



Lecture title: Digestive system

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Summary:

Gastrointestinal Tract

(GI) Tract

- ✓ The alimentary tract provides the body with a continual supply of water, electrolytes, and nutrients.
- ✓ Digestion is a process by which foods are broken down chemically and mechanically into smaller units that can be then absorbed.

Functions of Digestive system:

- (1) Ingestion of food
- (2) Digestion of food
- (3) movement of food through the alimentary tract
- (4) secretion of digestive juices
- (5) absorption of water, various electrolytes, and digestive products
- (6) circulation of blood through the gastrointestinal organs to carry away the absorbed substances
- (7) Regulation of acid base balance.
- (8) Excretion of waste product

control of all these functions by local, nervous, and hormonal systems.

- ✓ Each part is adapted to its specific functions: some to simple passage of food, such as the esophagus;
- ✓ others to temporary storage of food, such as the stomach;
- ✓ and others to digestion and absorption, such as the small and large intestine



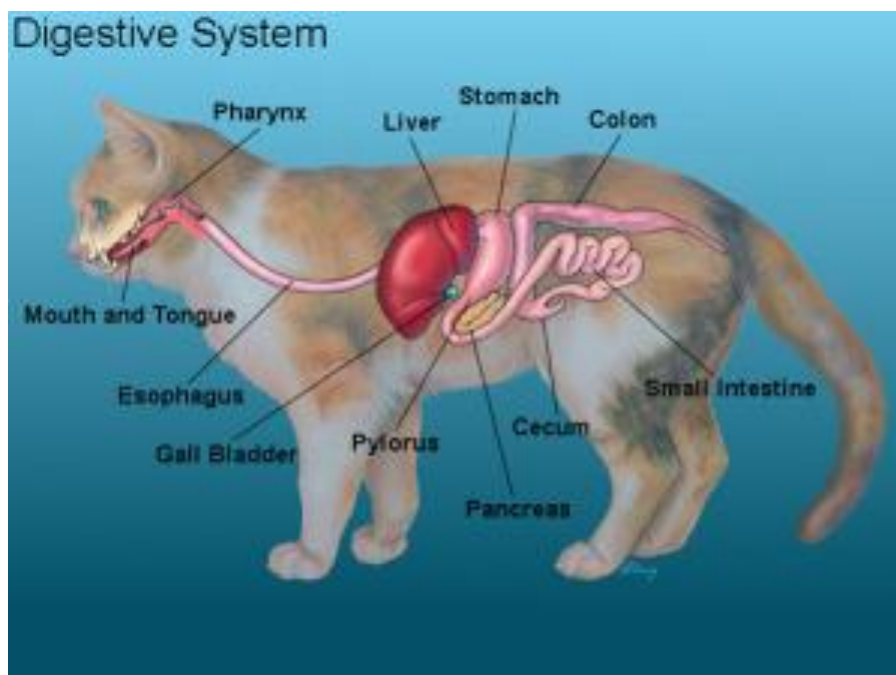
Three basic types of digestive tract systems are described: -

- 1- **Simple-stomached animals** (such as dogs and cats)
- 2- **Forestomach fermenters** (ruminants and camels)
- 3- **Hindgut fermenters** (such as the horse and rabbit).
- 4- **The avian digestive system** is modified to accommodate flight

Simple stomach (monogastric) animals

Simple stomach consists of: -

- ✓ Mouth, pharynx, esophagus, stomach, small intestine, large intestine and rectum.
- ✓ Accessory organ which includes (salivary gland, liver, pancreas).





Animals are classified according to their diet in natural conditions: -

- ✓ An herbivore is an organism that mostly feeds on plants.
 - ✓ An omnivore is an organism that eats plants and animals.
 - ✓ A carnivore is an organism that mostly eats meat.
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mouth

- ✚ The mouth is the beginning of the digestive tract; and, in fact, **digestion starts here** when taking the first bite of food.
 - ✚ Chewing breaks the food into pieces that are more easily digested
 - ✚ Saliva mixes with food to prepare for absorption.
 - ✚ The palate forms the roof of the mouth and is divided into the anterior hard palate and posterior soft palate, aid with tongue to push bolus to pharynx.
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Tongue

- ✚ The tongue is a voluntary muscular structure that occupies the floor of the mouth.
 - ✚ Tongue helps in the act of chewing and swallowing the bolus
 - ✚ Tongue helps in taste.
 - ✚ It also helps in secretion of mucus and serious to keep the mouth moist.
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Mechanical Factors Involved in Digestion

Prehension

Is the grasping and conveying of food into the oral cavity. The act of prehension varies between species.

- ✓ Cattle use protrusible tongue and incisors of lower jaw for prehension



- ✓ horses use upper lip, tongue, and incisor teeth to collect food.
- ✓ sheep and goat, the mobile upper lips are involved in prehension
- ✓ Pigs use lower lips for prehension
- ✓ dogs and cats grasp their prey with forelimbs and carry into the mouth by the movements of head and jaw.
- ✓ In cats, papillae of the tongue help in pushing the feed into the oral cavity.

Drinking

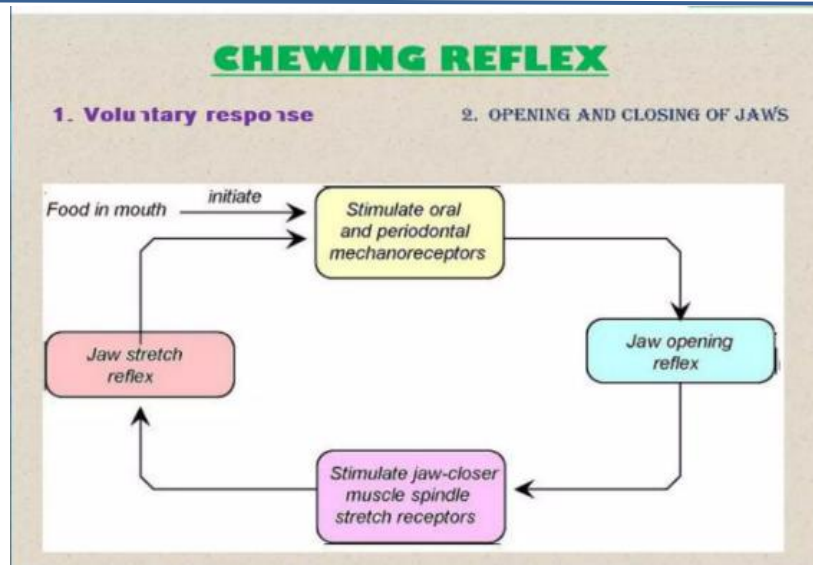
The drinking is facilitated by suction of fluids by creating negative pressure in horse, cattle, sheep, and goat.

- ✓ Dog and cat use their ladle shaped tongue for drinking. It is vigorously extended and retracted to carry the liquid into the mouth.
- ✓ Also, it occurs in the puppies during milk suckling.

Mastication(chewing)

It means breaks up large food particles by anterior teeth for strong cutting action and the posterior teeth for grinding action and then mixes the food with saliva and the rate of digestion is dependent on the total surface area exposed to the digestive enzymes.

- ✓ chewing reflex
 - ✚ The presence of a bolus of food in the mouth at first stimulate mechanoreceptor to initiate a **jaw opening reflex** by inhibition muscles of mastication (muscles of jaw)
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 - ✚ this inhibition allows the lower jaw to drop
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 - ✚ The drop in turn initiates a **jaw stretch reflex** of the jaw muscles that leads to rebound contraction
 - ↓
 - ✚ This automatically raises the jaw to cause closure of the teeth compressing the bolus against the linings of mouth.
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 - ✚ This inhibition of jaw muscles once again allowing the jaw to drop and rebound another time; this repeated again and again.

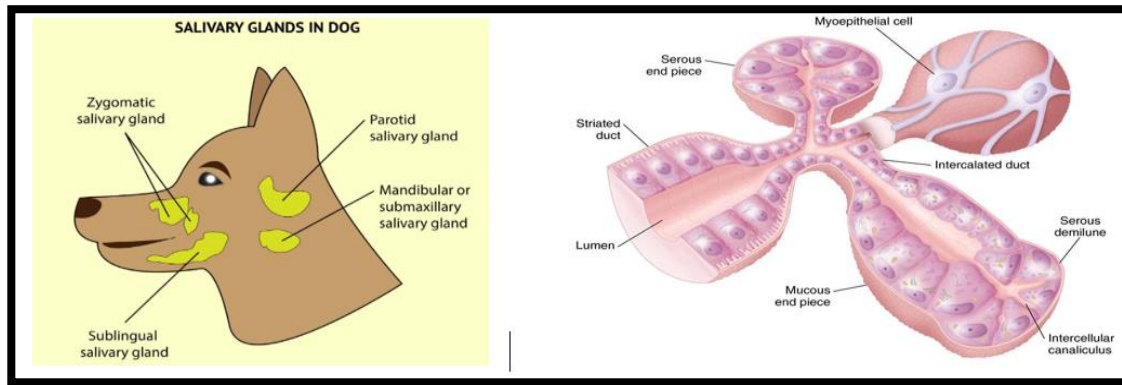


Saliva

- ✓ Is produced by acinar glands located along the mandible and maxilla of most species. The secretions of individual salivary glands range from a **watery serous secretion** to a more **mucoïd secretion**
- ✓ The salivary glands consist of pairs:
 - 1- **Parotid glands (serous)**. Serous glands produce thin, watery, and enzyme-rich secretions. Glossopharyngeal and Trigeminal nerve
 - 2- **mandibular (submaxillary) glands (sero-mucous)**. Lingual and facial nerve
 - 3- **Sublingual glands (mucous)**. Mucous cells secrete thick and viscid mucous. Lingual and facial nerve.



4-The Zygomatic salivary gland is found only in carnivores.



Function of saliva:

- ✚ **Taste:** Saliva helps in dissolution of feed particles and helps in the perception of taste.
- ✚ **Protection and Lubrication:** Saliva protects the oral tissue against irritating agents by forming a sero-mucosal layer
- ✚ **Dilution and Cleaning:** Saliva helps in mechanical cleaning of oral cavity and clears the residues such as non-adherent bacteria and cellular and food debris
- ✚ **Buffering Action:** The bicarbonate and phosphate present in the saliva act as buffering agents.
- ✚ **Integrity of Tooth Enamel:** Saliva plays a key role in maintaining the physical-chemical integrity of tooth enamel
- ✚ **Digestion:** In omnivores such as rats and pigs, saliva contains a starch-digesting enzyme α -amylase (**ptyalin**). This enzyme is usually absent from saliva of carnivores such as cats and dogs. **Lingual lipase** present in young animals helps to digest lipids during milk diet and disappears as the animals mature
- ✚ **Absorption of Vit-B12:** Salivary glands produce a glycoprotein called “**Haptocorrin**” that binds with Vit-B12 and protects it from acid digestion in stomach. However, in duodenum, the Vit-B12 once again becomes free to bind, this time to another molecule called “**Intrinsic Factor**” forming a B12–IF that is absorbed in the ileum



- + **Tissue Repair:** Epidermal growth factor produced by the submandibular glands has a role in wound contraction.
- + **Antibacterial Properties:** Secretory immunoglobulin A (IgA) of saliva neutralizes viruses, bacterial, and enzyme toxins.
- + **Thermoregulation:** Some animals such as rats spread their saliva on their body so that it evaporates and provides a cooling effect on the body. The parotid glands of dogs are capable of secreting at ten times of the rate of parotid glands in human during panting
- + **Special Functions in Ruminants:** In ruminants, saliva provides a proper media for the bacterial growth and activity in the rumen. Further, bicarbonates and other contents of alkaline saliva (pH 8.1) neutralize the volatile fatty acids produced during microbial fermentation and maintain a stable rumen pH.
- + **Saliva is used to prepare threads for the cocoons.**



✓ Phase of Salivary Secretion

Secretion of saliva occurs in two phases:

- + **Basal action** (Secretion of saliva without any stimulation is called basal salivary secretion).
- + **Reflex action** are 2 types:
 1. In unconditioned reflex, salivary secretion occurs due to the presence of food in mouth.
 2. The salivary secretion through conditioned reflex is brought about by thinking of food, sight, or smell. This reflex can be elicited even by non-physiological stimuli like ringing of a bell if properly conditioned.

+ **The sympathetic and parasympathetic stimulation:**

1. Sympathetic stimulation by norepinephrine causes the secretion become thick mucin-rich salivary secretion mediated by vasoconstriction (decrease salivation).



2. Parasympathetic stimulation cause vasodilation and copious salivary secretion rich in water and HCO_3 (increase salivation)

