

Republic of Iraq  
Ministry of Higher Education & Scientific Research  
University of Baghdad  
College of Veterinary Medicine  
Department of Anatomy and Histology  
Dr. Salah Hasan



## Digestive System

### Functions of Digestive System:

- 1- Intake the food.
- 2- Digestion of the food.
- 3- Absorption of the nutrients such as carbohydrates, fats and proteins.
- 4- Discarded the unused materials are as faeces.
- 5- Removes toxins from the blood stream.
- 6- Maintains healthy blood sugar levels.
- 7- Excretion of cholesterol, hormones and drugs.
- 8- Storage of glycogen, vitamins and minerals.

The Digestive System consists of:

- 1- Mouth cavity:
  - lips.
  - Tongue.
  - Teeth.
  - Salivary glands. Example:
    - Labial salivary gland.
    - Lingual salivary gland.
    - Sublingual salivary gland.
- 2- Pharynx.
- 3- Esophagus.
- 4- Stomach.
- 5- Intestine:
  - **Small intestine**:
    - Duodenum.
    - Jejunum.
    - Ileum.
  - **Large intestine**: - Cecum.

- Colon.
- Rectum.

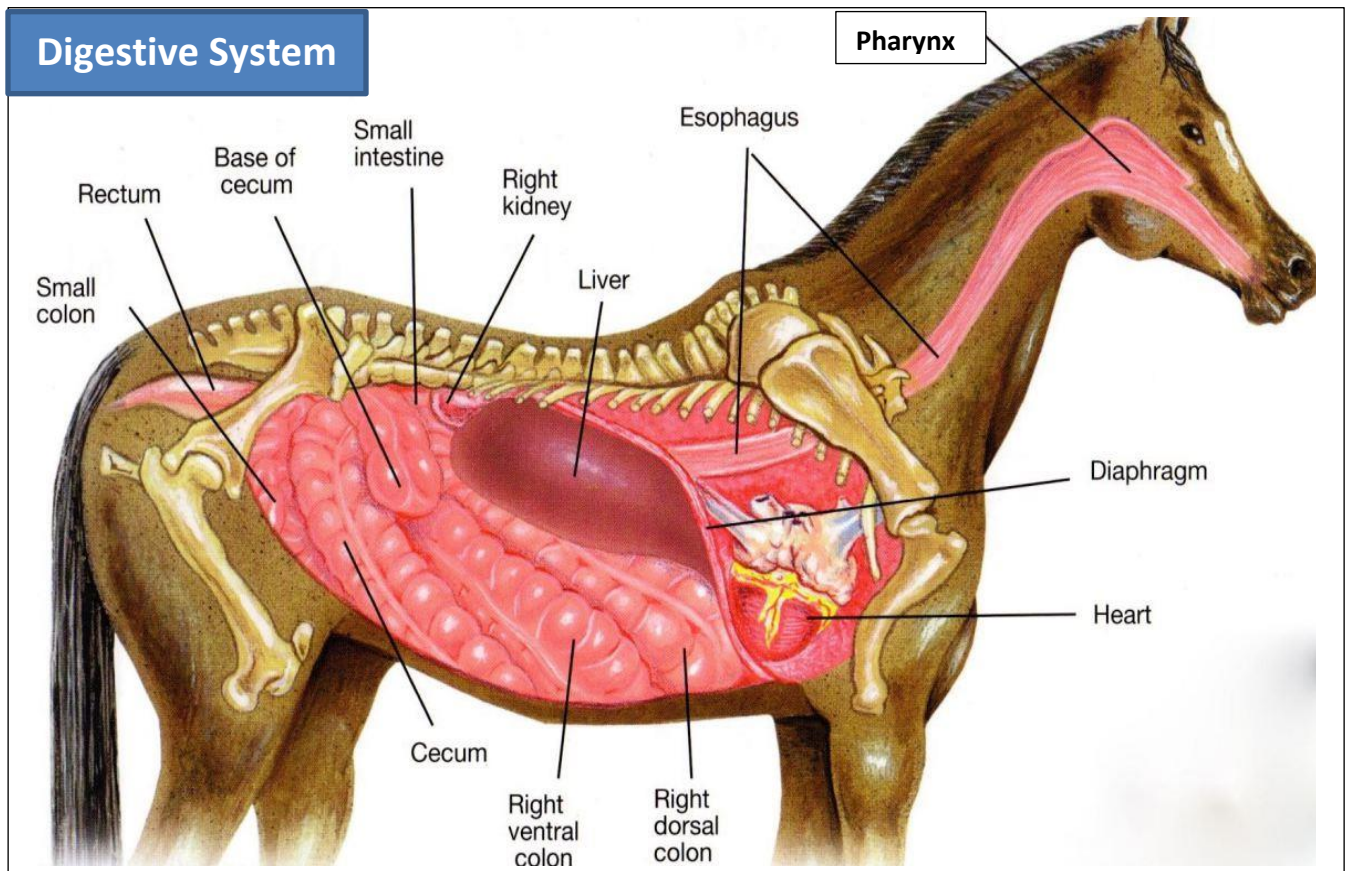
The colon consists of: - Ascending colon.  
 - Transvers colon.  
 - Descending colon.

**6-** Anus.

**7-** Accessory digestive glands: - Liver.

- Pancreas.

- Salivary glands (parotid and mandibular)



## **Mouth Cavity:**

It is first part of the digestive system.

### **Borders of mouth cavity:**

- 1- Cranially → lips (upper lip and lower lip).
- 2- Caudally → continuous with the pharynx.
- 3- Laterally → cheek (bucca) left and right.
- 4- Dorsally → hard palate & soft palate.
- 5- Ventrally → mucous membrane of the inter-mandibular space.

**The Mouth Cavity is divided by the teeth and alveolar processes into:**

### **1- Proper mouth cavity:**

It is the space of mouth cavity which is bounded by the teeth and alveolar processes which is contained the tongue.

### **2- Vestibule mouth cavity:**

Which is located between the teeth alveolar processes and lips with cheek, and subdivided into:

**A-** Incisive vestibule (between lips & incisive teeth)

**B-** Buccal vestibule (between cheek & molar and premolar teeth).

## **Lip:**

It is musculo-membranous fold formed from:

- 1- Skin (outer layer).
- 2- Muscular layer (mid layer) it is muscle called orbicularis oris with labial salivary glands.
- 3- Mucous membrane.

## **Cheek (Bucca):**

It is musculo-membranous wall formed side wall of the mouth cavity which consist from:

- 1- Skin.
- 2- Buccinator muscle & zygomatic muscle with buccal salivary glands.
- 3- Mucous membrane.

## Hard palate:

It is the cranial part of the roof of the mouth cavity and is continuous caudally with the soft palate.

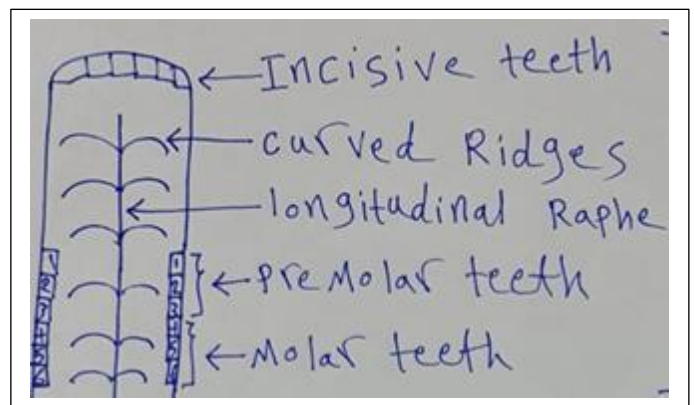
It consists of:

- 1- Bony part which are palatine bone, palatine process of maxillary bone and palatine process of incisive bone.
- 2- Venous plexus.
- 2- Mucous membrane.

Comparative of hard palate in different animals:

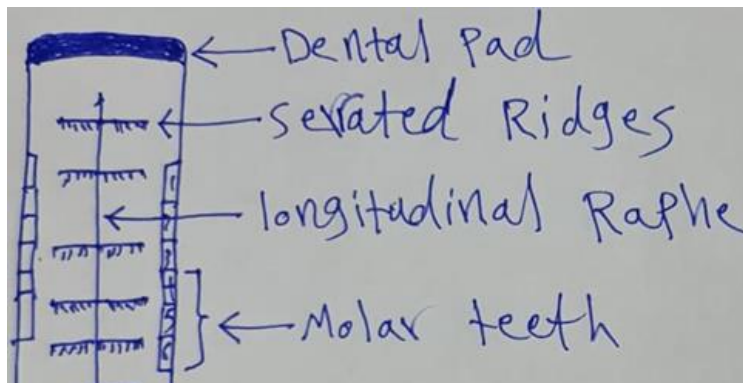
### Horse:

- Present incisive teeth.
- Have longitudinal raphe.
- Has curved transverse ridges.



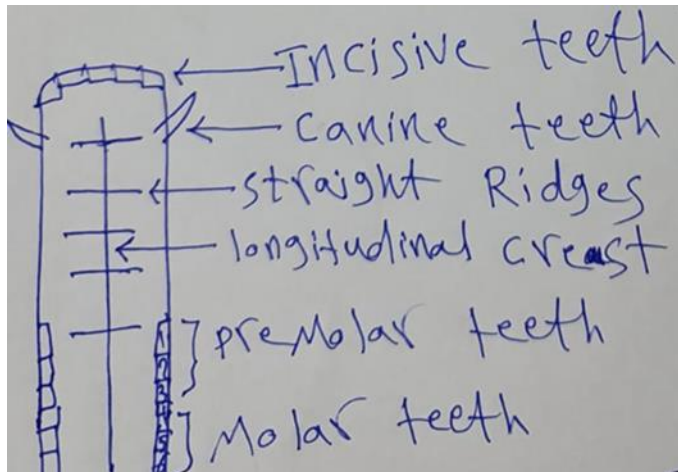
### Ruminants:

- Present dental pad.
- Have longitudinal raphe.
- Has serrated transverse ridges.



### Dog:

- Present incisive teeth and canine teeth.
- Have longitudinal crest.
- Has straight transverse ridges.



### Soft palate:

It is musculo-membranous fold which is separated the mouth cavity and pharynx except during swallowing food. Cranially the soft palate attached with hard palate but caudally is free.

The soft palate is attached with tongue by the palatoglossal arch and attached with the pharynx by palatopharyngeal arch.

### Tongue (linqua) (glossa):

It is musculo-membranous mobile organ situated on the floor of the proper mouth cavity between the bodies of the mandible.

The tongue formed from three parts:

- 1- Root → caudal part.
- 2- Body → middle part.
- 3- Apex (tip) → cranial part (free part).

The apex of tongue attached with the mouth cavity by frenulum.

### The tongue consists of:

- 1- Muscular mass.
- 2- Mucous membrane.

### **The muscles of the tongue are two types:**

- 1- Intrinsic muscles which are originated and inserted in the tongue.
- 2- Extrinsic muscles these muscles either originated or inserted in the tongue.

### **Fixation of the tongue:**

- 1- Frenulum linguae.
- 2- Lingual process of hyoid bone.
- 3- Extrinsic muscles.
- 4- Palatoglossal arch.
- 5- Blood vessels and nerves which supply the tongue.

### **Lingual papillae:**

Which are present on the mucous membrane, there are two types of papillae:

- 1-** Mechanical papillae including:
  - Filiform papillae.
  - Conical papillae.
  - Lenticular papillae.
  
- 2-** Gustatory papillae including:
  - Fungiform papillae.
  - Vallate papillae.
  - Foliate papillae.

### **Nerves supply of the tongue:**

- 1- Lingual nerve.
- 2- Glossopharyngeal nerve.
- 3- Hypoglossal nerve.
- 4- Chorda tympani nerve.

### **Blood supply of the tongue:**

- 1- Lingual artery.
- 2- Sublingual artery.

## **Veins of tongue:**

- 1- Lingual veins → - Deep lingual vein.  
- Sublingual vein.
- 2- Dorsal lingual vein.

## **Comparative of the tongue**

### **Horse:**

- Spatula like in shape.
- Has (4) types of lingual papillae there are:
  - A-** Filiform papillae.
  - B-** Fungiform papillae.
  - C-** Vallate papillae only (2-3) on the dorsum of root.
  - D-** Foliate papillae present just cranial to palatoglossal arch on each side of tongue.

### **Ruminants:**

- Thick root and body with pointed tip.
- Has (5) types of papillae there are:
  - A-** Filiform papillae.
  - B-** Fungi form papillae.
  - C-** Vallate papillae (19-22) on each side of dorsum of root in two row.
  - D-** Conical papillae.
  - E-** Lenticular papillae.
- The foliate are absent in ruminant.
- Have torus linguae with transvers fossa.

## Dogs:

- Wide and thin in all parts.
- Has longitudinal groove along the dorsum.
- Has (5) types of papillae:
  - A- Filiform papillae.
  - B- Fungi form papillae.
  - C- Vallate papillae (2-3) on each side of dorsum of root.
  - D- Foliate papillae.
  - E- Conical papillae.

## The Teeth

### Classification of teeth:

According to prominence:

- 1- Temporary teeth (deciduous teeth) (baby teeth) (milk teeth):
  - Less in number.
  - Small in size.
  - Rootless.
- 2- Permanent teeth (Adult teeth):
  - More in number.
  - Large in size.
  - Has either one or two root or more.

According to their functions:

- 1- Incisor teeth → For cutting
- 2- Canine teeth → For tearing
- 3- Premolar teeth → For grinding
- 4- Molar teeth → For grinding

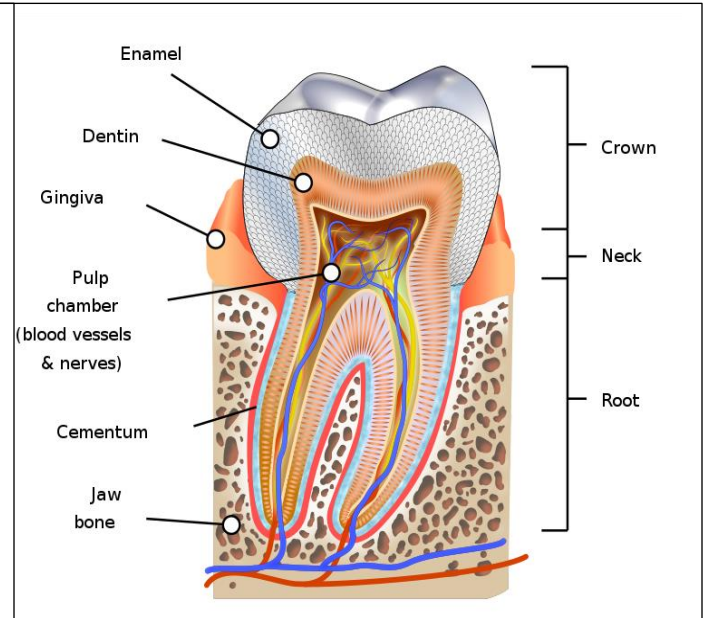
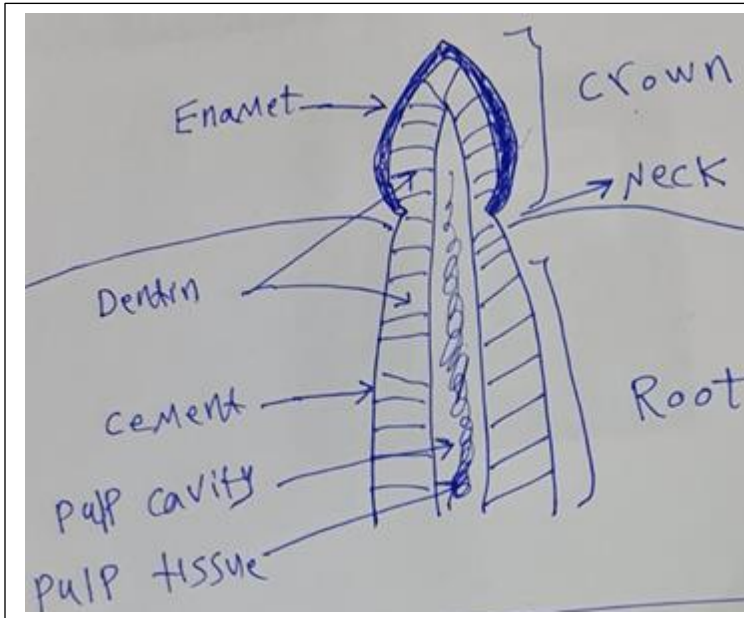
### Structure of the tooth:

Tooth is formed from (3) parts and four types tissues:

Tooth parts are: - Crown.  
- Neck.  
- Root.



**Tooth tissues are:** - Enamel  
- Dentin  
- Cement  
-Pulp tissue



## Salivary glands

Is special epithelial tissue modified to produce saliva.

**Saliva:** is a mixture of serous and mucous fluids that produced by the salivary glands.

### Functions of the saliva:

- 1- Lubrications and moisting of the upper part of digestive system.
- 2- Help in swallowing.
- 3- Tasting.
- 4- Sucking.
- 5- Contains to hormones and enzymes.

## Classification of salivary gland anatomically:

### According to their size:

#### 1- Minor salivary gland:

Small mass of glandular tissue present under the mucous membrane of mouth cavity example labial, lingual salivary gland.

#### 2- Major salivary gland :

Large mass of glandular tissue present outside the mouth cavity and has excretory duct example parotid, mandibular salivary gland.

### According to numbered excretory orifice (opening):

1- Mono-stomatic salivary gland: all the major type of salivary gland example parotid, mandibular salivary gland has one opening.

2- Poly-stomatic salivary gland: all the minor type of salivary gland has several opening.

## Comparative of the salivary glands:

### Parotid salivary gland:

#### Horse:

-Shape: quadrilateral in shape.

- Location: located in the parotid fossa.

-Duct: has parotid duct opened near to the 3<sup>rd</sup> or fourth upper cheek teeth.

#### Ruminants:

- Shape: large ruminant (cattle) is triangular in shape.

Small ruminant (sheep & goat) is quadrilateral in shape.

- Location: located in the parotid fossa.

- Duct: has parotid duct opened near the 3<sup>rd</sup> upper cheek teeth.

#### Dog:

- Shape: quadrilateral in shape.

- Location: located in parotid fossa.

- Duct: duct similar to the sheep.

## **Sublingual salivary gland:**

### **Horse:**

- Shape: It is thin glandular tape tissue.
- Location: It located on the lateral side (surface) of the tongue under the mucous membrane.
- Duct: It is poly-stomatic gland has about 28 orifices (opening).

### **Ruminant:**

- Shape: It is formed from two parts which cranial part is poly-stomatic and caudal part is mono-stomatic.
- Location: Located on the lateral side of tongue.
- Duct: Cranial part has several orifices on the lateral side of tongue. Caudal part has one duct opened in the sublingual caruncle.

### **Dog:**

- Shape: It is formed from two parts which cranial part is mono-stomatic and caudal part is poly-stomatic.
- Location: Similar to other animals.
- Duct: cranial part has one duct opened in the sublingual caruncle and caudal part has several orifices on the lateral side of the tongue.

## **Mandibular salivary gland:**

### **Horse:**

- Shape: oval.
- Location: located in Angle of mandible bone.
- Duct: has one duct opened on the sublingual caruncle.

### **Ruminant:**

- Shape: oval.
- Location: located in Angle of mandible bone.
- Duct: has one duct opened on the sublingual caruncle.

## Dog:

- Shape: Round
- Location: located in Angle of mandible bone.
- Duct: has one duct opened on the sublingual caruncle.

## Pharynx

It is musculo-membranous organ, funnel shaped, it is belonged the digestive and respiratory systems.

### The pharynx has seven opening:

- 1- Caudal opening of the mouth cavity. (one)
- 2- Caudal opening of the nasal opening. (two)
- 3- Laryngeal opening. (one)
- 4- Esophageal opening. (one)
- 5- Eustachian opening. (two)

## Esophagus

It is musculo-membranous tube, extended from pharynx to the stomach.

The esophagus can be divided in three parts topographically, these are:

- 1- Cervical part  longest part 70-90 cm.
- 2- Thoracic part  middle part 30-40 cm.
- 3- Abdominal part  shorter parts about 1.5-3 cm.

### Course of esophagus:

It is begin dorsal to the larynx and trachea at the level of 4<sup>th</sup> cervical vertebrae become on the lateral side of the trachea. It passes in this direction and at the level of the 4<sup>th</sup>-5<sup>th</sup> thoracic vertebrae become dorsal trachea again.

### The curvatures of esophagus:

- 1- Head-cervical curvature.
- 2- Cervico-thoracic curvature.
- 3- Intra-thoracic curvature.

### **Relations of the esophagus:**

- Cervical part → Larynx, trachea, common carotid artery, Jugular vein and thyroid gland.
- Thoracic part → Heart, lungs and thymus.
- Abdominal part → Liver and stomach.

### **Abdominal cavity:**

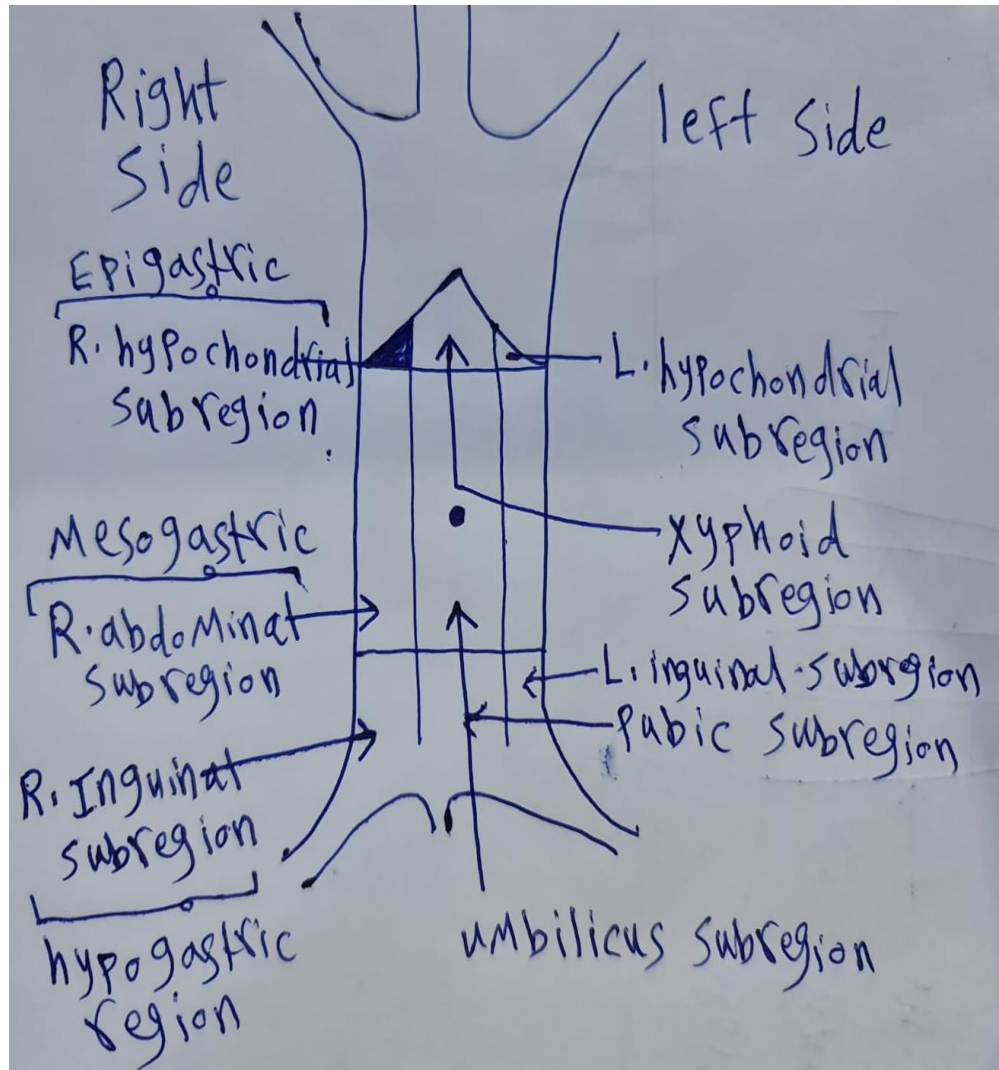
It is largest cavity in the body which separated by the diaphragm from thoracic cavity and continuous caudally with the pelvic cavity. The abdominal cavity contained large parts of digestive system.

### **Bonders of abdominal cavity:**

- 1- Cranially → Diaphragm.
- 2- Caudally → Pelvic cavity.
- 3- Laterally → External abdominal oblique muscle  
Internal abdominal oblique muscle  
Transverse abdominal muscle.
- 4- Dorsally → Lumber vertebrae and lumber muscles.
- 5- Ventrally → Rectus muscle.

### **Abdominal region divided topographically into:**

- 1- Epigastric region.
- 2- Mesogastric region.
- 3- Hypogastric region.



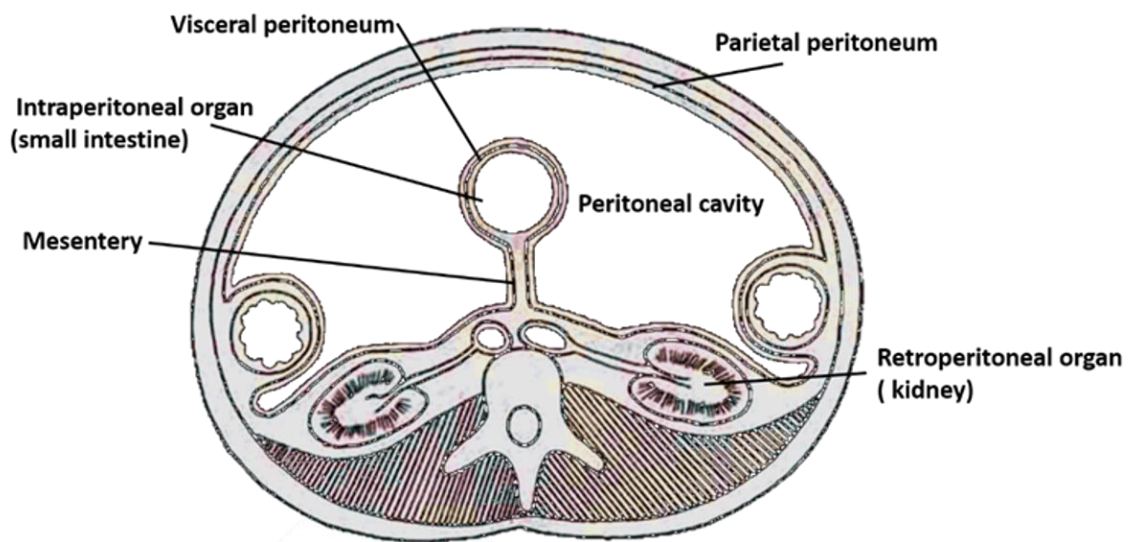
### Peritoneum:

It is the serous membrane which lines abdominal cavity and part of pelvic cavity and covers completely or partially the internal organs.

### Modifications of peritoneum:

- 1- **Mesentery:** it is two layer of visceral periton, containing blood vessels and nerves and it suspended any organ. E.g. mesocolon and mesovarian.

- 2- **Omentum:** it is two layers of visceral periton, containing blood vessels and nerves and attached with the stomach. E.g. lesser and greater omentum.
- 3- **Ligament:** it is two layers of visceral periton, has no blood vessels and nerves and attached with any organ.



## **Stomach (gastra)**

It is largest dilatation in digestive system (alimentary canal), it is located between the esophagus and intestine.

### **Classification of the stomach:**

According to the number of its chamber:

- 1- **Mono-ocular** stomach: has one chamber.  
Example: horse, dog, cat, pig.
- 2- **Multi-ocular** stomach: has more than one chambers.  
Example: ruminants (ox, cow, sheep, goat, camel).

According to the type of mucous membrane lining:

**1- Simple** stomach has one type of mucous membrane (glandular mucous membrane). Example: dog, cat.

**2 - Compound** stomach has two type of mucous membrane (glandular and non-glandular mucous membrane).

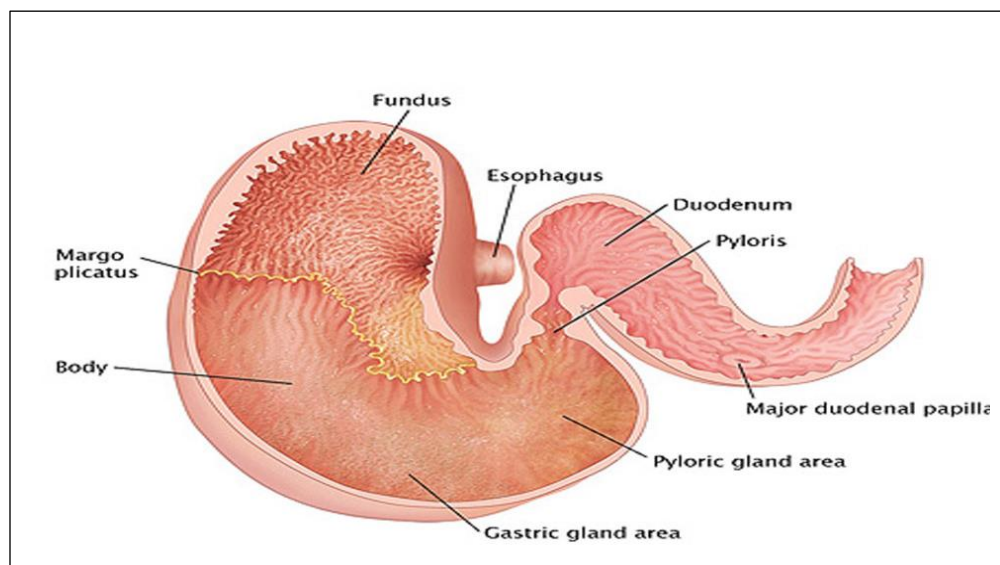
Example: horse, pig, ruminants.

### Fixation of the stomach:

- 1- Blood vessels and nerves which supply the stomach.
- 2- Pressure of adjacent organs.
- 3- Esophagus.
- 4- Duodenum.
- 5- Lesser omentum.
- 6- Greater omentum.

### Stomach of horse:

- 1- It is G shaped.
- 2- It mono-ocular compound stomach.
- 3- It located on the left hypo-chondrial sub-region.
- 4- It has non glandular part and glandular part.
- 5- It has two surfaces parietal and visceral surface.
- 6- It has two curvatures greater and lesser curvature.
- 7- It has two orifice (opening) cardiac and pyloric orifice.





## **Stomach of ruminants:**

- 1- It Multi-locular compound stomach.**
- 2- It located on the left side of the abdominal cavity.**
- 3- It is composed from four parts which rumen, reticulum, omasum (non-glandular) and abomasum (glandular).**
- 4- It has dorsal curvature contact with the crura of diaphragm and ventral curvature contact with the ventral abdominal wall.**
- 5- It has parietal surface which contact with lateral wall of abdomen and visceral surface which contact with intestine.**

### **Rumen:**

- **It is largest part of ruminant stomach.**
- **Have cardiac opening and rumeno-reticular opening.**
- **Externally it has (9) grooves:**
  - 1- Left longitudinal groove.**
  - 2- Right longitudinal groove.**
  - 3- Cranial transvers groove.**
  - 4- Caudal transvers groove.**
  - 5- Accessory groove.**
  - 6- Right dorsal coronary groove.**
  - 7- Left dorsal coronary groove.**
  - 8- Right ventral coronary groove.**
  - 9- Left ventral coronary groove.**
- **Internally it has (9) ruminal pillars located opposite to the external grooves and have the same names.**

### **Reticulum:**

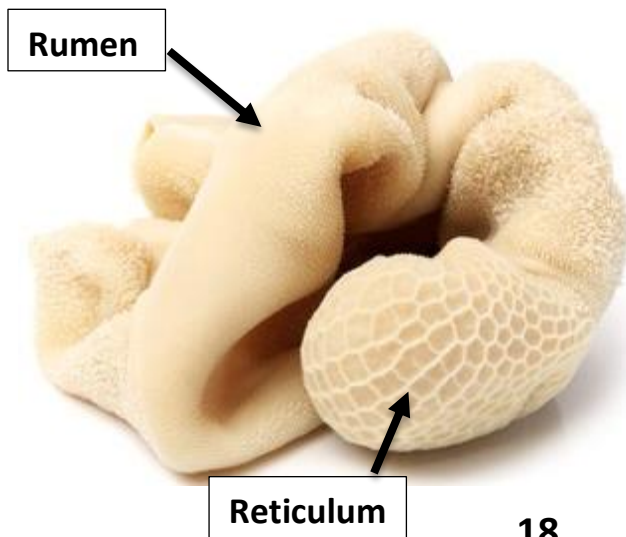
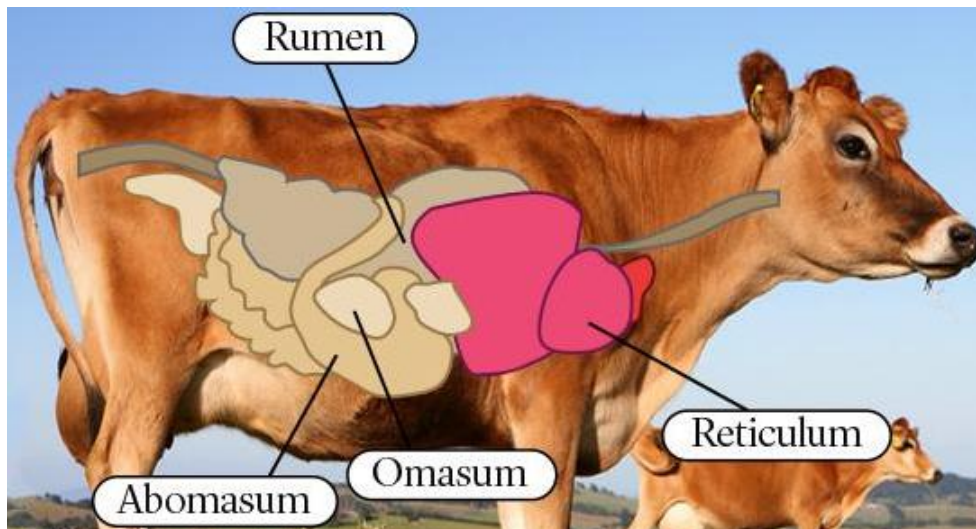
- **Oval round in shape.**
- **The inner surface is honey comb like.**
- **Have reticulo-ruminal opening and reticulo-omasal opening.**

### **Omasum:**

- It is dome like.
- It has inner surface book like, has longitudinal folds called omasal laminae.
- Has omaso-reticular opening and omaso-obomasal opening.

### **Abomasum:**

- Glandular stomach of ruminant.
- It has greater and lesser curvatures.
- The inner surface has longitudinal folds.



### **Gastric groove:**

It is a groove present in ruminants only which extent from the opening of esophagus to the omaso-obomasal opening.

- 1- It is very clear and useful in young animal.
- 2- It helps in direct milk to the abomasum directly.
- 3- It consists of two parts which reticular part and omasal part.

### **The Intestine**

It is a tube which extend from stomach to the anus, it divided in to small and large intestine.

**Small intestine** in general, in all animals it consists of:

- 1- Duodenum.
- 2- Jejunum.
- 3- Ileum.

Large intestine it consists of:

- Cecum.
- Colon.
- Rectum.

### **The Duodenum:**

- It concerned as a fixed part of small intestine.
- It is U shape.
- It consists of two parts and three curvatures.

The two parts are: A- Cranial part.

B- Caudal part which consists of: - Descending part.  
- Ascending part.

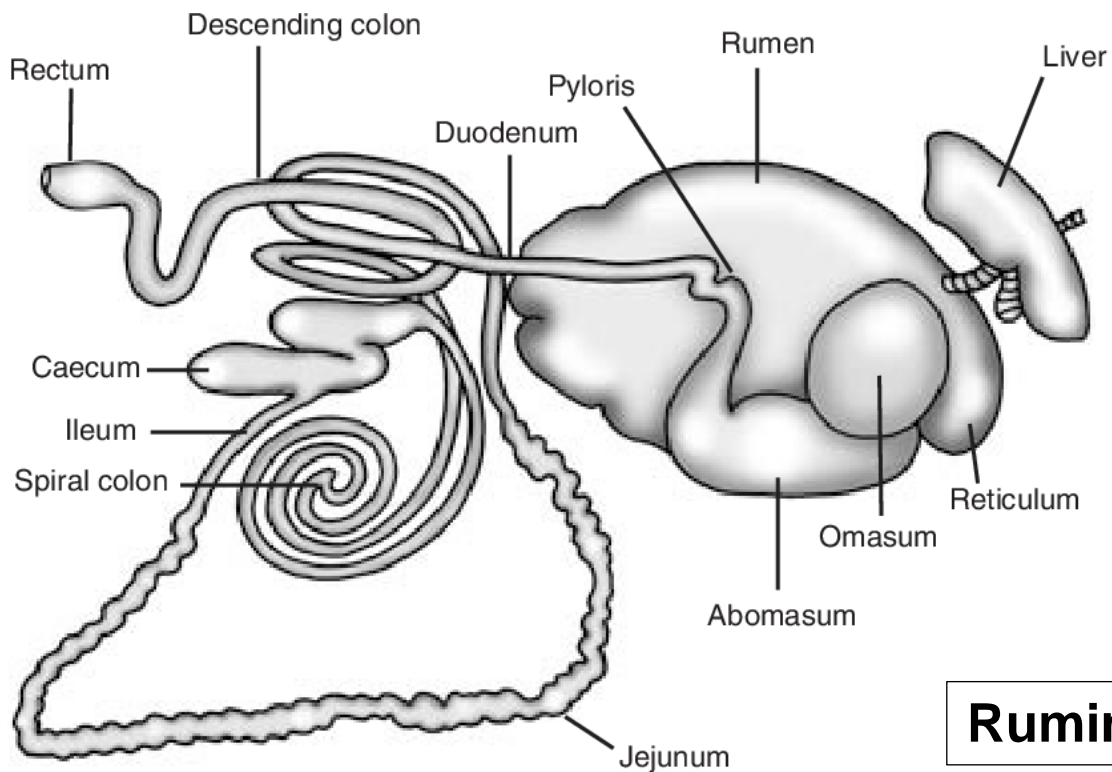
The three curvatures are: - Cranial flexure.  
- Caudal flexure.  
- Duodeno-jejunal flexure.

### **The Jejunum:**

- It is the largest part of small intestine.
- It has long mesentery.
- It appears as empty tube.

### **The Ileum:**

- It is shorter part of small intestine about (20-30) cm.
- It has thick wall and straight in tube.
- It is conducting with cecum by the ileoceco fold.



## **Large intestine of horse**

It is characterized by:

- 1- It has large diameter than the small intestine.
- 2- Present of muscular bands.
- 3- Present of sacculations.

### **Cecum of horse:**

- 1- Comma shape.
- 2- About (90) cm.
- 3- Has (4) muscular bands (dorsal, ventral, lateral, medial).
- 4- It is consist of base, body and apex.
- 5- It has two orifices ileocecal orifice and cecocolic orifice.

### **Cecum of Ruminants:**

- 1- It is cylindrical in shape.
- 2- About 25-30 cm.
- 3- It has one common opening called ileocecolic opening.
- 4- Has no muscular bands and sacculations.

### **Cecum of dog:**

- It has small pointed and blind end.
- Spinal in shape.
- About (2-3) cm.
- Has common opening called ileocecolic orifice.

### **Colon:**

- It consists of:
- 1- Ascending colon (Ascending part of colon).
  - 2- Transvers colon (part of colon).
  - 3- Descending colon (part of colon).

### Ascending colon of horse:

- 1- It is very long.
- 2- Has muscular bands and sacculations.
- 3- It consists of 4 parts are:
  - a- Ventral right colon.
  - b- Ventral left colon.
  - c- Dorsal left colon.
  - d. Dorsal right colon.
- 4- It consists of 3 flexures are:
  - a- Sternal flexure.
  - b- Pelvic flexure.
  - c- Diaphragmatic flexure.

### Colon of ruminants:

- It consists of **two** loops:
  - 1- Centripetal loop.
  - 2- Centrifugal loop.
- It consists of **three** flexures (ansa):
  - 1- Proximal ansa
  - 2- Central ansa.
  - 3- Distal ansa.

### Colon in dog:

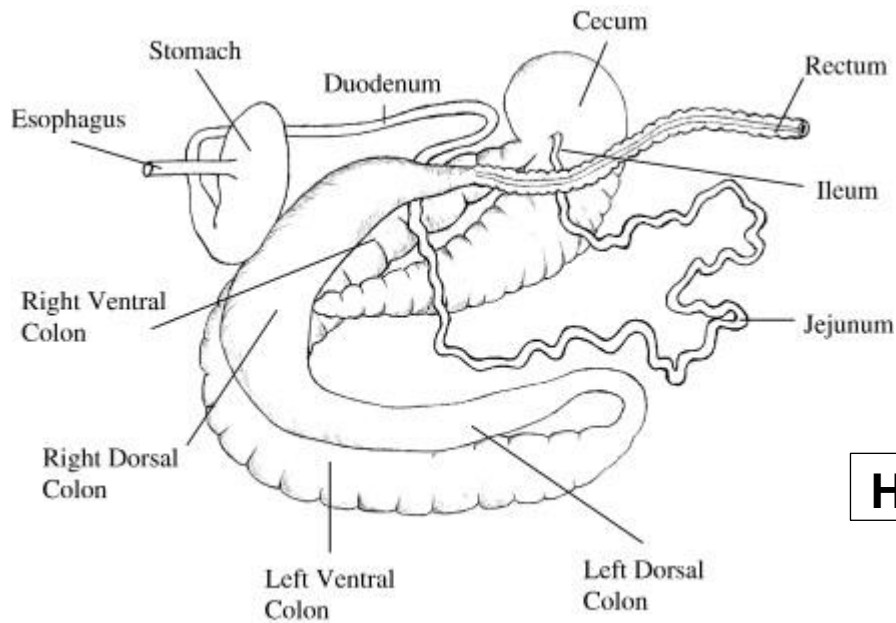
- The ascending colon is simple tube has no any modification.

### Rectum:

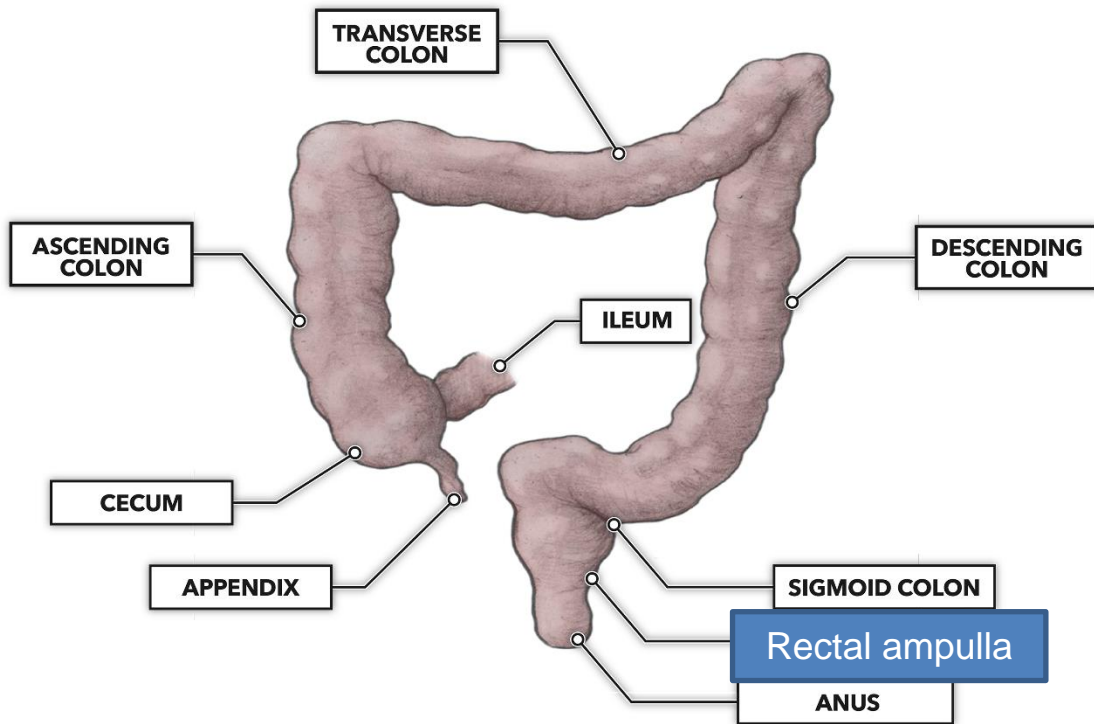
- It is the terminal part of large intestine which is located in the pelvic cavity.
- In horse is about 25 cm.
- In horse, dog and ox there is dilated part at the end of rectum called rectal ampulla.

**Anal canal:**

- Is the short terminal part of the digestive system extending from the rectal ampulla to external opening of the anus.
- In dog is characterized by present glands called anal glands.



**Horse**



## **Accessory digestive glands:**

### **The Pancreas:**

- It is lobulated, exocrine and endocrine gland.
- Endocrine insulin. Exocrine lipase.
- It consists of body, left and right lobes.

### **Pancreas of horse:**

- Its body has portal ring for passing portal vein.
- It has major and minor pancreatic duct.

### **Pancreas of ruminants:**

- There is no portal ring.
- In large ruminants has only minor pancreatic duct and in small ruminants has only major pancreatic duct.

## **The liver:**

It is the largest gland in the body and it is the most important accessory gland in the digestive system.

### **Position:**

In horse and dog it located transversely in the epigastric region, xyphoid and left and right hypogastric subregions. In ruminant is located in right hypochondrial subregion extends from the 5<sup>th</sup> to the 13<sup>th</sup> ribs.


**Note:** In horse, avian, camel and pigeon, the liver has **No gall bladder.**

### **Lobulations of liver depending to present the following:**

- 1- Esophageal notch. (Dorsal border).
- 2- Caudal vena cava. (Dorsal border).
- 3- Gall bladder. (Ventral border)
- 4- Round and Falciform ligaments. (Ventral border).
- 5- Portal area. (Center of visceral surface).



### **The liver can be divided into:**

- 1- Left lobe.
- 2- Right lobe.
- 3- Middle lobe: 
  - Quadrate lobe.
  - Caudate lobe.

\*The dorsal border is thick while the ventral border is thin and has interlobar fissures.

### **\*The visceral surface has:**

- 1- Gastric impression.
- 2- Duodenal impression.
- 3- Colic impression.

### **Fixation of the liver:**

- 1- Blood vessels and nerves which supply the liver.
- 2- Pressure of adjacent organs.
- 3- Esophageal attachment.
- 4- Caudal vena cava.
- 5- Round ligament.
- 6- Hepatogastric & hepatoduodenal ligaments.
- 7- Hepatorenal ligament.
- 8- Left & right triangular ligament.
- 9- Falciform ligament.

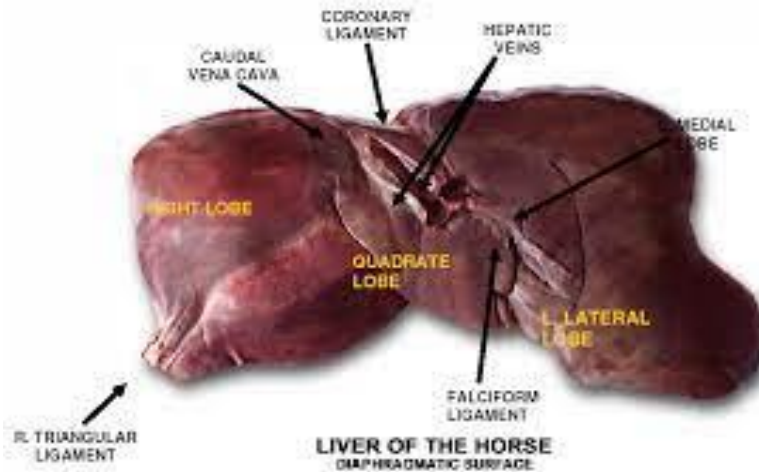
### **Excretory system of liver:**

- 1- Gall bladder.
- 2- Common hepatic duct.
- 3- Cystic duct.
- 4- Common bile duct.

**Gall bladder:** a small sac-shaped organ beneath the liver in which bile is stored after secretion by the liver and before release into the intestine, which present in ventral border of liver and consists from neck, body and fundus.

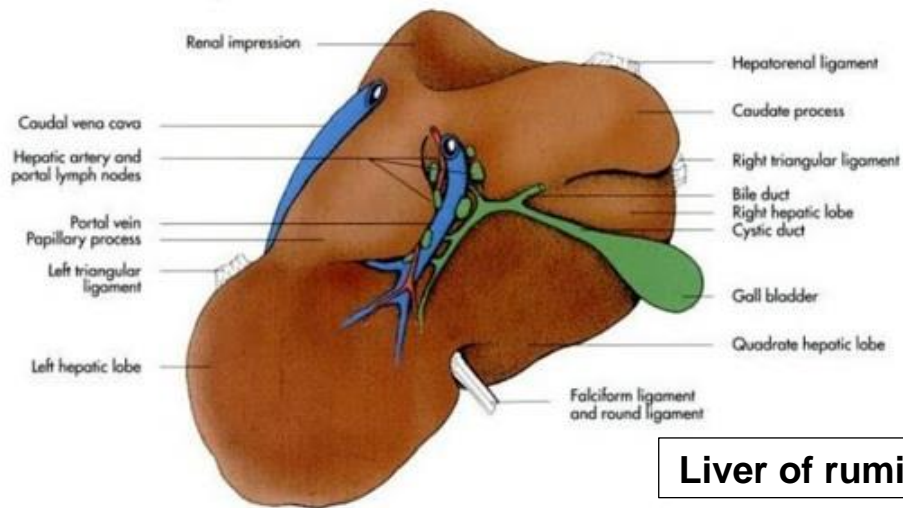
## Liver of horse:

- 1- Red brown to dark brown in color.
- 2- It is weight 5-7 kg.
- 3- Has **no** gall bladder.
- 4- The left lobe divided in to left lateral and left medial lobe.
- 5- Has **no** papillary process.



## Liver of ruminants:

- 1- Red brown to dark red in color.
- 2- In sheep about 500-800 gram in ox about 2-6 kg.
- 3- Has gall bladder.
- 4- The caudal lobe divided into caudate process and papillary process.
- 5- The interlobar fissure is not clear.
- 6- Both left and right lobes are **undivided**.



### Liver of dog:

- 1- Weight 130-400 gm.
- 2- Red brown in color.
- 3- Both left and right are **divided** into lateral and medial part (lobe).
- 4- Has gall bladder.
- 5- The caudal lobe divided into caudal process and papillary process.
- 6- The interlobar fissures are deep.
- 7- It is weight 130-400 gm.
- 7- Has gall bladder.