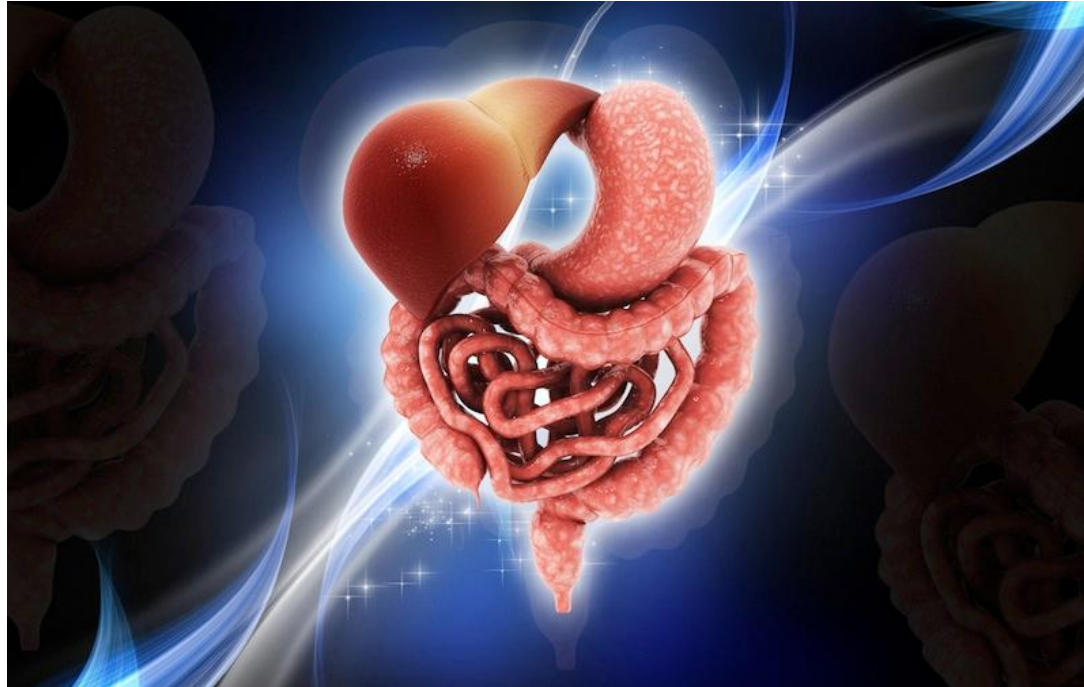


# Lecture 6

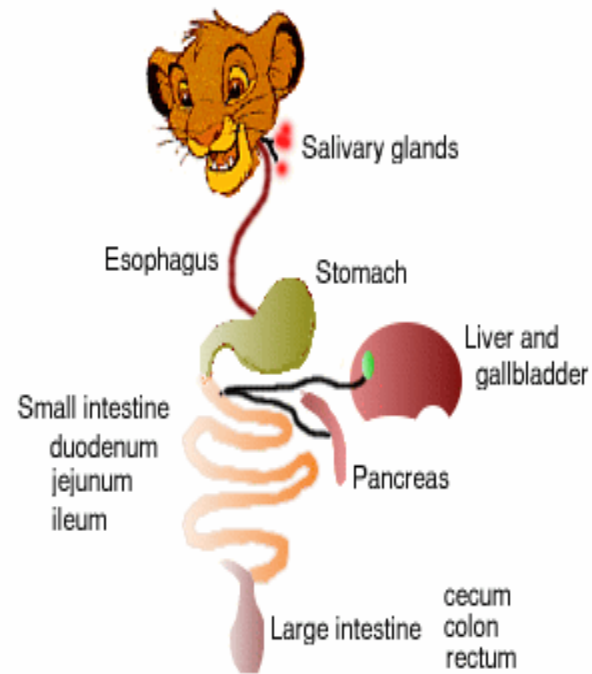


## The Gastrointestinal System

Asst. Prof. Dr. Wayne J. Fuller

# The Digestive System

- The digestive system is referred to as the
  - digestive system (or tract)
  - alimentary system
  - GI system (or tract)
- The digestive system is basically a long, muscular tube that begins at the mouth and ends at the anus

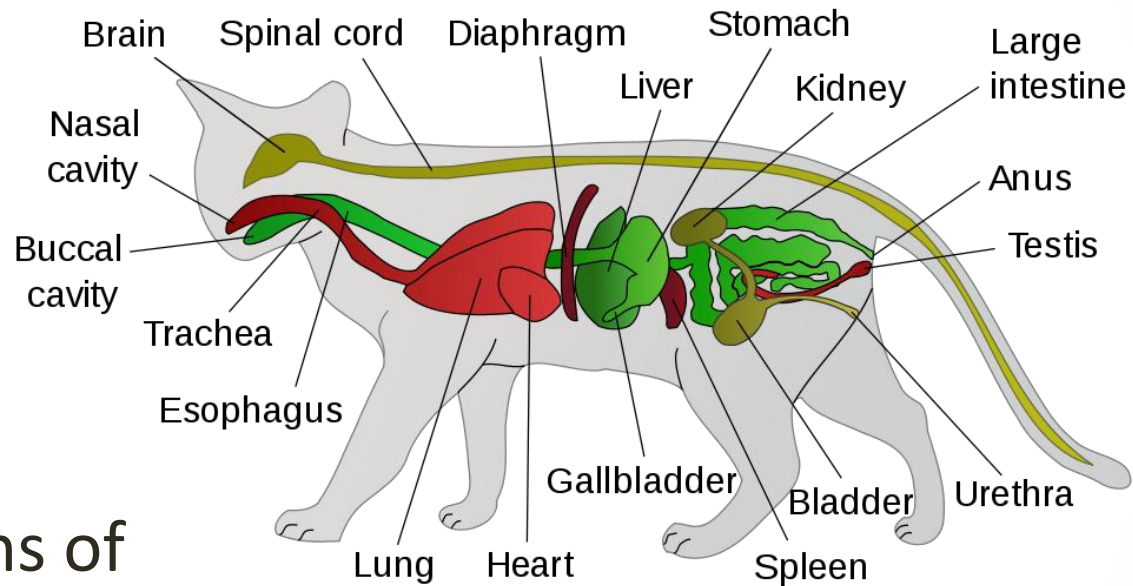


# The Digestive System

- Functions of the digestive system
  - intake and digestion of food and water
  - absorption of nutrients
  - elimination of solid wastes
- The combining form for nourishment is aliment/o

# Structures of the Digestive System

- Mouth or oral cavity
- Pharynx
- Esophagus
- Stomach
- Small intestines
- Large intestines
- Accessory organs of digestion



# Structures of the Mouth

- Mouth or oral cavity
  - Contains the lips, cheeks, palates (hard and soft), salivary glands, tongue, teeth, and periodontium
  - Combining forms are or/o and stomat/o
- Boundaries of the mouth are the maxilla and mandible (jaw)
  - Combining form for jaw is gnath/o
  - Prognathia means having an elongated mandible (overshot)
  - Brachygnathia means having a shortened mandible (undershot)

# Structures of the Digestive System

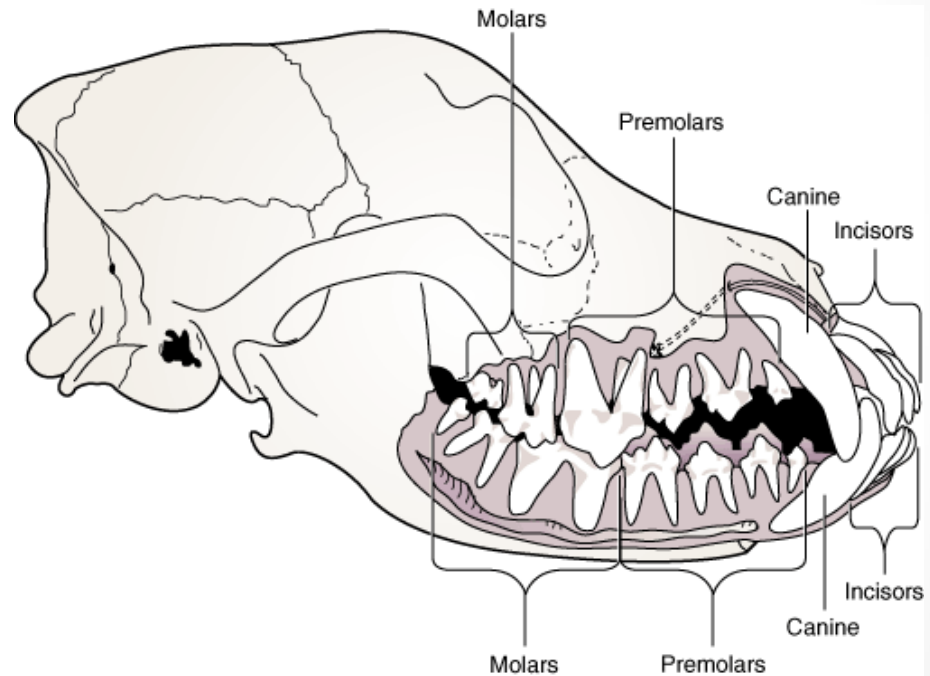
- Mouth or oral cavity
  - Lips form the opening to the oral cavity
    - Combining forms are cheil/o and labi/o
  - Cheeks form the walls of the oral cavity
    - Combining form is bucc/o
  - The palate forms the roof of the mouth
    - Combining form is palat/o
    - Rug/o = wrinkle or fold
- Tongue is a movable muscular organ
  - Combining forms are gloss/o and lingu/o
  - Papillae are the elevations on the tongue
    - Filiform = threadlike
    - Fungiform = mushroom-like
    - Vallate = cup-shaped

# Structures of the Mouth

- Teeth are arranged in the maxillary and mandibular arcade
  - Combining forms are dent/o, dent/l, and odont/o
- Dentition refers to the teeth as a whole
  - The primary dentition is temporary and known as the deciduous dentition
    - decidu/o = shedding
  - The secondary dentition is permanent
- Dental formula represents the type and number of each tooth type found in that species
  - Adult dog is 2(I 3/3, C 1/1, P 4/4, M 2/3)

# Tooth Names

- Types of teeth
  - incisor = front, cutting tooth
  - canine = long, pointed bonelike tooth for grasping and tearing
  - premolar = cheek tooth that grinds food
  - molar = caudal cheek tooth that grinds food
  - Carnassial teeth





# Dental Formula's

- The number of each type of tooth varies from one species to another and the conventional way of describing them is by a "dental formula". The type of teeth are indicated by the first letter, and the number of teeth on one side of the upper jaw is indicated over the number of the same type of teeth on the lower jaw. Because the formula is for one side of the mouth the total number of teeth is the total in the formula x 2.
- The dental formula for different species are as follows where **I** = incisors, **C** = canines, **P** = premolars and **M** = molars :
- **Man (adult)**
- **I - 2/2 C - 1/1 P - 2/2 M - 3/3 = 16 x 2 = 32**

## Dog

a) Puppy (temporary teeth) Not present at birth - but complete by 60 days.

**I** - 3/3 **C** - 1/1 **P** - 3/3 **M** - 0/0 = 14 x 2 =  
28

b) Adult (permanent teeth) - emerge at about 4 months of age

**I** - 3/3 **C** - 1/1 **P** - 4/4 **M** - 2/3 = 21 x 2 =  
42

## Cat

a) Kitten (temporary teeth). Not present at birth but complete by 60 days.

$$I - 3/3 \quad C - 1/1 \quad P - 3/2 \quad M - 0/0 = 13 \times 2 = 26$$

b) Adult (permanent teeth) - emerge at about 4 months of age

$$I - 3/3 \quad C - 1/1 \quad P - 3/2 \quad M - 1/1 = 15 \times 2 = 30$$

## Horse

a) Temporary teeth

$$I - 3/3 \quad C - 0/0 \quad P - 3/3 \quad M - 0/0 = 12 \times 2 = 24$$

b) Adult (permanent teeth)

$$I - 3/3 \quad C - 1/1 \quad P - 3 \text{ or } 4/3 \quad M - 3/3 = 20 \\ (\text{or } 21) \times 2 = 40 \text{ (or } 42)$$

## Cattle

### a) Temporary teeth

$$I - 0/4 \quad C - 0/0 \quad P - 3/3 \quad M - 0/0 = 10 \times 2 = 20$$

### b) Permanent teeth

$$I - 0/4 \quad C - 0/0 \quad P - 3/3 \quad M - 3/3 = 16 \times 2 = 32$$

In cattle the permanent teeth are not fully erupted until 3.5-4 years of age

## Sheep

### a) Temporary teeth

$$I - 0/4 \quad C - 0/0 \quad P - 3/3 \quad M - 0/0 = 10 \times 2 = 20$$

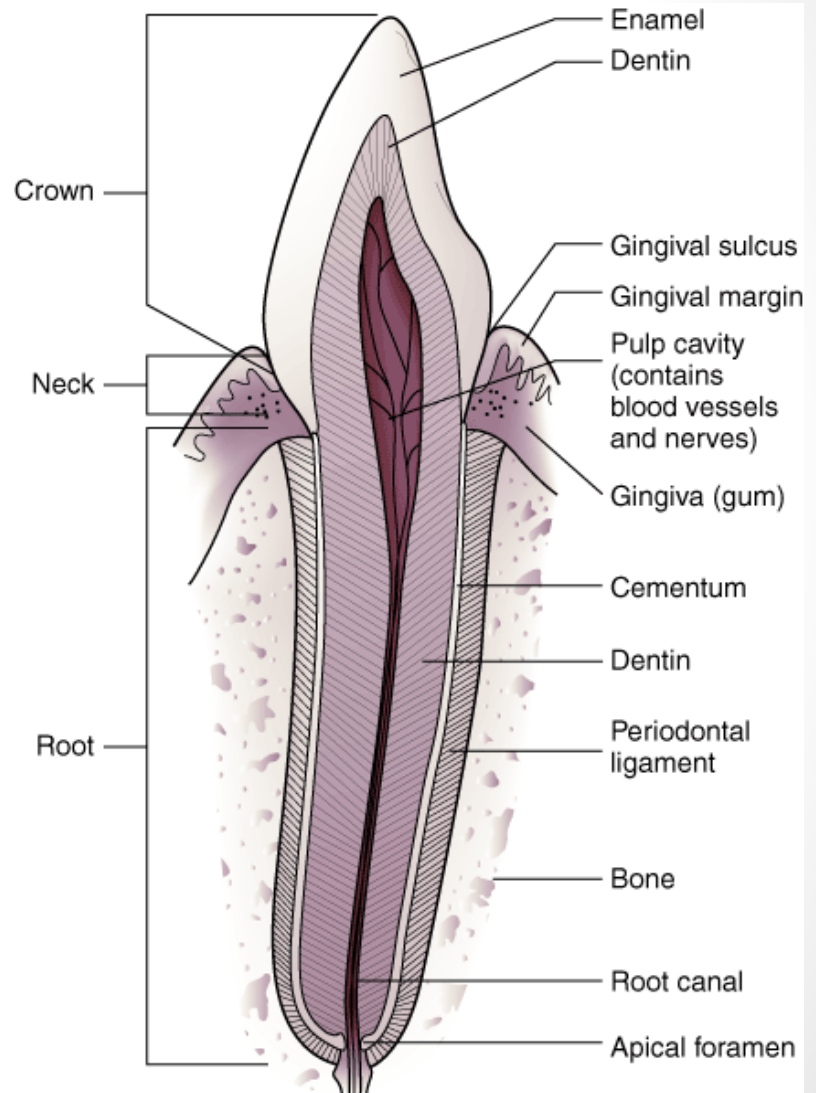
### b) Permanent teeth

$$I - 0/4 \quad C - 0/0 \quad P - 3/3 \quad M - 3/3 = 16 \times 2 = 32$$

In sheep the permanent teeth are not completely erupted until 3.5 - 4 years of age

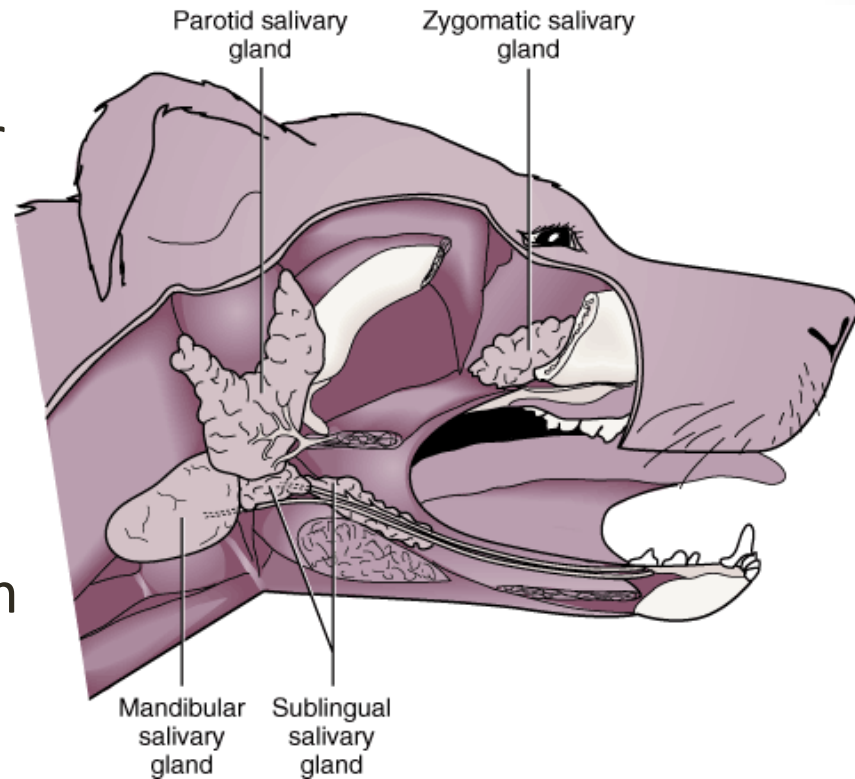
# Tooth Anatomy

- The anatomy of a tooth consists of
  - enamel = outer surface located in the crown
  - cementum = outer surface located in the root
  - dentin = connective tissue surrounding the pulp
  - pulp = inner part of tooth that contains nerves, vessels, and loose connective tissue



# Other Mouth Structures

- Gingiva is the mucous membrane that surrounds the teeth
  - The combining form for gingiva is gingiv/o
- Salivary glands are groups of cells that secrete saliva
  - Named for their location
  - Combining forms are sialaden/o and sial/o

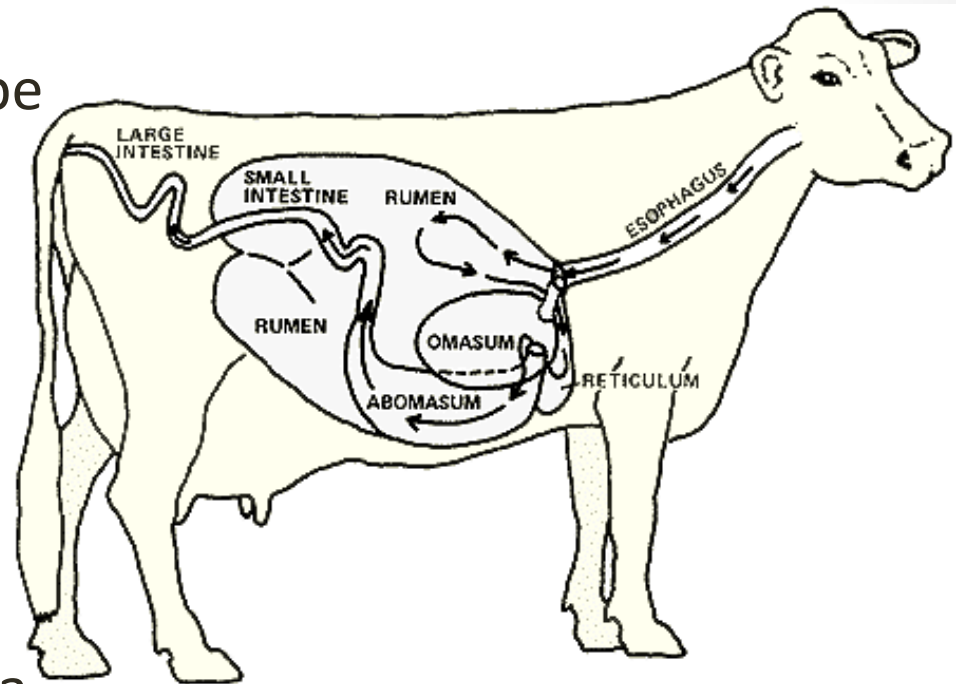


# The Throat

- The pharynx is the cavity in the caudal oral cavity that joins the respiratory and gastrointestinal systems
  - Also known as the throat
  - Combining form is pharyng/o

# The Gullet

- The esophagus is a collapsible, muscular tube that leads from the oral cavity to the stomach
  - Also known as the gullet
  - Combining form is esophag/o
  - Enters the stomach through an opening that is surrounded by a sphincter
    - Sphincter is a ring-like muscle that constricts an opening





# The Abdomen

- The remaining digestive organs are found in the abdomen
  - Also known as the peritoneal or abdominal cavity
  - Located between the diaphragm and pelvis
  - Combining forms are abdomin/o and celi/o
  - Combining form for abdomen or flank is lapar/o

# Abdominal Structures

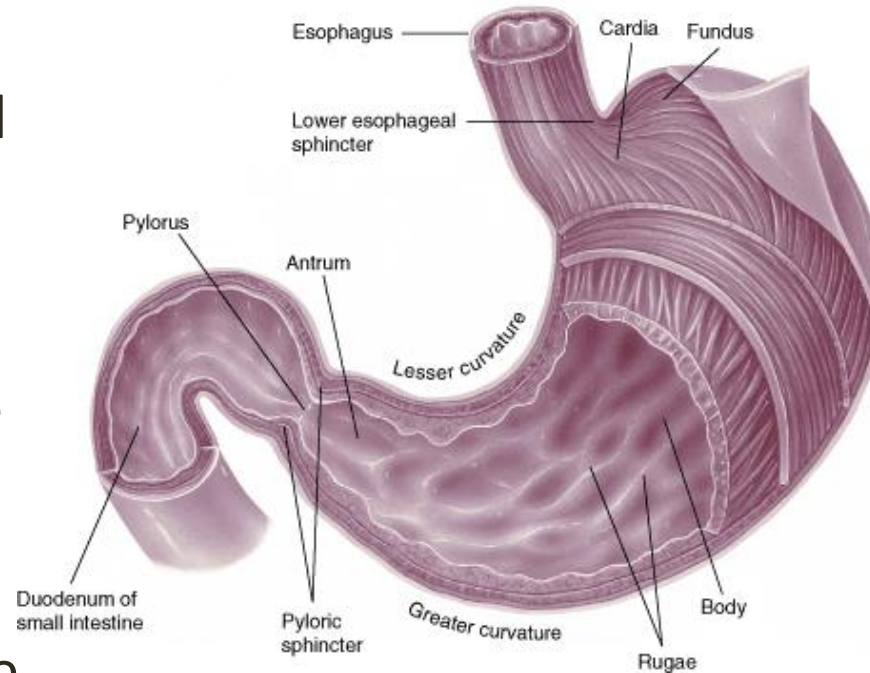
- The peritoneum is the membrane lining that covers the abdominal and pelvic cavity and some of the organs in this area
  - The layer that lines the abdominal and pelvic cavities is called the parietal peritoneum
  - The layer that covers the abdominal organs is called the visceral peritoneum
  - The omentum is a fold of the peritoneum that connects the stomach to the other visceral organs

# The Stomach

- The stomach is a saclike organ that aides in digestion of food
  - Combining form is gastr/o
  - Animals can be classified as monogastric or ruminant
    - Monogastric animals have one true, glandular stomach (one that produces secretions)
    - Ruminants have one true, glandular stomach plus three forestomachs

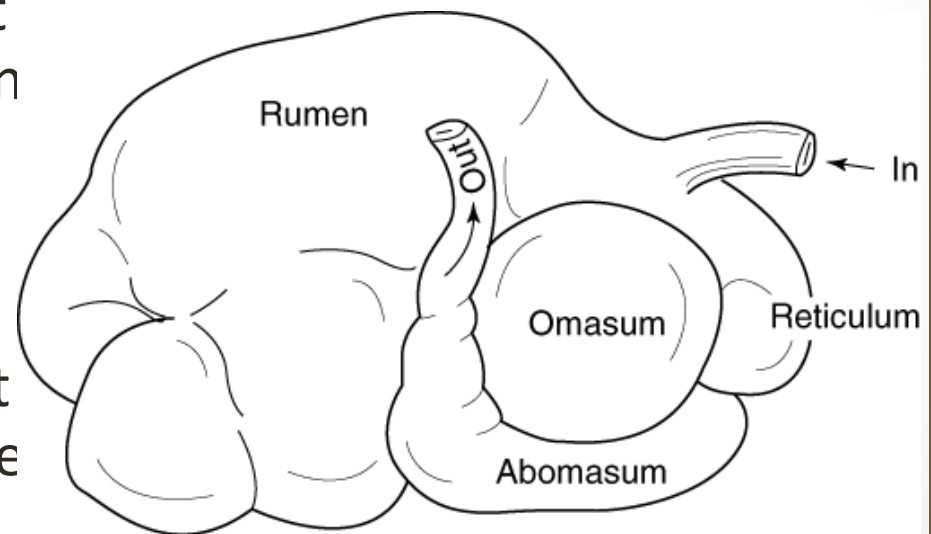
# Stomach Parts

- Parts of the stomach
- cardia (entrance near esophagus)
  - fundus (cranial, rounded part)
  - body (main part)
  - antrum (caudal part)
  - pylorus (narrow passage between the stomach and duodenum)
  - pyloric sphincter (muscle ring that controls flow of material from the stomach to the small intestine)
  - rugae (folds in the mucosa)



# Ruminant Stomach Parts

- Ruminants regurgitate and remasticate their food
- Ruminant stomach parts:
  - rumen: largest part that serves as a fermentation vat
  - reticulum: most cranial portion
  - omasum: third part that squeezes fluid out of the food bolus
  - abomasum: fourth part that is the true glandular stomach

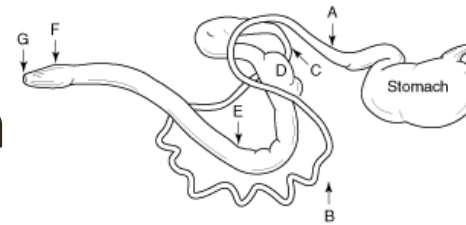


# Small Intestines

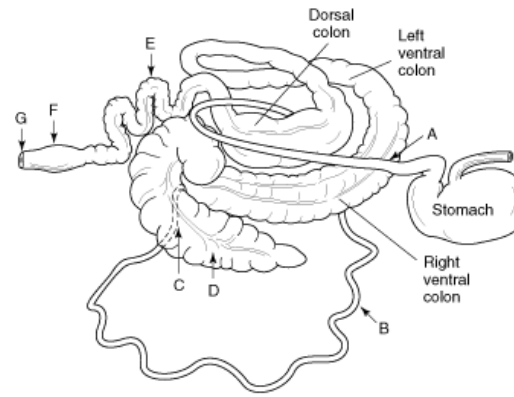
- Small intestine extends from the pylorus to the large intestine
- It is held in place by the mesentery
- Enter/o means small intestine
- Three segments of the small intestine are
  - duodenum: proximal part
    - duoden/i or duoden/o
  - jejunum: middle part
    - jenun/o
  - ileum: distal part
    - ile/o

# Large Intestine

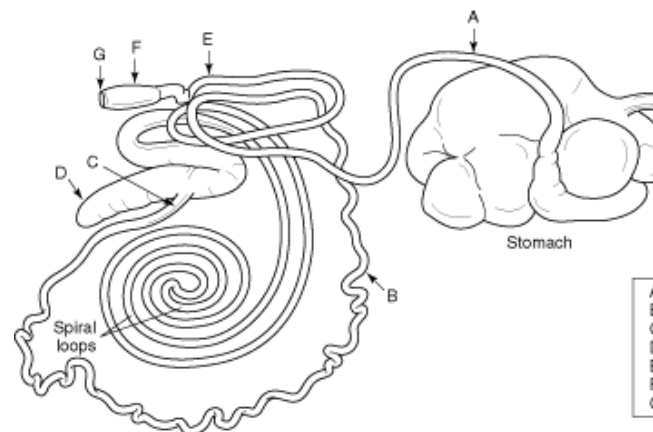
- Large intestine extends from the ileum to the anus
- Four segments of the large intestine are
  - cecum: pouch that takes food from the ileum
    - cec/o
  - colon: varies among species
    - col/o
  - rectum: caudal portion
    - rect/o
  - anus: caudal opening



(a) Dog



(b) Horse

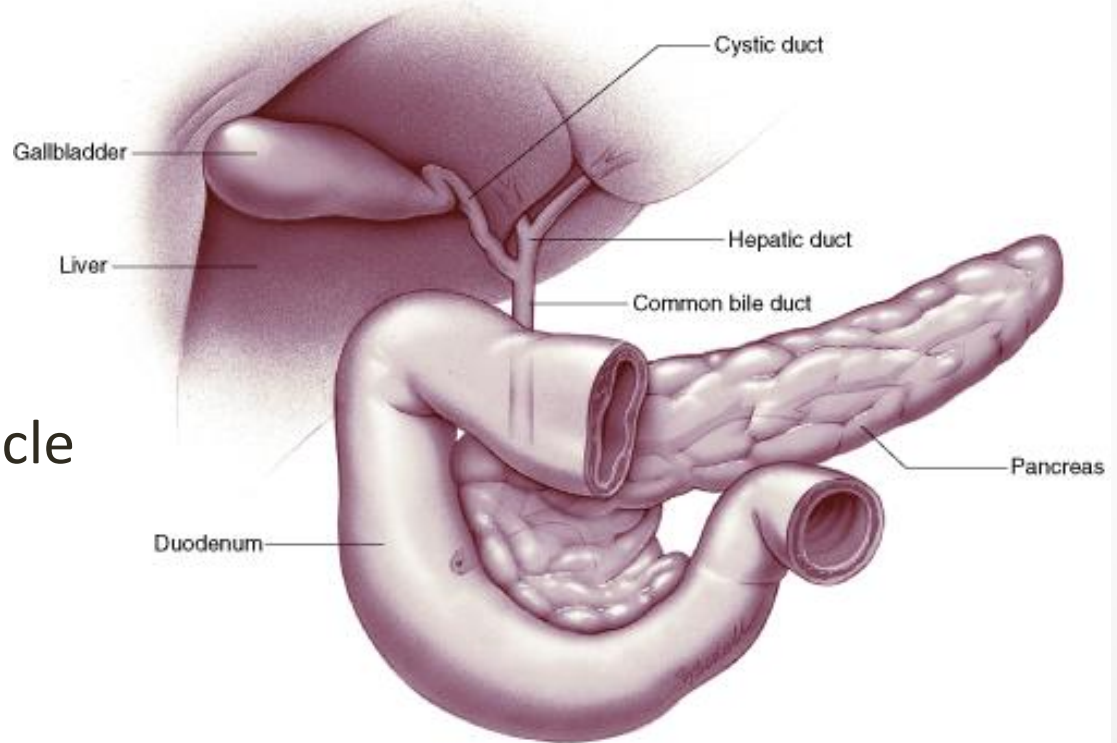


(c) Ruminant

A	Duodenum
B	Jejunum
C	Ileum
D	Cecum
E	Colon
F	Rectum
G	Anus

# Accessory Organs

- Liver: located caudal to the diaphragm
  - hepat/o
- Gallbladder
  - chol/e = bile
  - cyst/o = sac
  - doch/o = receptacle
- Pancreas
  - pancreat/o
- Salivary glands
  - previously covered





# Digestion

- Digestion is the process of breaking down foods into nutrients that the body can use
- Metabolism is the processes involved in the body's use of nutrients
  - Meta- means change or beyond
  - Anabolism is building up of body cells
  - Catabolism is breakdown of body cells

# Absorption

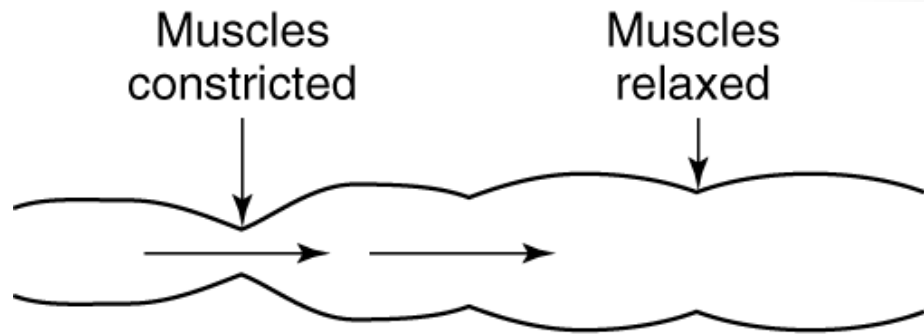
- Absorption is the process of taking digested nutrients into the circulatory system
  - also called assimilation
- Absorption occurs in the small intestine
  - Villi are tiny hairlike projections that help increase the surface area of the small intestine allowing more nutrients to be absorbed
    - Vill/i means tuft of hair
  - The valleys that result from the projections of the small intestine are called crypts

# Path of Digestion

- Food is grasped and collected into the oral cavity
  - This is called prehension
- Mastication (chewing) breaks food into smaller pieces
- Deglutition moves chewed food into the pharynx and on into the esophagus
  - The epiglottis closes off the entrance to the trachea
- Food moves down the esophagus by gravity and peristalsis
  - Peristalsis is a series of wavelike contractions of smooth muscle
    - -stalsis means contraction

# Peristalsis versus Segmentation

- Food moves through the small intestines by peristalsis and segmentation
- Peristalsis is a series of wavelike contractions that move ingesta caudally toward the anus
- Segmentation involves the side-to-side mixing of ingesta



(a) Peristaltic wave of contraction



(b) Segmentation