AGA 2110

THE DIGESTIVE SYSTEM OF FARM ANIMALS 1

DEPARTMENT OF ANIMAL SCIENCE

UNZA

INTRODUCTION

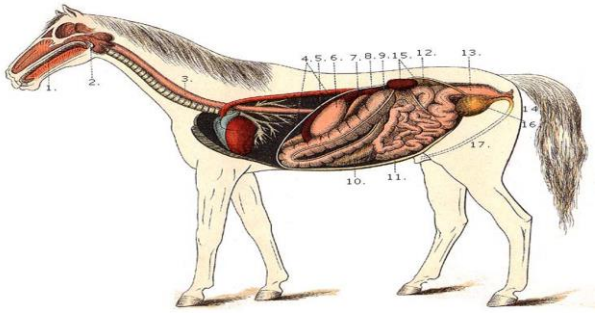
- The digestive system is one of the largest organ systems in an animal's body
- It consists of a group of organs that form a closed tube-like structure called the gastrointestinal tract (GI tract) or the alimentary canal
- The functions of the digestive system can be summarized as follows: ingestion (eat food), digestion (breakdown of food), absorption (extraction of nutrients from the food), and defecation (removal of waste products)

KEY TERMS

- Digestion is the process of breaking down feed into simple substances that can be absorbed by the body.
- Absorption is the taking of the digested parts of the feed into the bloodstream.
- The digestive system consists of the parts of the body involved digestion & absorption of feed. This system also moves the digested feed through the animal's body.

THE DIGESTIVE SYSTEM (TRACT)

- The alimentary canal is a muscular tube lined with mucous membrane that is continuous with the external skin at the mouth & at the anus.



SUBDIVISIONS OF THE DIGESTIVE SYSTEM

❑ The organs that make up the digestive system are;

✓ Mouth
✓ Tongue
✓ Pharynx
✓ Esophagus
✓ Stomach (or forestomach in ruminants)
✓ Small intestine
✓ Large intestine
✓ Anus
✓ Accessory glands (salivary glands, liver and pancreas)

THE DIGESTIVE SYSTEM (TRACT)

❑ The primary functions of the digestive system are;

i. Prehension - the act of taking hold or grasping.
ii. Mastication - chewing
iii. Digestion and absorption of food
iv. elimination of solid wastes.

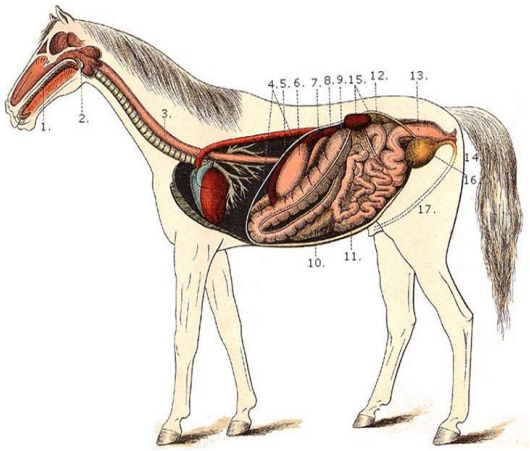
The digestive system breaks down various nutrients found in feed into molecules that can be used by the cells of the body

POSITION OF THE DIGESTIVE SYSTEM

- ❑ Outside the cavities - oesophagus
- ❑ lie within the abdominal & pelvic cavities
- ❑ Within the cavity they are lined by a serosa (serous membrane) called peritoneum
- ❑ Peritoneum is of 2 parts

i. Viscera peritoneum – lines organs

ii. Parietal peritoneum – lines walls



WALLS OF THE DIGESTIVE TRACT

- ❑ Comprises four (4) layers, or tunics.
- ❑ These are, from inside to outward

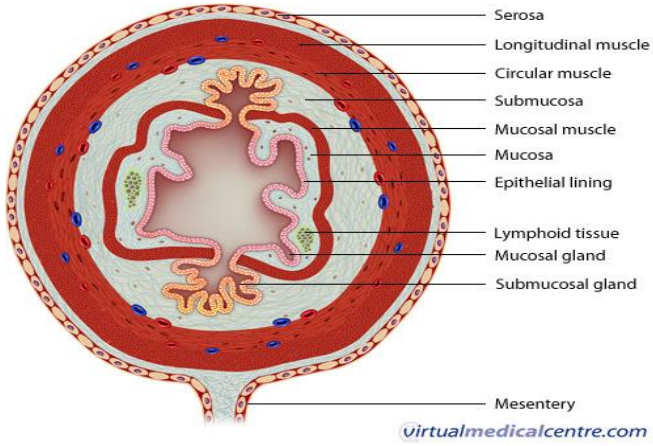
i. Tunica mucosa,

ii. Tunica submucosa

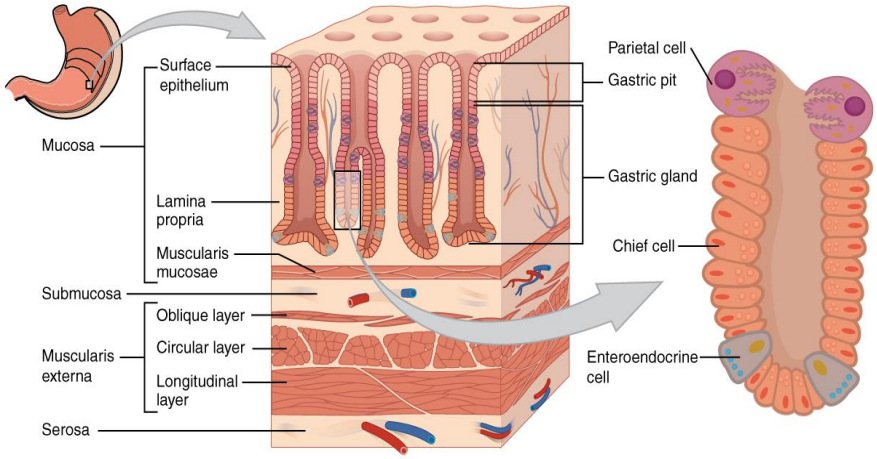
iii. Tunica muscularis,

iv. Tunica serosa

LAYERS OF THE WALLS OF THE DIGESTIVE TRACT



WALLS OF THE DIGESTIVE TRACT



TUNICA MUCOSA

- The layer closest to the space (the lumen) inside the digestive tract.
- From mouth to stomach – lined by stratified squamous
- From the stomach to anus – lined by simple columnar epithelium

TUNICA SUBMUCOSA

- Is a layer of loose connective tissue
- Contains blood vessels & nerves.
- In some locations, glands of the digestive tract can be found in the submucosa, as can lymphatic nodules

TUNICA MUSCULARIS

- ❑ Well developed
- ❑ The deeper layer has fibers that encircle the gut
- ❑ The more superficial muscle layer assumes a longitudinal arrangement.

TUNICA SEROSA/ TUNICA ADVENTITIA

- ❑ Outermost layer
- ❑ Lines part of digestive tract which lies within the cavities
- ❑ Parts outside the cavities are lined by tunica adventitia ie
- ✓ thoracic and cervical parts of the esophagus
- ✓ distal end of the rectum and anal canal

THE MOUTH

- ❑ Also referred to as oral cavity
- ❑ gathers and chews food to aid in swallowing
- ❑ It's a site of reduction of food particle size
- ❑ Houses teeth & tongue that assist in digestion
- ❑ Salivary enzymes are added to digesta in the mouth

PHYSIOLOGY

SALIVA

- ❑ Saliva consists of water, electrolytes, mucus, & enzymes.
- ❑ Role of saliva is to soften and lubricate the ingesta to facilitate mastication and swallowing.
- ❑ Saliva has 2 types of enzymes

i. ***Lysozyme*** is a salivary enzyme with antibacterial actions.

ii. The starch-digesting enzyme ***amylase*** is present in the saliva of omnivores

PARTS OF THE DIGESTIVE SYSTEM

THE TONGUE

- ❑ Is a mass of muscle covered by mucous membrane
- ❑ Divided into 3 parts

i. Apex – most rostral part
ii. Body
iii. Root

- ❑ Tongue is mobile & attached to the hyoid apparatus & mandible
- ❑ Covered by thick keratinized stratified squamous epithelium.
- ❑ Surface has large number of projections called papillae

TONGUE PAPILLAE

THE TEETH OF FARM ANIMALS

- Farm animals develop a set of ***deciduous teeth*** (baby teeth or milk teeth)
- Milk teeth fall out and are replaced with ***permanent teeth.***
- As growing teeth emerge from the gums, they are said to ***erupt.***
- The age of animals with a full set of permanent teeth can be estimated through examination of the wear pattern of the occlusal surfaces.

TOOTH

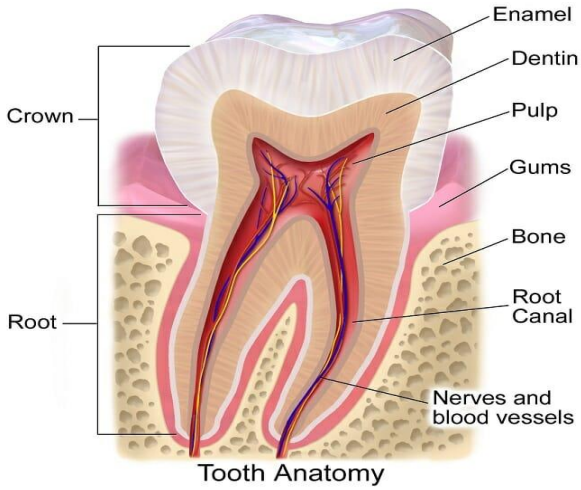
- Has 2 parts

i. A tooth - is anchored in a socket of bone called an ***alveolus***

ii. Crown is the visible part of the tooth above the gums

- Most of the tooth's substance is made up of mineralized substance called ***dentin***
- At the center of the dentine is the dental cavity (houses the nerves & blood vessels and connective tissue)
- ***dental pulp*** **-** The connective tissues, nerves, and blood vessels of the tooth reside in this cavity and constitute the dental pulp
- Superficial to the dentin is a layer of enamel – hardest substance in the body

STRUCTURE OF A TOOTH

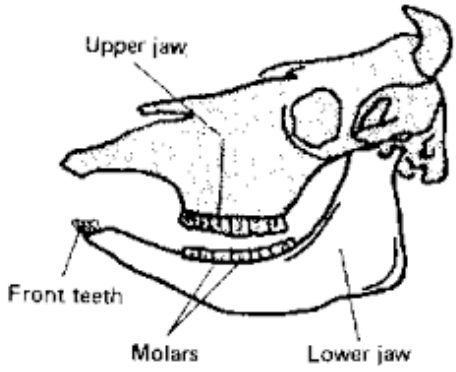


Tooth Anatomy

THE TEETH

- Teeth are arranged in two dental arcades
  i. one associated with the mandible
  ii. one with the incisive and maxillary bones
- A gap in each arch between the front teeth (incisors) and the cheek teeth is called diastema
- Farm animals have various types of teeth specialised for different types of prehension & mastication

THE TEETH



TYPES OF TEETH

- Incisors – front teeth designated as (I) in dental formulars
- Canine teeth (C)
- Cheek teeth comprise premolars (P), and Molars (M)
- Only Premolars are preceded by deciduous teeth

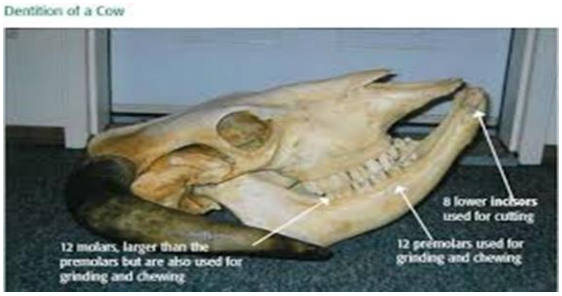
TYPES OF TEETH

- Incisors - Cutting
- Canines – grip and tear flesh
- Premolars – grinding & chewing
- Molars – grinding & chewing

TYPES OF TEETH

INCISORS

- Ruminants lack incisors in the upper dental arcade instead have a dental pad
- The dental pad is lined with mucous membrane (dense, keratinized)



THE TEETH

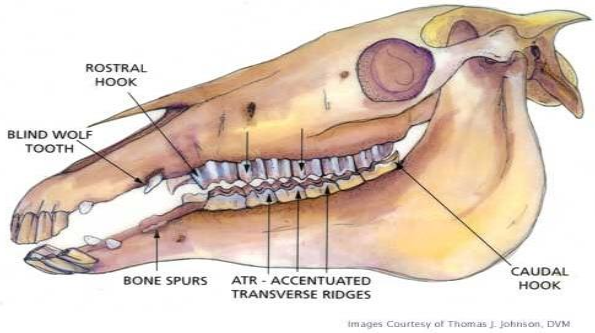
CANINE TEETH (C)

✓ Ruminants have no canine teeth

✓ Pigs – large. In boar, they are called tusks. Lower tusk is large than the upper. Its open rooted (grows throughout life)

HORSE - PREMOLARS

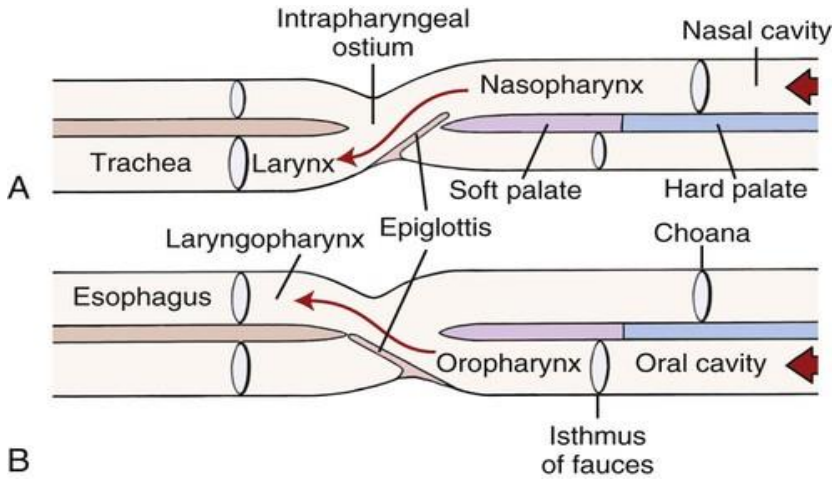
❑ Horse – 1st premolar is usually absent & when present is small only seen in the upper arcade, its called wolf tooth



THE PHARYNX(pl. pharynges)

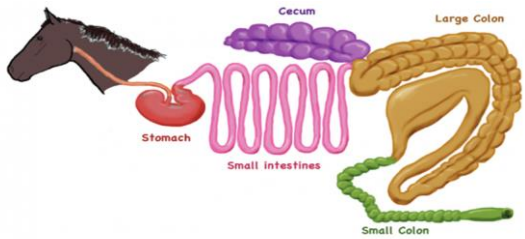
- Is the common passage for food and air
- Lies caudal to oral & nasal cavities
- Lined by mucous membrane & surrounded by muscles
- The muscles of the walls of the pharynx are responsible for the orderly directing of air, food, and liquids.
- Air from the nasal cavity is directed into the ventral larynx and food and liquids are directed into the dorsal esophagus.

THE PHARYNX(pl. pharynges)

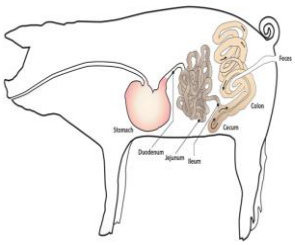


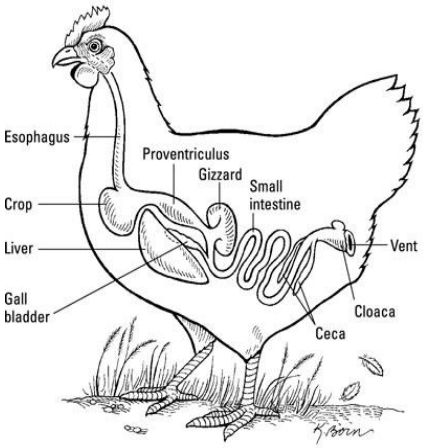
OESOPHAGUS

- ❑ The esophagus is a muscular tube
- ❑ Connects the pharynx and the stomach
- ❑Separate from the stomach by oesophageal sphincter
- ❑ In birds, caudal part is specialised to form the crop



PIG DIGESTIVE SYSTEM



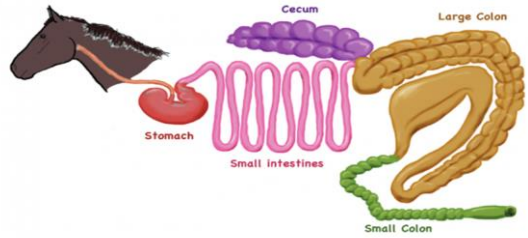


THE STOMACH

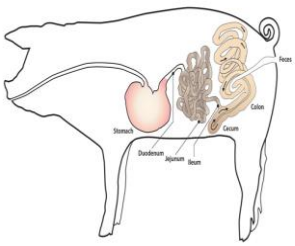
- Muscular chamber
- Secretes gastric juices
- Different lining of stomachs - Esophageal-like epithelia & Glandular epithelia

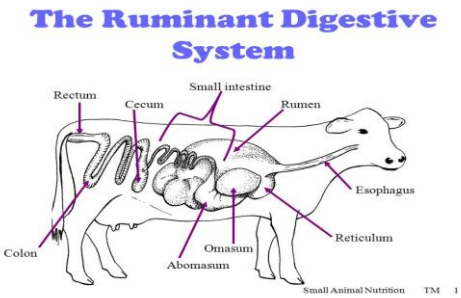
THE STOMACH – SPECIES VARIATIONS

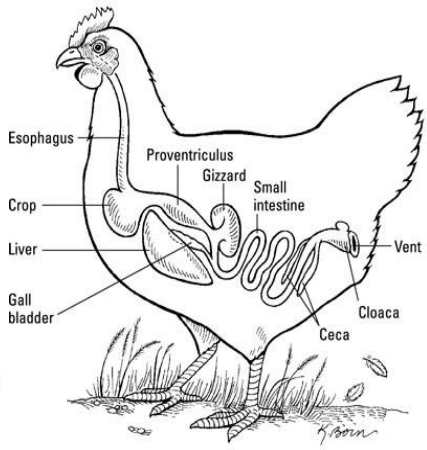
- Ruminant stomach – has 4 chambers: rumen, reticulum, omasum, abomasum
- Pigs & Horses – Have single (simple) stomach
- Birds – have 2 parts (proventriculus & gizzard)
  proventriculus – glandular part
  gizzard – 'grinding mill'



PIG DIGESTIVE SYSTEM







COMPONENTS OF THE INTESTINES

- ❑ The small intestines is divided into: duodenum, jejenum & ileum
- ❑ The large intestine is divided into: colon, cecum and rectum
- ❑ Mesentery – fold of membrane (fanlike) that attaches the intestines to the abdominal wall and holds them in place
- ❑ Mesentery allows blood vessels, lymphatics and nerves to supply the intestines

THE ACCESSORY GLANDS

- ❑ Accessory glands (salivary glands, liver and pancreas)
- ❑ Role is to supply secretions to the digestive tract & provide for digestion within the lumen
- ❑ These secretions are in addition to those supplied by the many glands of the stomach and intestine
- ❑ Secretions supplied are;
- ✓ electrolytes
- ✓ water
- ✓ digestive enzymes
- ✓ bile salts.

THE ACCESSORY GLANDS

1. SALIVARY GLANDS

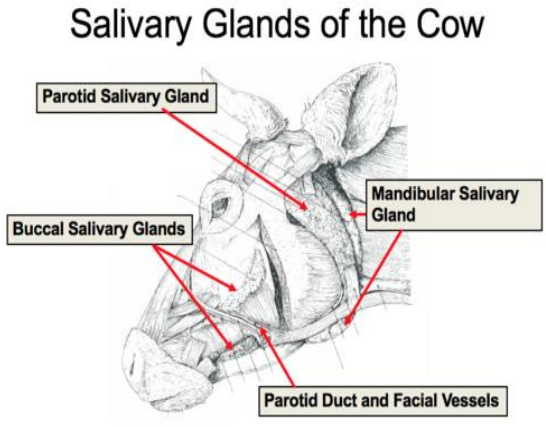
- ❑ Salivary glands are serous, mucous, or mixed, depending on their secretion.
- ❑ A serous secretion is a watery, clear fluid as compared with
- ❑ A mucus secretion is a viscous which acts as a protective covering throughout the digestive tract.
- ❑ A mixed gland secretes both serous and mucous fluids

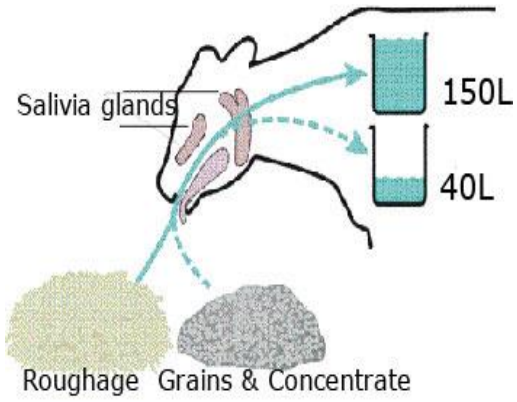
THE ACCESSORY GLANDS

1. SALIVARY GLANDS

- ❑ Named based on location
- ❑consist of 3 pairs of well-defined glands
- ❑ The larger glands are
- ✓Parotid
- ✓Mandibular
- ✓and sublingual salivary glands.
- ❑ These glands are connected to the oral cavity by excretory ducts

SALIVARY GLANDS





THE ACCESSORY GLANDS

2. THE PANCREASE

- ❑ Located near the 1st part of the duodenum & appears as an elongated gland of loosely connected aggregated nodules
- ❑ Lies close to the common bile duct or the duct empties directly into the common bile duct so that a mixture of bile & pancreatic juice enters the duodenum

THE ACCESSORY GLANDS

2. THE PANCREAS

- ❑ The pancreatic gland has both endocrine & exocrine functions:
- ❑ It produces hormones (endocrine) & digestive secretions (exocrine).

EXOCRINE FUNCTION OF THE PANCREAS

- ❑ Secretes sodium bicarbonate and digestive enzymes into the deodenum.
- ❑ Enzymes - trypsinogen & chymotrypsinogen, amylase, lipase

THE ACCESSORY GLANDS

2. THE PANCREAS

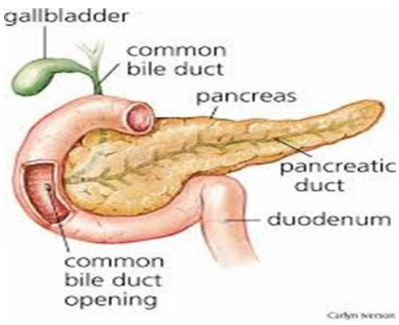
- ❑ The endocrine portion are the pancreatic islets (former islets of Langerhans)
- ❑ Pancreatic islets are isolated groups of cells scattered throughout the gland.
- ❑ The cells are of 2 types;

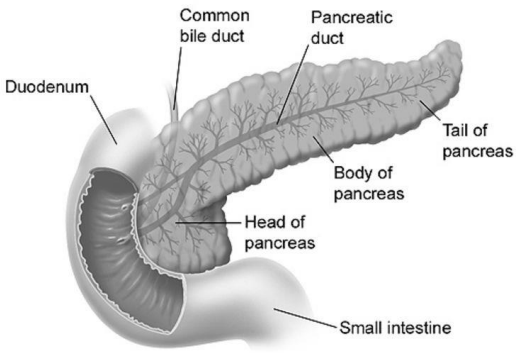
i. Beta cells produce insulin

ii. Alpha cells produce glucagon.

- ❑ Secretions from alpha and beta cells are made directly into the blood

THE PANCREAS





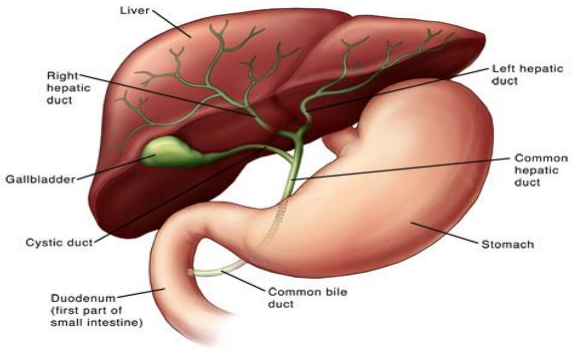
National Cancer Institute

THE ACCESSORY GLANDS

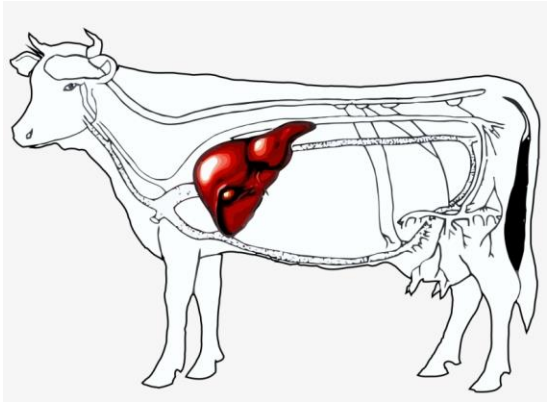
3. THE LIVER

- ❑ Largest gland in the body
- ❑ lies caudal to the diaphragm – attached to the diaphragm by the falciform ligament
- ❑ Usually on the right side of the body
- ❑ divided into lobes -
- ❑ the gall bladder lies between the lobes and is connected to the liver by a duct.
- ❑ The other duct connects liver to the deodenum

LIVER & GALL BLADDER



THE LIVER



THE ACCESSORY GLANDS

- ❑ Liver cells (hepatocytes) are responsible for bile formation.
- ❑ Bile is a greenish-yellow salt solution consisting primarily of;
- ✓bile salts
- ✓Cholesterol
- ✓ phospholipids (lecithins)
- ✓ and bile pigments (bilirubin).
- ❑ Bile salts assist in digestion & absorption of lipids (triglycerides), and the production and secretion of these salts is the most important digestive function of the liver

THE ACCESSORY GLANDS

FUNCTIONS OF THE LIVER

i. Bile production & secretion
ii. Storage of glycogen, vitamins & minerals
iii. Synthesis of plasma proteins eg albumin & clotting factors
iv. Processing (Metabolism) of nutrients from the digestive tract
v. Filter blood coming from the digestive tract before passing it to the rest of the body
vi. Detoxifies chemicals and metabolises drugs

ANATOMY OF THE SMALL INTESTINE