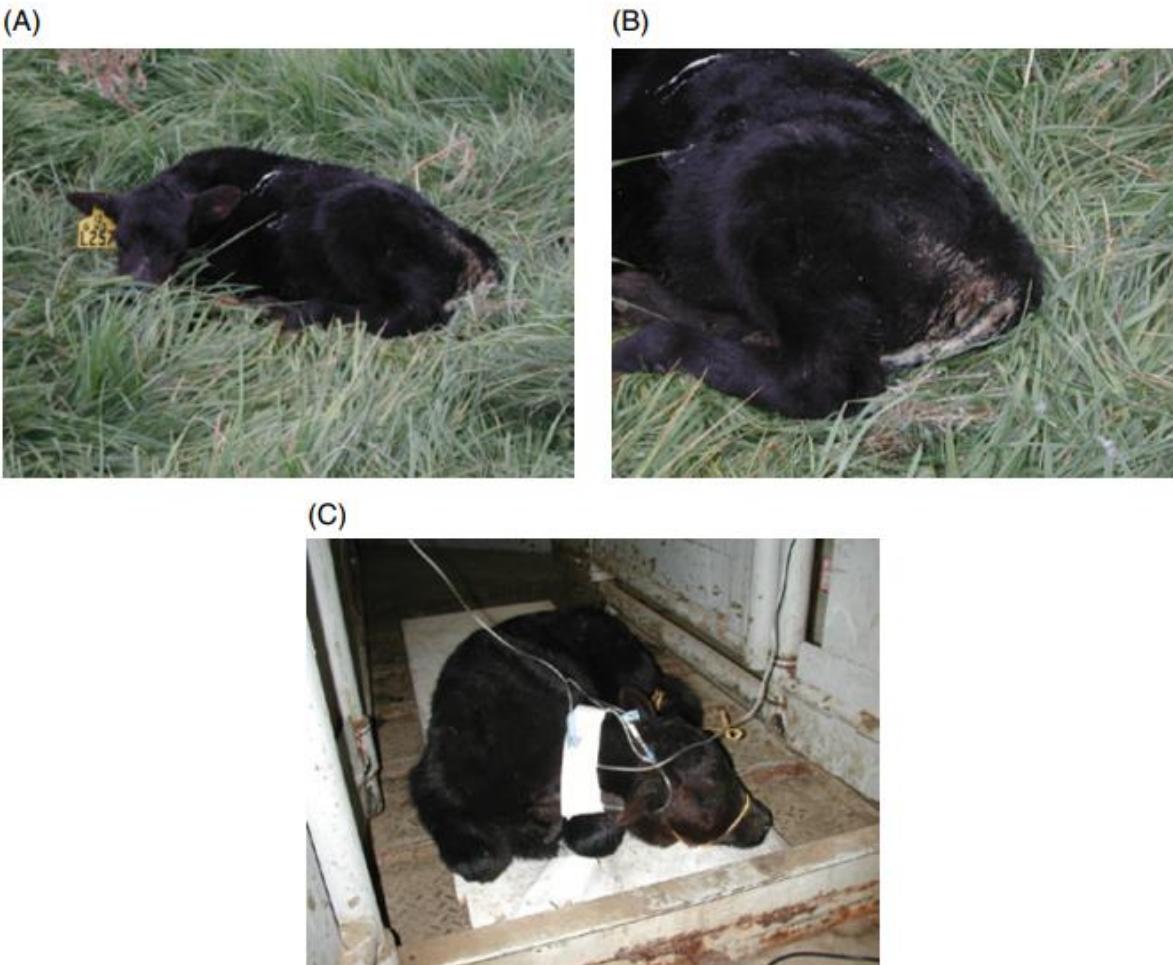


Figure 4.40 (A, B) Calf with scours. (C) Calf on IV fluids for treatment. Source: Courtesy of Patrick Hemming, DVM.

Pathology and Procedures

Tenesmus	Ineffectual and painful straining at defecation and urination.
Torsion	Axial twist; twisting around the long axis of the gut
Trichobezoar	Hairball (Figure 4.41).
Ulcer	Erosion of the skin and mucous membranes (Figure 4.42).
Ultrasound	Diagnostic technique using ultrasound waves to produce an image of an organ or tissue (Figure 4.43).
Volvulus	Twisting on itself (Figure 4.44).



Figure 4.41 Trichobezoar surgically removed from a cat. Source: Courtesy of Samantha Patterson, AAS.

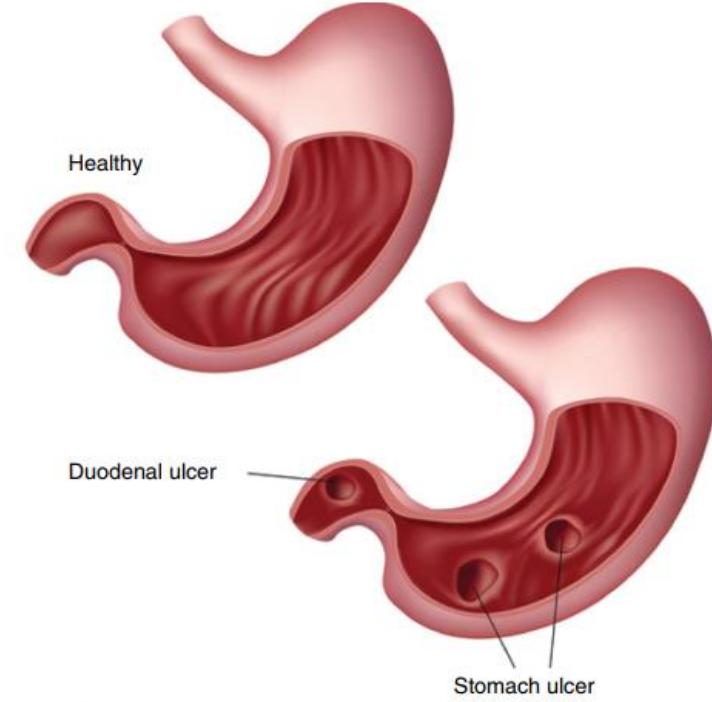


Figure 4.42 Gastric ulcers. Source: Courtesy of shutterstock/Alila Sao Mai.



Figure 4.43 Ultrasound on a dog. Source: Courtesy of Kari Walker, BS, CVT, VTS (SAIM).

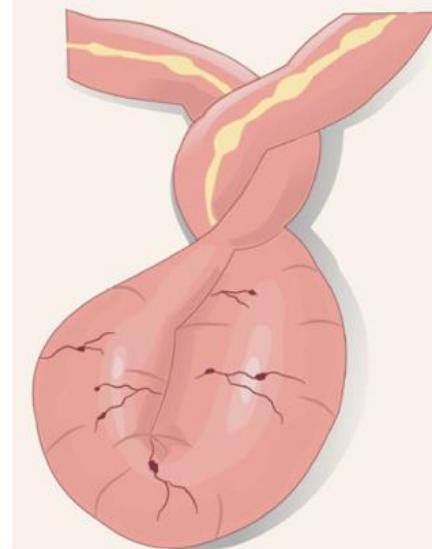


Figure 4.44 Intestinal volvulus. Source: Courtesy of shutterstock/ellepigrafica.

Building the Terms

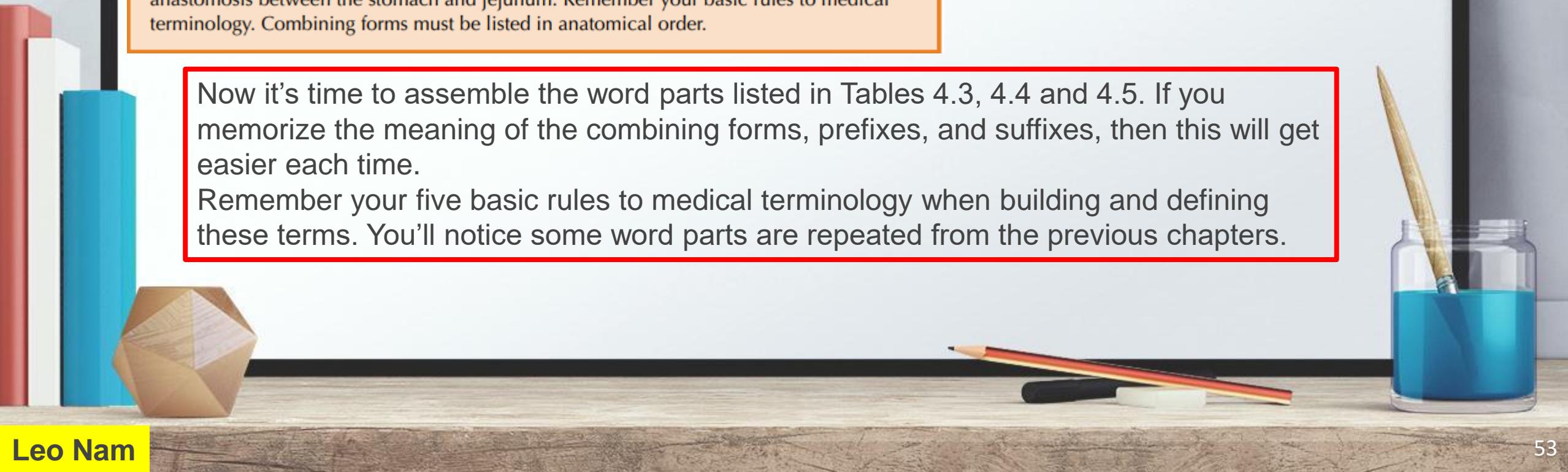
TECH TIP 4.11 Rules for Using the Suffix “-stomy”

Rule 1: If “-stomy” is attached to just one combining form, then its definition is a new opening to the outside of the body. You insert the combining form into the definition of “-stomy.” For example, a gastrostomy would be a new opening from the stomach to the outside of the body. Just remember to use this format: a new opening from the _____ to the outside of the body.

Rule 2: If “-stomy” is attached to more than one combining form then its meaning changes to a surgical connection or an anastomosis. For example, a gastrojejunostomy would be a surgical connection between the stomach and jejunum. Or you could say an anastomosis between the stomach and jejunum. Remember your basic rules to medical terminology. Combining forms must be listed in anatomical order.

Now it's time to assemble the word parts listed in Tables 4.3, 4.4 and 4.5. If you memorize the meaning of the combining forms, prefixes, and suffixes, then this will get easier each time.

Remember your five basic rules to medical terminology when building and defining these terms. You'll notice some word parts are repeated from the previous chapters.



Building the Terms

Table 4.3 Combining forms.

Combining Forms	Definition	Combining Forms	Definition
Abdomin/o	Abdomen	Hem/o	Blood
Acu/o	Sudden; sharp; severe	Hemat/o	Blood
Adip/o	Fat	Hepat/o	Liver
Aliment/o	To nourish	Herni/o	Hernia
Amyl/o	Starch	Hydr/o	Fluid; water
An/o	Anus	Ile/o	Ileum
Bi/o	Life	Inguin/o	Groin
Bil/i	Bile; gall	Jejun/o	Jejunum
Bilirubin/o	Bilirubin	Labi/o	Lips
Bucc/o	Cheek	Lapar/o	Abdomen
Carcin/o	Cancerous; cancer	Lingu/o	Tongue
Cec/o	Cecum	Lip/o	Fat

Building the Terms

Combining Forms	Definition	Combining Forms	Definition				
Celi/o	Belly; abdomen	Lith/o	Stone	Enter/o	Small intestine	Pylor/o	Pyloric sphincter; pylorus
Cheil/o	Lip	Mandibul/o	Mandible; lower jaw	Esophag/o	Esophagus	Radi/o	X-ray; radius; radioactivity
Chol/e	Bile; gall	Muc/o	Mucus	Faci/o	Face	Rect/o	Rectum
Cholangi/o	Bile vessel; bile duct	Nas/o	Nose	Gastr/o	Stomach	Rug/o	Wrinkle or fold
Cholecyst/o	Gallbladder	Necr/o	Death	Gingiv/o	Gums	Sial/o	Saliva; salivary
Choledoch/o	Common bile duct	Odont/o	Tooth	Gloss/o	Tongue	Sialaden/o	Salivary gland
Chron/o	Time	Or/o	Mouth	Gluc/o	Sugar	Steat/o	Fat; sebum
Cib/o	Meals	Palat/o	Palate; roof of the mouth	Glyc/o	Sugar	Stomat/o	Mouth
Col/o, Colon/o	Large intestine; colon	Pancreat/o	Pancreas	Glycogen/o	Glycogen	Trich/o	Hair
Copr/o	Feces	Peritone/o	Peritoneum	Gnath/o	Jaw	Vill/i	Tuft of hair; thread-like projection from membrane
Cyst/o	Urinary bladder; cyst; sac of fluid	Phag/o	Eat; swallow				
Decidu/o	Shedding	Pharyng/o	Throat; pharynx				
Dent/o, dent/i	Tooth	Proct/o	Anus and rectum				
Dips/o	Thirst	Prote/o	Protein				
Duoden/o, duoden/i	Duodenum	Py/o	Pus				

Building the Terms

Table 4.4 Prefixes.

Prefix	Definition	Prefix	Definition
a-, an-	no; not; without	mega-	large
ante-	before; forward	meta-	change; beyond
anti-	against	neo-	new
brachy-	short	para-	near; beside; abnormal; apart from; along the side of
de-	lack of; down; less; removal of	peri-	surrounding; around
dys-	bad; painful; difficult; abnormal	poly-	many; much
endo-	in; within	post-	after; behind
hyper-	above; excessive	pre-	before; in front of
hypo-	deficient; below; under; less than normal	pro-	before; forward
mal-	bad	sub-	under; below

Building the Terms

Table 4.5 Suffixes.

Suffix	Definition	Suffix	Definition	Suffix	Definition	Suffix	Definition
-al, -ar, -ary, -eal, -ic, -ous	Pertaining to	-opsy	view of	-genesis	producing; forming	-rrhea	flow; discharge
-ase	enzyme	-orexia	appetite	-graph	instrument for recording	-scope	instrument for visual examination
-ation	process; condition	-ose	full of; pertaining to; sugar	-graphy	process of recording	-scopy	visual examination
-cele	hernia	-osis	abnormal condition	-ia	condition	-spasm	sudden involuntary contraction of muscles
-centesis	surgical puncture to remove fluid	-otic	pertaining to the abnormal condition	-iasis	abnormal condition	-stalsis	contraction
-chezia	defecation; elimination of waste	-pepsia	digestion	-ion	process	-stasis	stopping; controlling
-cyte	cell	-pexy	surgical fixation; to put in place	-ism	process; condition	-stenosis	tightening; narrowing; stricture
-ectasis, -ectasia	stretching; dilation; dilatation	-phagia	eating; swallowing	-itis	inflammation	-stomy	new opening to the outside of the body
-ectomy	removal; excision; resection	-plasty	surgical repair	-lithiasis	abnormal condition of stones	-tomy	incision; process of cutting into
-emesis	vomiting	-prandial	meal	-logy	study of	-tresia	opening
-emia	blood condition	-ptyalo	spit; saliva	-lysis	breakdown; separation; destruction; loosening	-um	structure; tissue; thing; pertaining to
-emic	pertaining to a blood condition	-ptysis	spitting	-megaly	enlargement		
-gen	producing; forming	-rrhaphy	suture	-oma	tumor; mass; fluid collection		

Building the Terms

Parts		Medical Term	Definition	
Abdomin/o	+ -al	= Abdominal	: _____	
Abdomin/o	+ -centesis	= Abdominocentesis (Figure 4.45)	: _____	
Adip/o	+ -ose	= Adipose	: _____	
Amyl/o	+ -ase	= Amylase	: _____	
An/o	+ -al	= Anal	: _____	
peri-	+ An/o	+ -al	= Perianal	: _____
An/o	+ -plasty		= Anoplasty	: _____
An/o	+ Rect/o	+ -al	= Anorectal	: _____
anti-	+ -emesis	+ -ic	= Antiemetic	: _____
Bi/o	+ -logy		= Biology	: _____
Bil/i	+ -ary		= Biliary	: _____
hyper-	+ Bilirubin/o	+ -emia	= Hyperbilirubinemia	: _____
Bucc/o	+ -al		= Buccal	: _____
Carcin/o	+ -gen		= Carcinogen	: _____
Cec/o	+ -al		= Cecal	: _____
Celi/o	+ -ac		= Celiac	: _____
Cheil/o	+ -osis		= Cheilosis	: _____

Also called a paracentesis.

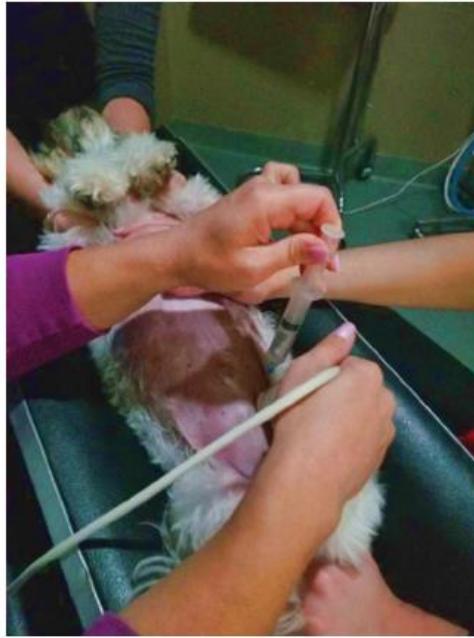


Figure 4.45 Ultrasound-guided abdominocentesis in a dog. Source: Courtesy of Kari Walker, BS, CVT, VTS (SAIM).

Building the Terms

Cholangi/o	+ -ectasia	= Cholangiectasia	: _____	
Cholangi/o	+ -stomy	= Cholangiostomy	: _____	
Cholangi/o	+ Carcin/o	+ -oma	= Cholangiocarcinoma	: _____
Cholangi/o	+ Hepat/o	+ -itis	= Cholangiohepatitis	: _____
Cholangi/o	+ Gastr/o	+ -stomy	= Cholangiogastrostomy	: _____
Cholangi/o	+ Enter/o	+ -stomy	= Cholangioenterostomy	: _____
Chol/e	+ -stasis		= Cholestasis	: _____
Cholecyst/o	+ -ic		= Cholecytic	: _____
Cholecyst/o	+ -ectomy		= Cholecystectomy	: _____
Cholecyst/o	+ -itis		= Cholecystitis	: _____
Cholecyst/o	+ -lithiasis		= Cholecystolithiasis	: _____
Cholecyst/o	+ Jejun/o	+ -stomy	= Cholecystojejunostomy	: _____
Choledoch/o	+ -al		= Choledochal	: _____
Choledoch/o	+ -lithiasis		= Choledocholithiasis	: _____
Choledoch/o	+ Jejun/o	+ -stomy	= Choledochojejunostomy	: _____
Choledoch/o	+ -tomy		= Choledochotomy	: _____
ante-	+ Cib/o	+ -um	= Antecibum	: _____
post-	+ Cib/o	+ -um	= Postcibum	: _____
Colon/o	+ -ic		= Colonic	: _____
Col/o	+ -itis		= Colitis	: _____
Colon/o	+ -scopy		= Colonoscopy (Figure 4.46)	: _____
Col/o	+ -stomy		= Colostomy	: _____

Also called colonitis.

Also called colonostomy.

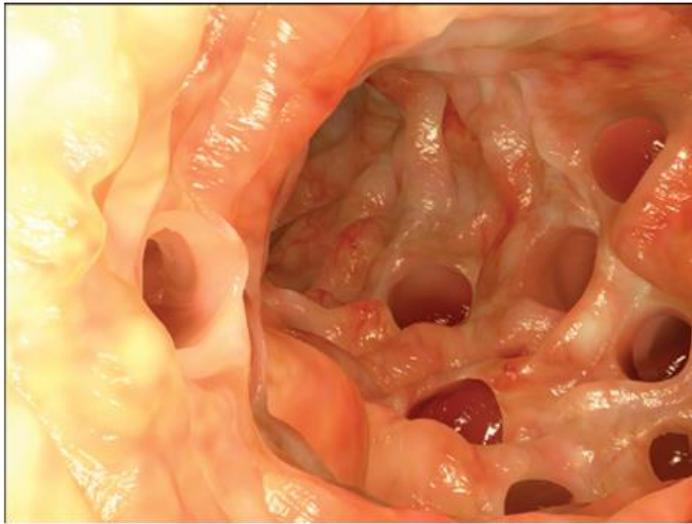


Figure 4.46 Colonoscopy showing diverticulitis. Source: Courtesy shutterstock/Juan Gaertner.



Building the Terms

Col/o	+ -tomy	= Colotomy	: _____	
Copr/o	+ -phagia	= Coprophagia	: _____	
Copr/o	+ Phag/o	+ -ic	= Coprophagic	: _____
Duoden/o	+ -al		= Duodenal	: _____
dys-	+ -chezia		= Dyschezia	: _____
dys-	+ -pepsia		= Dyspepsia	: _____
dys-	+ -phagia		= Dysphagia	: _____
Enter/o	+ -itis		= Enteritis	: _____
Enter/o	+ -tomy		= Enterotomy	: _____
Enter/o	+ -stomy		= Enterostomy	: _____
Enter/o	+ -ic		= Enteric	: _____
Enter/o	+ -ic +	+ -oma	= Enteric carcinoma	: _____
Carcin/o				
Enter/o	+ Col/o	+ -stomy	= Enterocolostomy	: _____
Enter/o	+ Col/o	+ -itis	= Enterocolitis	: _____
Esophag/o	+ -eal		= Esophageal	: _____
Esophag/o	+ -eal	+ Spasm	= Esophageal spasm	: _____
Esophag/o	+ -plasty		= Esophagoplasty	: _____
Esophag/o	+ -itis		= Esophagitis	: _____
Faci/o	+ -al		= Facial	: _____
Gastr/o	+ -ic		= Gastric	: _____
Gastr/o	+ -tomy		= Gastroscopy	: _____
Gastr/o	+ -ectomy		= Gastrectomy	: _____
Gastr/o	+ -stomy		= Gastrostomy	: _____
Gastr/o	+ Jejun/o	+ -stomy	= Gastrojejunostomy	: _____
Gastr/o	+ Enter/o	+ -itis	= Gastroenteritis	: _____
Gastr/o	+ Duoden/o	+ -stomy	= Gastroduodenostomy	: _____
Gastr/o	+ -pexy		= Gastropexy	: _____

*This is the procedure used
to correct bloat.*

(Figure 4.47)

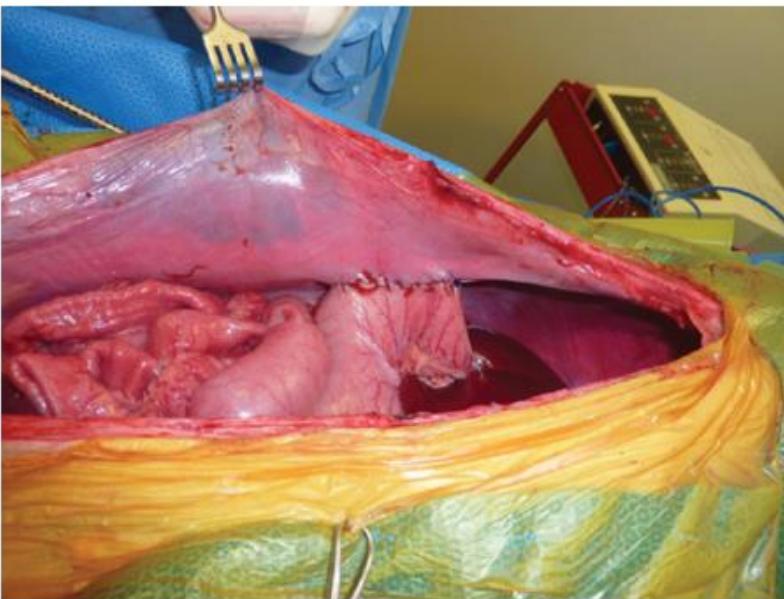


Figure 4.47 Gastropexy to correct a gastric dilatation volvulus. Source: Courtesy of Deanna Roberts BA, AAS, CVT.



Building the Terms

Gingiv/o	+ -al	= Gingival	: _____	
Gingiv/o	+ -itis	= Gingivitis	: _____	
Gingiv/o	+ -ectomy	= Gingivectomy	: _____	
Gloss/o	+ -al	= Glossal	: _____	
Gloss/o	+ -itis	= Glossitis	: _____	
hypo-	+ Gloss/o	+ -al	= Hypoglossal	: _____
Glyc/o	+ -emic		= Glycemic	: _____
hyper-	+ Glyc/o	+ -emia	= Hyperglycemia	: _____
hypo-	+ Glyc/o	+ -emia	= Hypoglycemia	: _____
hyper-	+ Glyc/o	+ -emic	= Hyperglycemic	: _____
hypo-	+ Glyc/o	+ -emic	= Hypoglycemic	: _____
brachy-	+ Gnath/o	+ -ia	= Brachyggnathia	: _____
pro-	+ Gnath/o	+ -ia	= Prognathia	: _____
Gnath/o	+ -ism		= Gnathism	: _____
			(Figure 4.48)	

Condition can affect the mandible or the maxilla.

Hemat/o	+ -emesis	= Hematemesis	: _____	
Hemat/o	+ -chezia	= Hematochezia	: _____	
Hem/o	+ peritoneum	= Hemoperitoneum	: _____	
Hem/o	+ abdomen	= Hemoabdomen	: _____	
		(Figure 4.49)		
Hem/o	+ -ptysis	= Hemoptysis	: _____	
Hepat/o	+ -megaly	= Hepatomegaly	: _____	
Hepat/o	+ -itis	= Hepatitis	: _____	
Hepat/o	+ -oma	= Hepatoma	: _____	
Hepat/o	+ -tomy	= Hepatotomy	: _____	
Hepat/o	+ -cyte	= Hepatocyte	: _____	
erni/o	+ -rrhaphy	= Herniorrhaphy	: _____	
	+ Hydr/o	+ -ation	= Dehydration	: _____

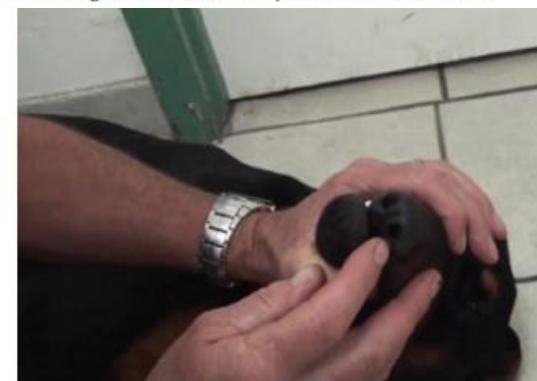


(A)

Figure 4.49 Hemoabdomen in a dog. Source: Courtesy of Sam Grebe, CVT.



(C)



(D)

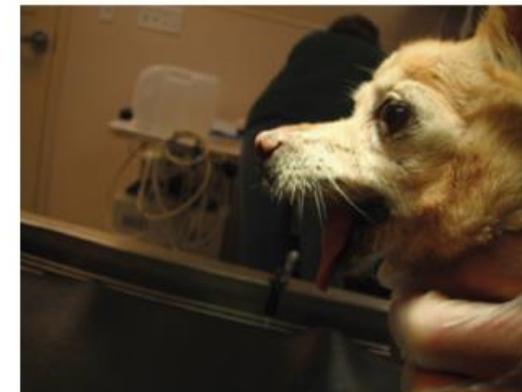


Figure 4.48 Mandibular deformities. (A) Elongated mandible. Source: Courtesy of A.K. Traylor, DVM; Microscopy Learning Systems. (B, C) Elongated mandible. Source: Courtesy of Greg Martinez, DVM; www.youtube.com/drgregdvm. (D) Chihuahua with mandibular brachyggnathism. Source: Courtesy of Deanna Roberts BA, AAS, CVT.

Building the Terms

Lingu/o	+ -al	= Lingual	:
sub-	+ Lingu/o	= Sublingual	:
Lip/o	+ -ase	= Lipase	:
Lip/o	+ -oma	= Lipoma (Figure 4.51)	:



Figure 4.51 (A) Lipoma in a Beagle. (B) Lipoma surgically removed from the Beagle. Source: Courtesy of Jennifer Tabor, AAS.

Labi/o	+ -al	= Labial	:
Lapar/o	+ -tomy	= Laparotomy	(Figure 4.50)



Figure 4.50 Laparotomy incision. Source: Courtesy of shutterstock/Kanwarjit Singh Boparai.



Building the Terms

Mandibul/o	+ -ar	= Mandibular	: _____	
sub-	+ Mandibul/o	+ -ar	= Submandibular	: _____
Muc/o	+ -ous		= Mucous	: _____
Necr/o	+ -opsy		= Necropsy	: _____
Necr/o	+ -osis		= Necrosis (Figure 4.52)	: _____
Nas/o	+ -al		= Nasal	: _____
Nas/o	+ Gastr/o	+ -ic	= Nasogastric	: _____
Or/o	+ -al		= Oral	: _____
Or/o	+ Gastr/o	+ -ic	= Orogastric	: _____
Or/o	+ Nas/o	+ -al	= Oronasal	: _____
Palat/o	+ -plasty		= Palatoplasty (Figure 4.53)	: _____
Pancreat/o	+ -itis		= Pancreatitis (Figure 4.54)	: _____

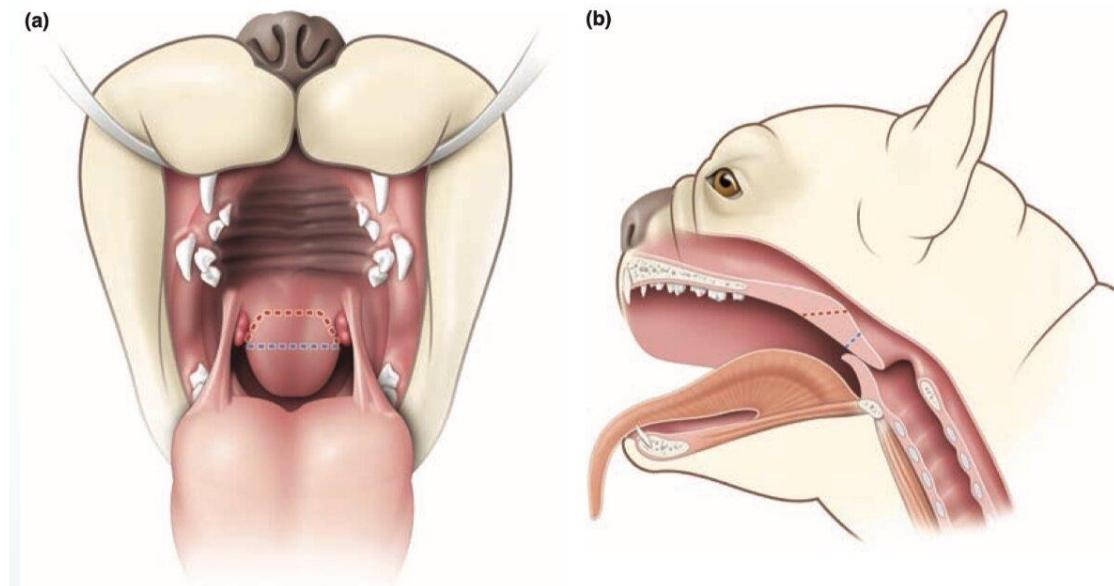


Figure 4.52 Intestinal necrosis. Source: Courtesy A.K. Taylor, DVM; Microscopy Learning Systems.



Figure 4.53 Palatoplasty in a dog in which the hard palate separated from the bone plate. Source: Courtesy of Deanna Roberts, BA, AAS, CVT.



Figure 4.54 Dog with pancreatitis. Note the hunched appearance due to abdominal pain. Source: Courtesy of A.K. Taylor, DVM; Microscopy Learning Systems.

Building the Terms

Pancreat/o	+ -ic	= Pancreatic	: _____	
Peritone/o	+ -itis	= Peritonitis	: _____	
Peritone/o	+ -al	= Peritoneal	: _____	
Pharyng/o	+ -eal	= Pharyngeal	: _____	
Pharyng/o	+ -itis	= Pharyngitis	: _____	
poly-	+ Dips/o	+ -ia	= Polydipsia	: _____
poly-	+ -phagia		= Polyphagia	: _____
pre-	+ -prandial		= Preprandial	: _____
post-	+ -prandial		= Postprandial	: _____
Proct/o	+ -logy		= Proctology	: _____
Proct/o	+ -plasty		= Proctoplasty	: _____
Prote/o	+ -ase		= Protease	: _____
Py/o	+ -rrhea		= Pyorrhea	: _____
Pylor/o	+ -ic		= Pyloric	: _____
Pylor/o	+ -plasty		= Pyloroplasty	: _____
Pylor/o	+ -ic	+ Stenosis	= Pyloric stenosis	: _____
Pylor/o	+ -spasm		= Pylorospasm	: _____
Radi/o	+ -graph		= Radiograph	: _____
Radi/o	+ -logy		= Radiology	: _____
Rect/o	+ -al		= Rectal	: _____
Rect/o	+ -cele		= Rectocele	: _____
Sialaden/o	+ -itis		= Sialadenitis	: _____
Sialaden/o	+ -osis		= Sialadenosis	: _____
Sial/o	+ -cele		= Sialocele	: _____
Steat/o	+ -oma		= Steatoma	: _____
Steat/o	+ -lysis		= Steatolysis	: _____
Steat/o	+ -itis		= Steatitis	: _____
Stomat/o	+ -itis		= Stomatitis	: _____
Stomat/o	+ Gastr/o	+ -ic	= Stomatogastric	: _____
Stomat/o	+ -logy		= Stomatology	: _____

Abbreviations

Abbreviation	Definition
ac	Before meals (ante cibum)
Alk. phos.	Alkaline phosphatase (liver enzyme)
ALT	Alanine aminotransferase (liver enzyme)
AST	Aspartate aminotransferase
BCS	Body condition score



Abbreviations

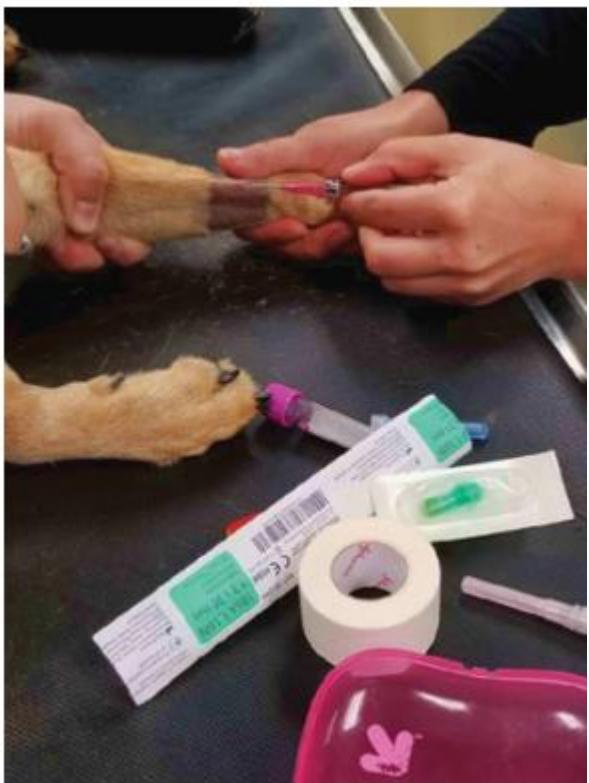
Abbreviation	Definition		
BS	Body score	hg	Hecogram
BSA	Body surface area	HGE	Hemorrhagic gastroenteritis
c	Cup	IC	Intracardiac
cc	Cubic centimeter	ID	Intradermal
cg	Centigram	IM	Intramuscular
dg	Decigram	IO	Intraosseous
dkg	Dekagram	IP	Intraperitoneal
fl oz	Fluid ounce	IV	Intravenous
GDV	Gastric dilatation volvulus	IVC	Intravenous catheter
GI	Gastrointestinal	inj	Injection
g or gm	Gram	L (l)	Liter
gal	Gallon	LDA/RDA	Left displaced abomasum/right displaced abomasum; condition in which the abomasum becomes trapped under the rumen
gr	Grain		
gtt, gtts	Drop, drops		

Abbreviations

Abbreviation	Definition	Abbreviation	Definition
TGE	Transmissible gastroenteritis	oz	Ounce
mcg; µg	Microgram	pc	After meals (post cibum)
meq	Milliequivalent	PO	By mouth (per os)
mg	Milligram	pt	Pint
mL	Milliliter; 1 mL = 1 cc	qt	Quart
mm	Millimeter	SQ or SC	Subcutaneous (sub Q)
ng	Nanogram	T, Tbs, Tbsp	Tablespoon; 1 Tbsp = 15 mls
NG tube	Nasogastric tube	t or tsp	Teaspoon; 1 tsp = 5 mls
NPO	Nothing by mouth (nil per os)	# or lbs	Pounds
oz	Ounce	kg	Kilogram; 1# = 2.2 kg
pc	After meals (post cibum)	RUQ; RU	Right upper quadrant
PO	By mouth (per os)	RLQ; RL	Right lower quadrant
		LUQ; LU	Left upper quadrant
		LLQ; LL	Left lower quadrant

Abbreviations

(A)



(B)



(C)



Figure 4.55 Placement of an intravenous catheter (IVC). (A) The technician places the IVC in the cephalic vein while another technician holds off the vein. (B) Once placed into the vein, the IVC is taped onto the limb. (C) The IVC is then flushed with saline. Source: Courtesy of Kari Walker, BS, CVT, VTS (SAIM).

Case Study: Give the medical terms and abbreviations for definitions in bold print

You'll notice some terms from the previous chapters

Maverick, a three-year-old Shetland Sheepdog, presents to your clinic with **blood in the feces** and **vomiting blood**. On exam you notice a **condition of drowsiness**. Abdominal palpation is difficult because Maverick has a hunched posture. He also appears to have a **condition of lack of fluid**. A group of tests is performed to check for parasites. After the tests come back negative a **diagnostic procedure using ultrasound waves** is performed. **Inflammation of the pancreas** is noted and a slight **enlargement of the liver** is seen.

An **IVC** (Figure 4.55) is placed and Maverick is given **IV** fluids. He was **NPO** for 24 hours. A **substance is given to counteract the vomiting**. Blood work is performed and the lab results show that Maverick has a **blood condition of excessive sugar**. His **ALT** and **Alk. Phos.** are also elevated.

Maverick's owner asks that we give him eye drops that he usually gets each night. The directions are to give 2 **gtts** in each eye at night. Maverick is also given an **inj.** for the pain.

After two days of hospitalization, Maverick improves and is allowed to go home.

