

TVET CERTIFICATE III in ANIMAL HEALTH

DOMESTIC ANIMAL BODY DESCRIPTION

ANHBD302

Describe the body of domestic animal

Competence



Credits: 9

Learning hours: 80

Sector: Agriculture and Food processing

Sub-sector: Animal Health

Module Note Issue date: June, 2020

Purpose statement

This general module describes the skills, knowledge and attitude to be acquired by learner to perform the domestic animal body description. Any animal care technician has to manipulate the body of the animal during his professional work. So, this competence is very important for the animal care training and it is a prerequisite for all the specific module of the qualification involving the manipulation and treatment of the different animal species. Upon completion of this module, the trainee will be able to:

- Describe the animal morphology
- Describe the body apparatus and assess anatomo-physiological parameters of the main functions

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GENERAL INTRODUCTION

Studies of gross anatomy can be approached in several different ways including systemic, regional, or clinical anatomy. **Systemic anatomy** is an approach to anatomic study organized by organ systems, such as the respiratory, digestive, or reproductive systems, which relates structure to function. **Regional anatomy** is an approach to anatomic study based on regions and deals with structural relationships among the parts of the body such as the thorax and abdomen, emphasizing the relationships among various systemic structures such as muscles, nerves, and blood vessels.

Anatomy is best learned by emphasizing its connection to clinical medicine, and thus **clinical anatomy** emphasizes the practical application of anatomic knowledge to the solution of clinical problems that are important and have real pertinence to the practice of medicine. In this introductory chapter, the systemic approach to the study of anatomy is used. In subsequent chapters, the clinical and regional approaches to the study of anatomy are used because many injuries and diseases involve specific body regions, and dissections and surgical procedures are performed region by region.

Learning Unit 1 – Describe the animal morphology

LO. 1.1. Use of anatomical nomenclature

- Topic1. Anatomical nomenclature of animal body external regions

Directional terms and planes of the animal body

Certain descriptive terms are employed to indicate precisely and unambiguously the position or direction of body parts. The most important anatomical terms are illustrated in table below.

The body of animal has the major divisions which are clearly distinguishable externally: the head (caput), the neck (collum), the trunk (truncus), the tail (cauda), and the limbs (membra).

Each one of these sections is in turn divided into regions, which function as descriptive motifs for topographic anatomy.

Term	Meaning
Cranial	Towards the head, trunk and tail
Caudal	Towards the tail
Lateral	Towards the side
Median	In the middle
Ventral	Towards the belly
Dorsal	Towards the back
Proximal	Towards the trunk
Distal	Away from the trunk
External (superficial)	Located outside
Internal (deep)	Located inside

LO. 1.2. Identify external parties and main regions of animal

- **Topic1. Animal body external regions in domestic animals**

The main external regions of the animal from **cranial to caudal** direction

- ✓ the **head**,
- ✓ the **neck**;
- ✓ the **trunk** including **chest** (thorax) and the **abdomen** (stomach),
- ✓ The **limbs** such as the **forelimbs** and the **hind limbs**.

1. External parts of ruminants

a. Different parts of the head and the neck

The main parts of the head and the neck are listed as follow:

- ✚ Forehead
- ✚ Eyes
- ✚ Muzzle
- ✚ Mouth with lips
- ✚ Horns
- ✚ Ears
- ✚ Poll
- ✚ Jaw
- ✚ Throat

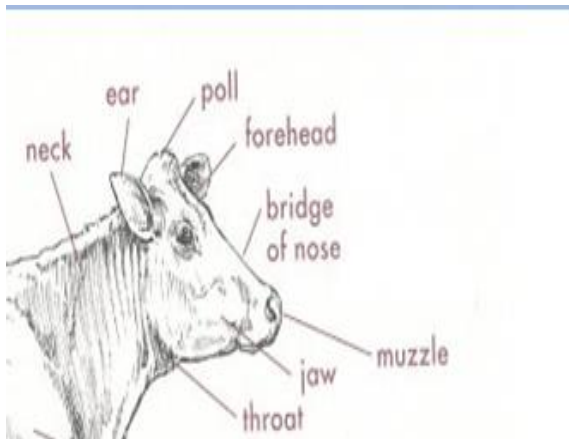


Figure1. Parts of the head and the neck of the cattle

b. Different parts of the trunk

The main parts of the trunk are shown on the following figure:

b1. Different parts of forelimbs

The following figure describes the main parts of the forelimbs of the cattle

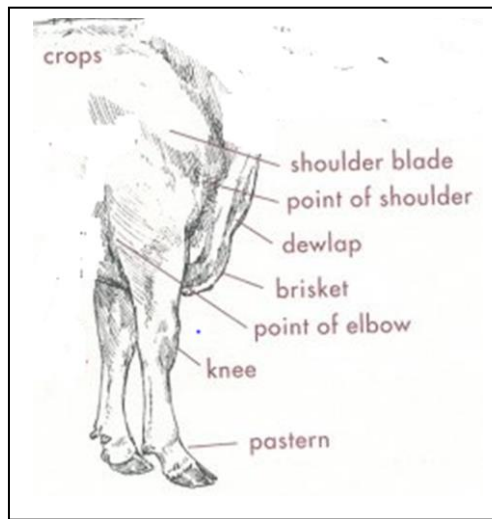


Figure2.Parts of the forelimbs of the cattle

b2. Different parts of hind limbs

This figure is describing the main parts
of the hind limbs

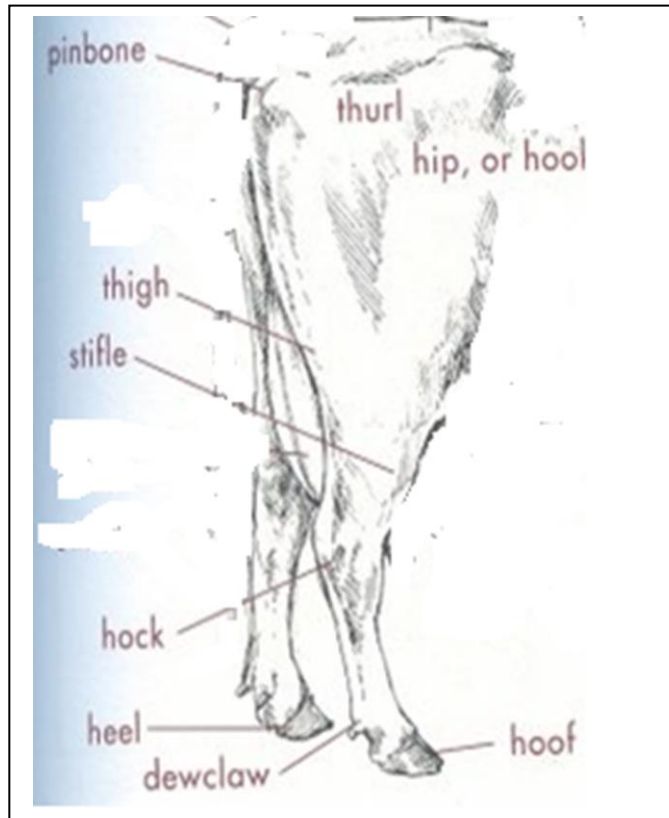


Figure3. Parts of hind limbs of cattle

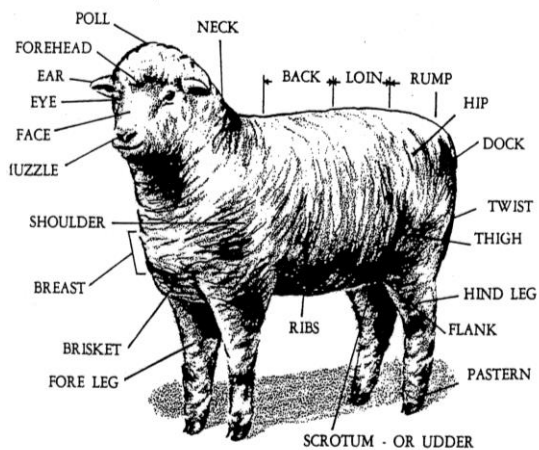


Figure4. The external parts of the sheep

2. External parts of non-ruminants

The following pictures describe some examples of non ruminant animals including pig, poultry and rabbit.

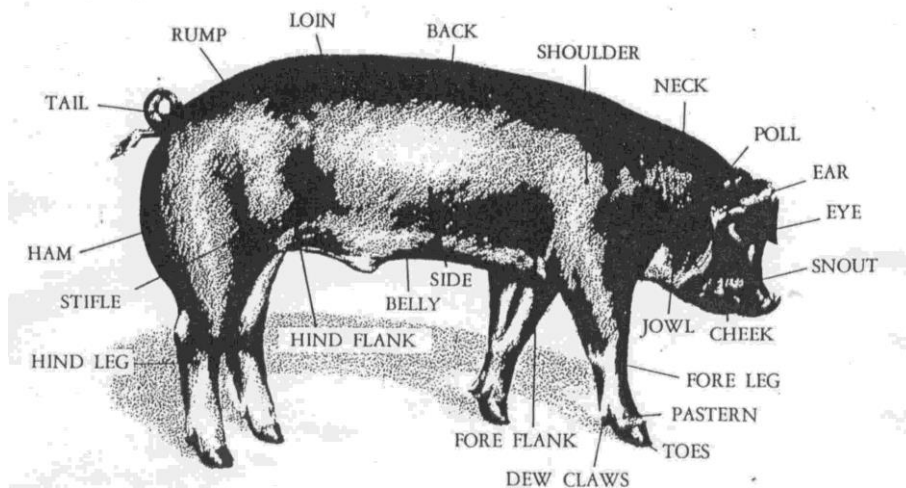


Figure5. The external parts of the domestic swine

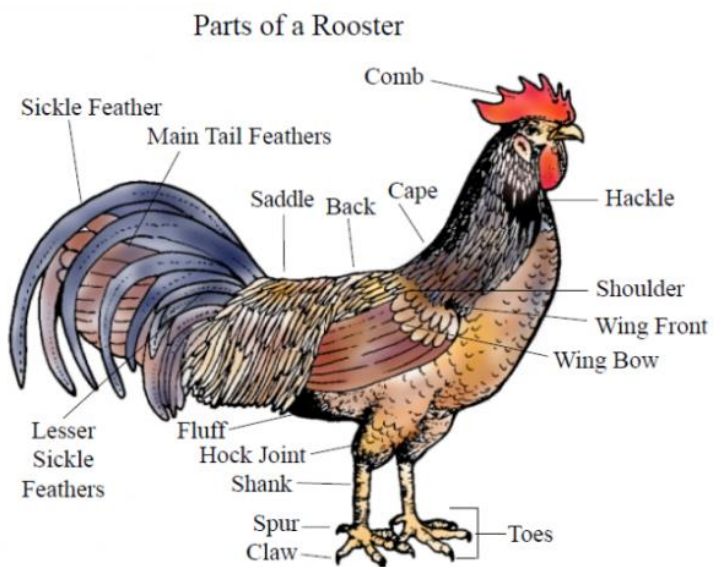


Figure6. The external parts of the domestic chick

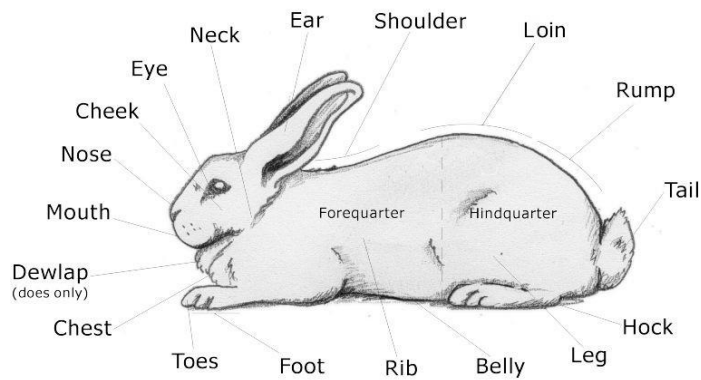


Figure7. The main external parts of a domestic rabbit

LO. 1.3. Identify domestic animal coats

• Topic1. Description of domestic animal coats

1. Definition

Animal coat is the nature and quality of a mammal's pelage. The pelage of a show animal may be divided into different types of hair, fur or wool with a texture ranging from downy to spiky. The state of the coat is considered an indication of the animal's breeding and health.

2. Type of coats

2.1. Simple coats

Basically, it is formed with one color.

a) Blackcoats



b) White coats



Figure8.

Figure8. Black colour and white colour of cattle

c) Red coats



Figure9. Red colour of cattle

d. Mixed

It is formed of a mixture of the color band and the white band.



Figure10. Black-White or White-Black



Figure11. Red-White or White-Red

2.2. Composite coats

It is made of a mixture of different colored hairs.



Figure 12. Composite coat

2.3. Coats particularities



Figure13. Coat particularity

LO.1.4. Delimitate animal body regions

- **Topic1. Delimitation of the body region correspondence and anatomic bases**

A **reference point** is a prominent structure or feature of the animal body that can be located and described by visual inspection or palpation at the body's surface; used to define movements and postures. Also known as **anatomical land mark**.

1. Skeleton reference point

There are many reference points on a domestic animal, but the most important are listed as follow: hump, sternum point, shoulder point, last ribs, external ilium angle, sacrum, ischium point, trochanter, patella, elbow, calcaneum, cannon, etc. see the following diagram.

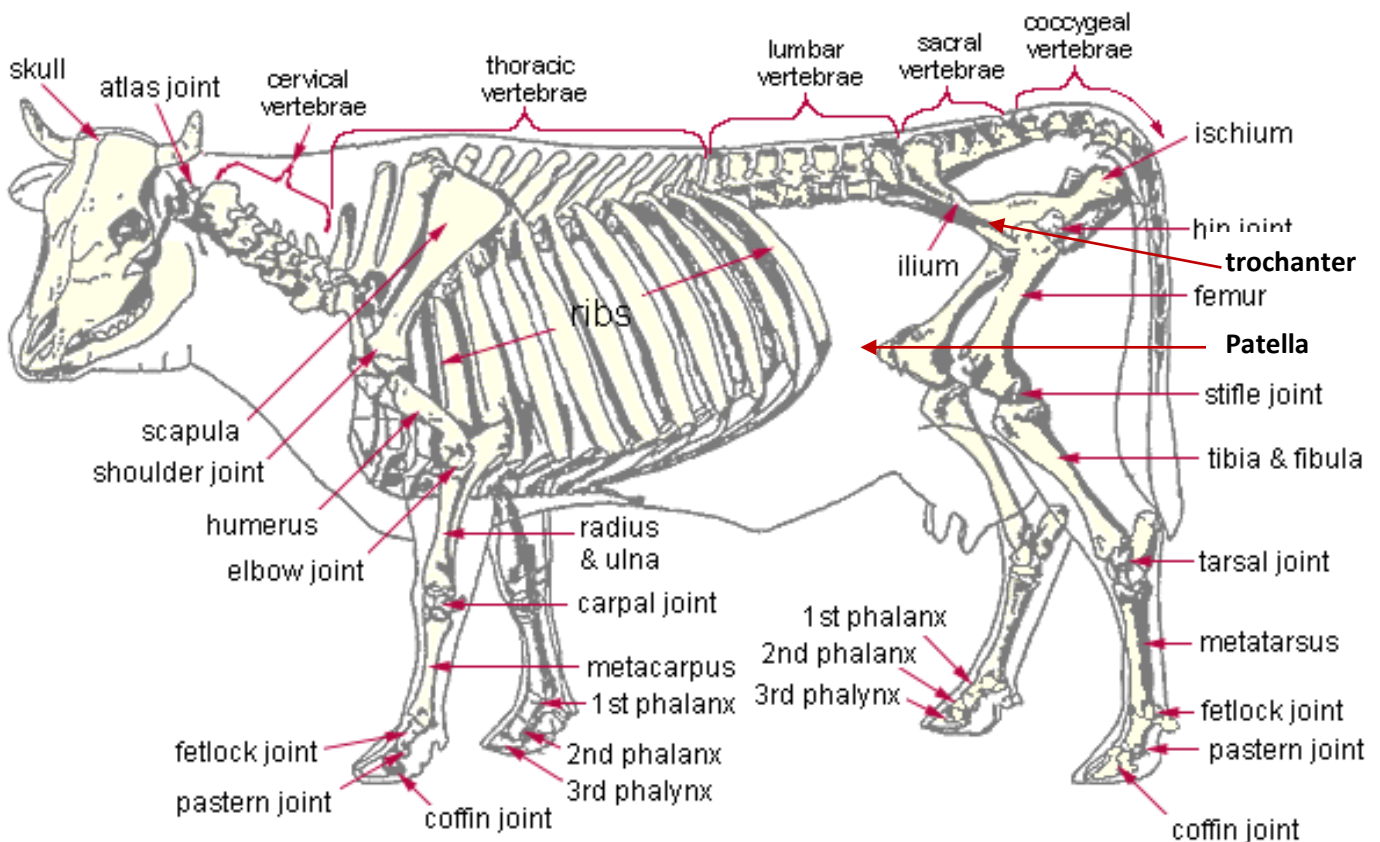


Figure14. Points and joints in cattle

2. Movable joints reference point

A movable joint is the most common type of joint in the animal body, and freely moving ones are found wherever movement is important. They are more commonly known as synovial joints because each contains synovial fluid — a liquid that helps to decrease friction when the joint moves.

The main movable joints reference point are the upper and lower joints, scapula-humeral joint, radio-humeral joint, carpe joint, metacarpo-phalangeal joints, hip joint, tibio-femoral joint, tarsal joints (see the figure above).

3. Body cavities reference point

- **Cranial cavities:** These are the empty spaces protected by the bones of the skull and face; where the brain, sinuses, oral, nasal, orbital cavities are located.
- **Spinal cavity:** delimited by the vertebrae from the neck to the tail, logging the spinal cord.
- **Thoracic cavity:** surrounded by the ribs, thoracic vertebrae, sternum and diaphragm caudally.
- **Abdominal cavity:** from the diaphragm to the cranial part of the pelvis.
- **Pelvic cavity:** delimited by the pelvic bones (ilium, ischium, sacrum and pubis).

4. Limbs reference point

- **Fore limb:** the following are the main reference points of the fore limb: hump, shoulder point, elbow, cannon.
- **Rear (hind) limb:** the main reference points of the hind limb are listed as: external ilium angle, ischium point, trochanter, patella, calcaneum, cannon, etc.

Learning unity 2: Describe of the body apparatus

LO. 2.1. Select material, tools and equipment for anatomical dissection

- Topic1. Identify and select material tools and equipment

a) Definition of Dissection terminology

Dissection is:

1. The act of dissecting or something dissected.
2. A minute and detailed examination or analysis.

Dissect is:

1. To study an animal's anatomy by cutting it apart to perform a necropsy or an autopsy
2. To study a plant or other organism's anatomy similarly.
3. To separate muscles, organs and so on without cutting into them or disrupting their architecture

b) Proper selection of material, tools and equipment for anatomical dissection

The need for application of different methodologies to dissection and research requires some knowledge on different forms of dissecting.

Examples of tools and equipment to dissect soft tissue:

- Dissecting forceps
- Dissecting needle
- Glass pipette with rubber bulb
- Dissecting scalpel blade
- Scalpel handle
- Dissecting scissors
- Plastic ruler in millimetre and centimetre
- Large wood handle spatula
- Ear punch for animals
- Needle
- Knife
- Interchangeable handle
- Forceps jar
- Forceps
- Pang

Some are found in dissecting kits.

Examples of tools and equipment to dissect hard tissue:

- Knife
- Suture hook
- Utility sheer
- Combination probe set
- Tweezers with magnifier
- Forceps
- Forceps jar
- Pang

LO.2.2. Describe musculoskeletal system

- **Topic1. Characterize the animal skeleton**

A skeleton is the internal structure that protects and supports the soft organs, tissues and other parts of a vertebrate organism, and is composed of bones and cartilages or, in certain animals, cartilages alone.

1. Definition of terminologies:

- **Skeleton** is the system that provides support to an organism, internal and made up of bones and cartilage in vertebrates, external in some other animals.
- **Joint** is any part of the body where two bones join, in most cases allowing that part of the body to be bent or straightened.

2. Skeleton features

2. 1. Axial skeleton

Because the bones of the head and trunk are located along the axis of the body, they are referred to as the axial skeleton.

a) **The skull**

The skull contains both cranial and facial bones.

Cranial bones:

- Frontal bones (2)
- Interparietal bones (2)
- Occipital bone (1)
- Parietal bones (2)

- Temporal bones (2)
- Ethmoid bone (1)
- Sphenoid bone(1)

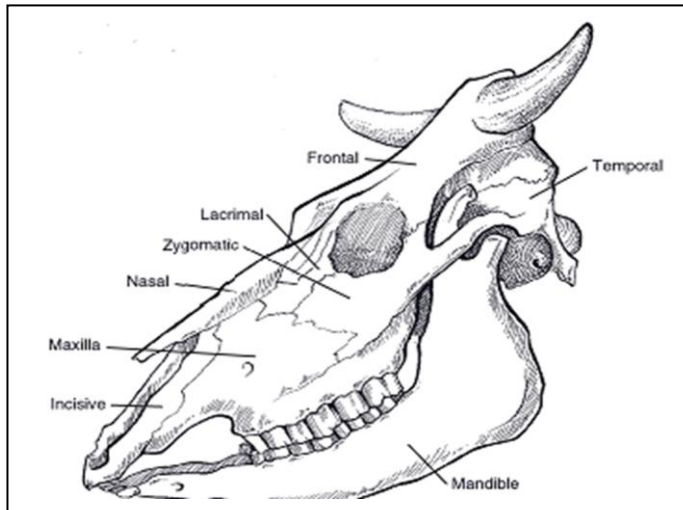


Figure15. Cranial bones

Facial bones:

- Incisive bones (2)
- Lacrimal bones (2)
- Mandible(1 or 2)
- Maxillary bones (2)
- Nasal bones (2)
- Zygomatic bones (2)
- Palatine bone (2)
- Ptergoid bones (2)
- Turbinates (2)
- Vomer bone (1)

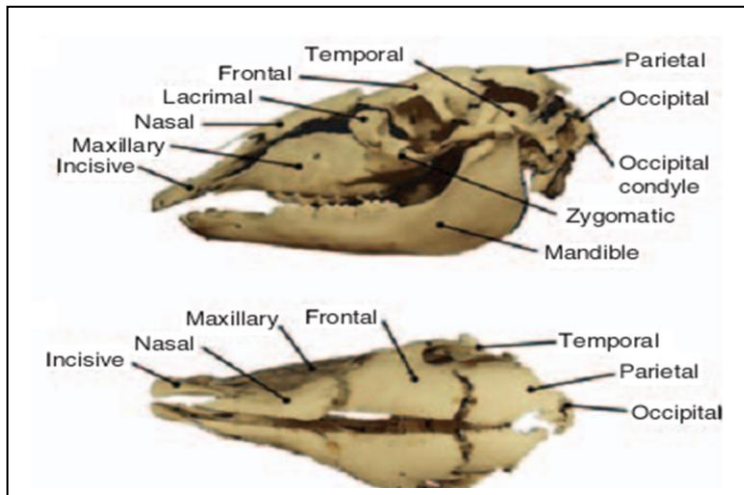


Fig16. Bones of the calvari

b) Hyoid bone

The hyoid bone is also called hyoid apparatus, looks somewhat like the letter H with its two legs bent back to form a U-shaped structure. It is located high in neck, just above the larynx, between the caudal ends of the mandible. It supports the base of the tongue, the pharynx and the larynx, and helps the animal swallow.

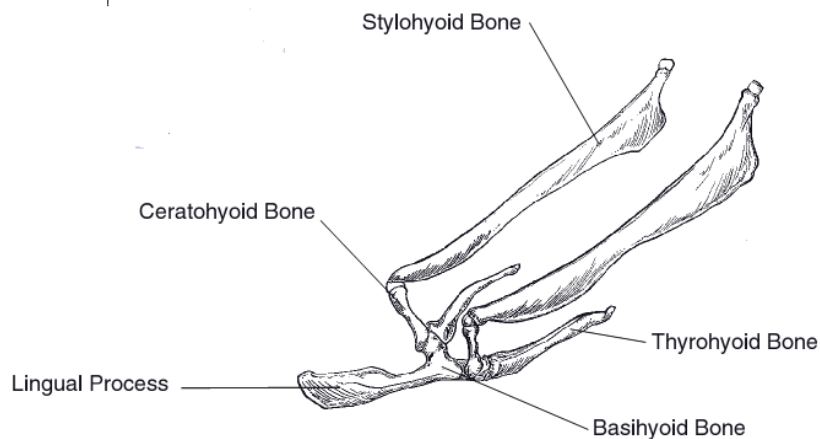


Figure17.Hyoid bone

C) Neck bones

The bones of the neck are mostly the cervical vertebra.

The first and second cervical vertebrae are called the atlas and axis, respectively.

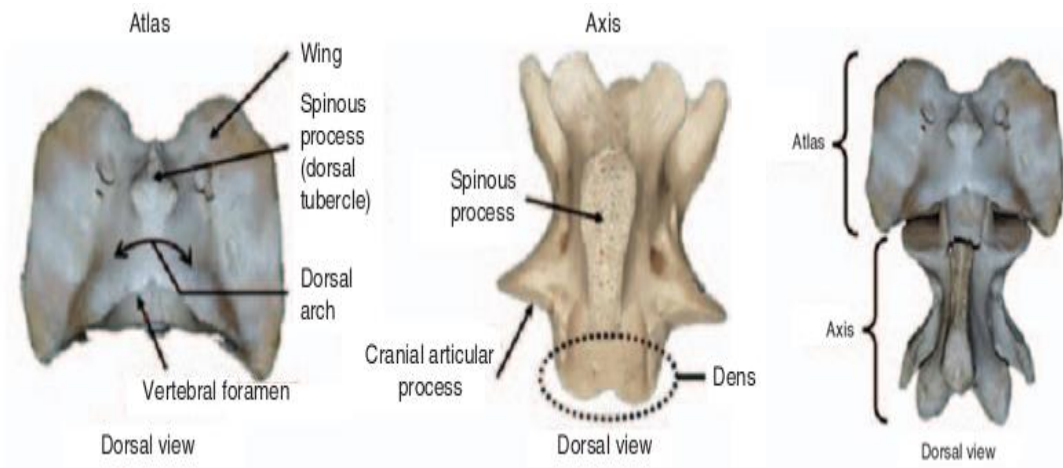


Figure18. Atlas and Axis vertebrae structure

d) Ribs

The ribs consist of long, curved bones that form the lateral wall of the thorax. The ribs can be grouped as follow:

- **True ribs or sternal ribs** : they articulate directly to the sternum via their costal cartilage;
- **False ribs or asternal ribs** : they include all ribs that are not true ribs and join the adjacent costal cartilage;
- **Floating ribs** : they include the last false ribs or these unattached. They end in costal cartilage that does not join to the sternum or the costal arch.

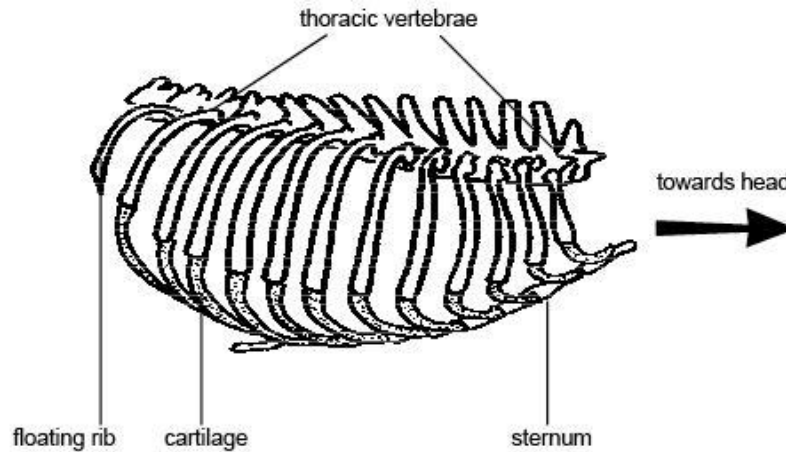


Figure19. Ribs

e) Sternum

The sternum also called the breastbone forms the floor of the thorax. It is made up of a series of rod like bones called **sternebra**. Only the first and the last sternebra are named and used as landmarks. The others are numbered from cranial to caudal. The first most cranial sternebra is called the **manubrium** or manubrium sterni. The last most caudal sternebra is called the xiphoid or xiphoid process. A piece of cartilage, known as the xiphoid cartilage , extends caudally from the xiphoid process and is easily felt in most animals at the caudal end of the sternum.

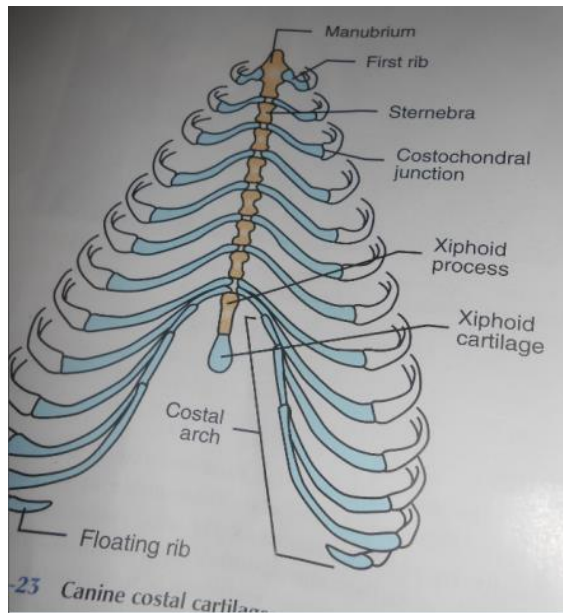


Figure20. Sternum

f) **The vertebral column**

The vertebral column, also called the spine, protects the spinal cord, supports the head and serves as an attachment site for muscles affecting body movements. The vertebral column bones are grouped into the cervical (neck), thoracic (back), lumbar (loin), sacral (croup), and caudal (tail) vertebrae.

Table1. Number of vertebrae in different species

<i>Species</i>	<i>Cervical</i>	<i>Thoracic</i>	<i>Lumbar</i>	<i>Sacral</i>	<i>Caudal</i>
Carnivore	C7	T13	L7	S3	Ca20-24
Pig	C7	T11-15	L6-7	S4	Ca20-23
Horse	C7	T18	L6	S5	Ca15-21
Ox	C7	T13	L6	S5	Ca18-20
Sheep	C7	T13	L6-7	S4	Ca16-18
Chicken	C7	T7	L14 (lumbar-sacral)		

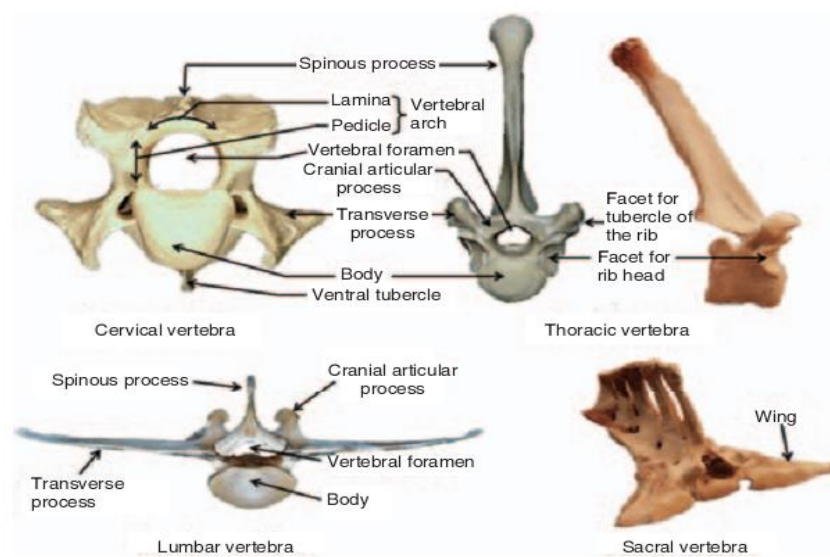


Figure21. The vertebral column

The thorax is the body cavity formed by the sternum, ribs, costal cartilages and bodies of the thoracic vertebrae.

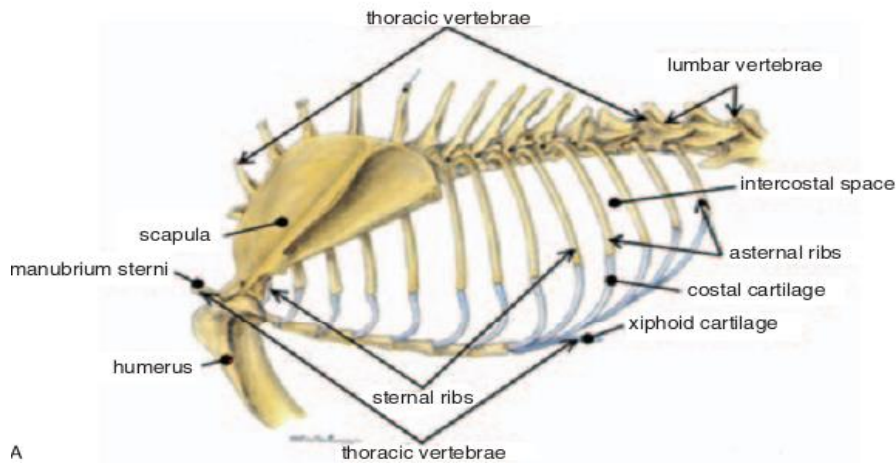


Fig22. Thoracic bones

Topic2. Identification of appendicular system

Appendicular system

a. Thoracic limb

It is composed of:

- The scapula: is a flat, triangular bone in the shoulder.
- The humerus, sometimes called the brachial bone, is the largest bone in the thoracic limb.
- The radius and ulna
- The carpal bones

- The metacarpal (MC) bones

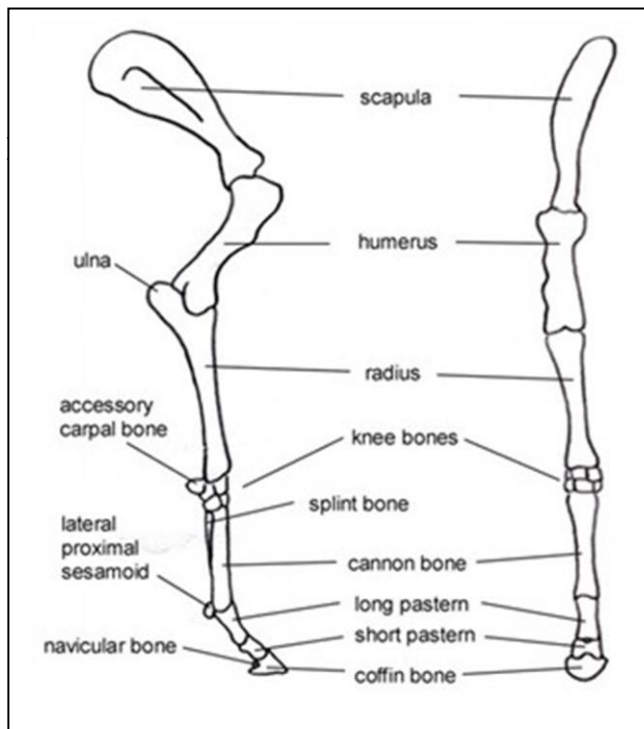


Figure23. Thoracic limb

b.Hind limb skeleton

- Pelvis: (Ilium, Ischium)
- Femur
- Patella
- Tibia
- Fibula
- Tarsal bones
- Metatarsal bones
- Phalanges

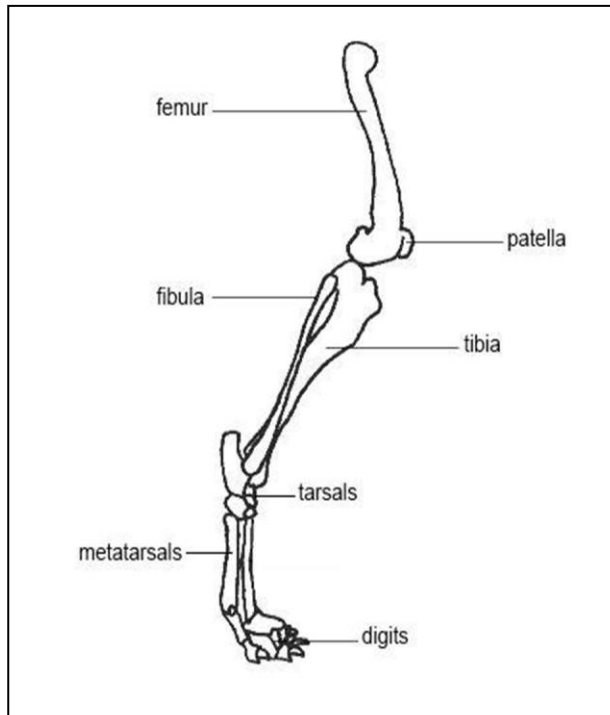


Figure24. Hind limb skeleton

- **Topic3. Description of visceral skeleton**

Visceral skeleton

The visceral skeleton consists of bones that form in soft organs or viscera. It is the strangest division of the skeleton and the most variable. Not all animal have visceral bones.

The bones of viscera skeleton are:

a) The os penis

The os penis is a bone in the penis of dogs that partially surround the penile portion of the urethra.

b) The os cordis

The os cordis is a bone in the heart of cattle and sheep that helps support the valves of the heart.

c) The os rostri

The os rostri is a bone in the nose of swine that strengthens the snout for the rooting behaviour of pigs, whereby they dig into the ground with their snouts .

- **Topic4. Characteristics of bone**

Bone characteristics

Bone is one of the most fascinating body tissue. It is the second hardest natural substance in the body only the enamel of the teeth is harder. Despite it's dead, rock like appearance, bone is a vital, living tissue with an excellent capacity to repair itself after injury. Bone is composed of a sparse population of cells embedded in a hard intercellular substance called the **matrix**. The cells that produce bone are called **osteoblasts**.

The osteoblasts secrete the matrix , which is initially soft and composed of collagen fibers embedded in a gelatin like ground substance made of protein and complex carbohydrates called **polysaccharides**. The osteoblasts then harden the matrix through a process called ossification. When the ossification takes place , the matrix is infiltrated with Calcium and Phosphate in the form of hydroxyapatite crystals. These hydroxyapatite crystals give bone characteristic hardness. As they create areas of bone, the osteoblasts become trapped in spaces in the ossified matrix called **lacunae** .

Osteocytes live out their days in their little cell-like lacunae. Their only contact with each other or with their blood supply is through threadlike, cellular processs in tiny channels through the bone called **canaliculi**. The canaliculi are like slots in the jail cell doors through which the osteocytes get food and communicate with each other.

- **Topic5. Description of types and structure of joints**

1. Types of joints

a. Immovable fibrous joints

The anatomical term for fibrous joints is synarthrosis. Fibrous joints are immovable in that the bones are firmly united by fibrous tissue. Some examples include the sutures that unite most of

the skull bones and the fibrous union of the splint bones of horses with the large metacarpal and metatarsal bones.

b. Slightly movable cartilaginous joints

Slightly movable cartilaginous joints are termed amphiarthrosis. They are capable of only a slight rocking movement. Examples include the intervertebral disks between the bodies of adjacent vertebrae in the spine and the symphyses between the two halves of the pelvis and between the two sides of the mandible.

C. Freely movable synovial joints

Synovial joints are what we usually think of when we hear the word joint. They are freely movable joints such as the shoulder joint and the stifle joint. The anatomical term for synovial joints is diarthrosis. Example: Coxofemoral (hip) joint, glenohumeral (shoulder) joint.

2. Characteristics and structures of synovial joint

The synovial joint includes:

- articular surface on the bones,
- articular (hyaline) cartilage covering the articular surfaces
- A fluid filled joint cavity enclosed by joint capsule
- Firm connective tissue called ligament
- The joint cavity called joint space
- Synovial membrane
- Out layer of the joint capsule called fibrous tissue

Note:- Joint capsule =Fibrous layer and synovial membrane together.

-Meniscus = fibrocartilage in the synovial cavity, interposed between the bones

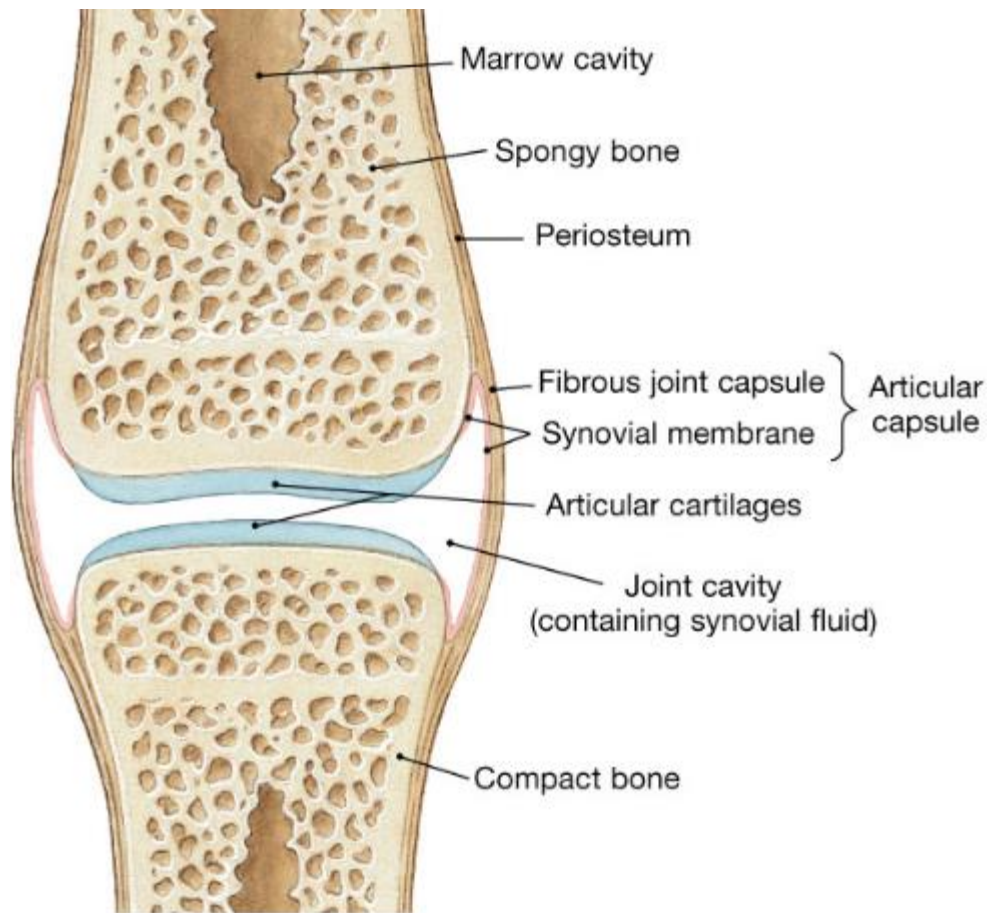


Figure25. Synovial joint

- **Topic6. Description of Poultry skeleton**

The skeletal system of the bird is compact and lightweight, yet strong.

Vertebrae are movable, but the body vertebrae are fused together to give the body sufficient strength to support the wings. There are two special types of bones which make up the bird's skeletal system: the pneumatic and medullar bones.

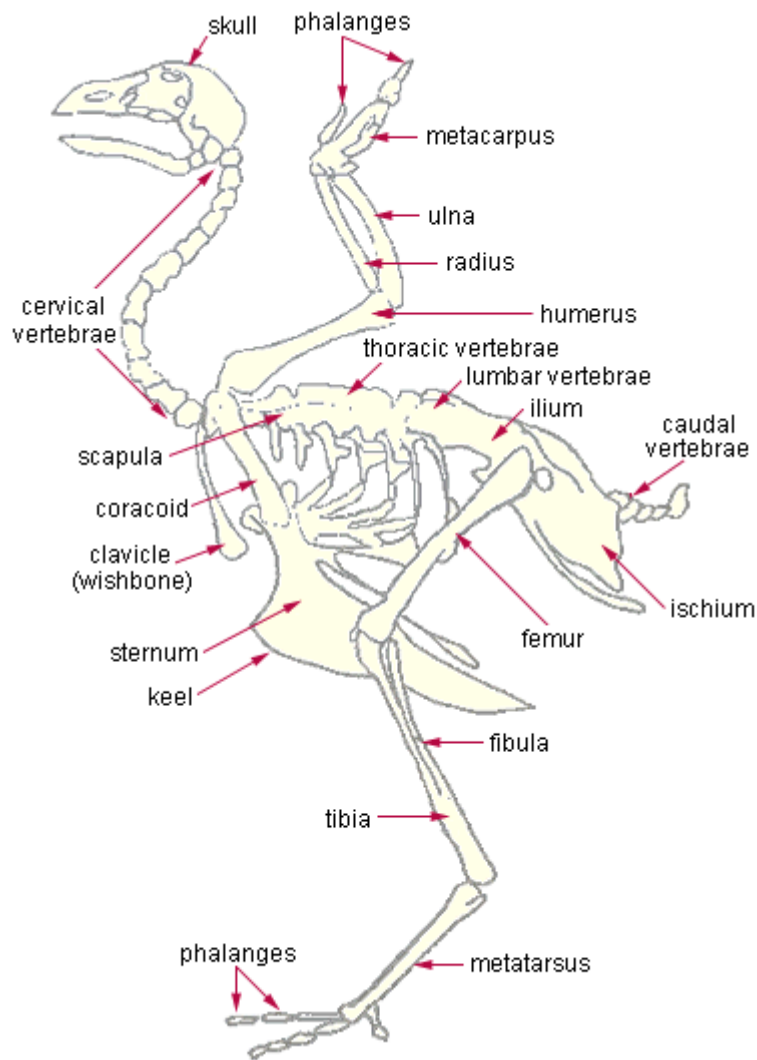


Figure26. Poultry skeleton

- **Topc7. Characterization of the main muscles of veterinary importance**

The following paragraphs will describe the characterization of the main types of muscles of veterinary importance. This will help students and teachers to understand the basics of mycology and will be a milestone of the module of minor surgery.

Types of muscles

There are three different types of muscles that make up the muscular system:

- **Skeletal muscle or red muscles;**
- **Cardiac muscle;**

- Smooth muscle /white muscle or visceral.

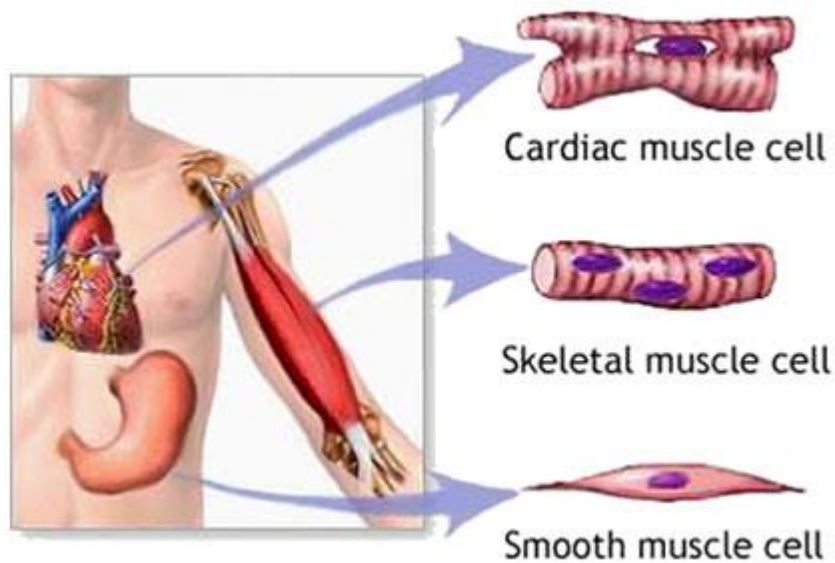


Figure27. Muscle types of human being

1. Skeletal muscle or red muscles

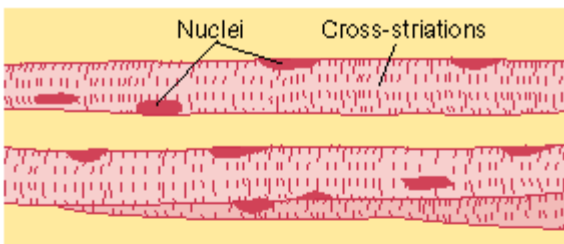
Skeletal muscle is the type that usually comes to mind when we hear the word muscle. It is called **skeletal muscle** because it moves the bones of the skeleton and generates heats, which in turn move the animal around. It is also called voluntary striated muscle because it is *under* the control of the conscious mind. This type is what we usually think of as muscle. Most muscles are attached to bones by tough, fibrous tissue bands called tendons and others instead of connecting by **tendons**, are attached to bones or other muscles by broad sheets of fibrous connective tissue called **aponevrosis**.

2. Cardiac muscle

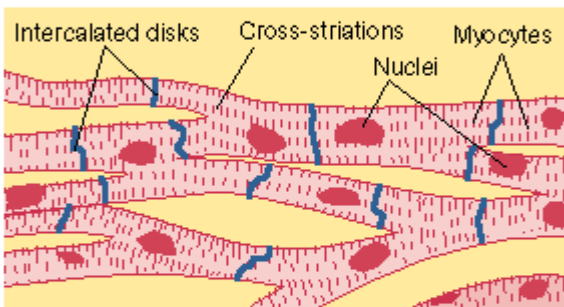
Cardiac muscle is found in only one place in the body, the heart. It is also called **involuntary striated** muscle. It is called involuntary because its contractions are not under conscious control. The striated part of the name is given because under the microscope its cells have the same kind of striped appearance as skeletal muscle cells. Its forms most of the volume of the heart and makes up the majority of the walls of the cardiac chambers, the atria and the ventricles

3. Smooth muscle /white muscle or visceral

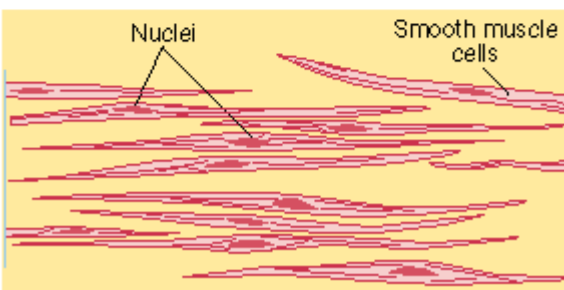
Smooth muscle is also called **non striated involuntary muscle**, or sometimes involuntary muscle. It is found all over the body in places such as the eyes, the air passageways in the lungs, the stomach and intestines, the urinary bladder, the blood vessels, and the reproductive tract. It carries out most of the unconscious, internal movements that the body needs to maintain itself in good working order.



Skeletal muscle



Cardiac muscle



Smooth muscle

Figure28. Comparison *of* **muscle**types, www.nvo.com,

4. Forms of muscles

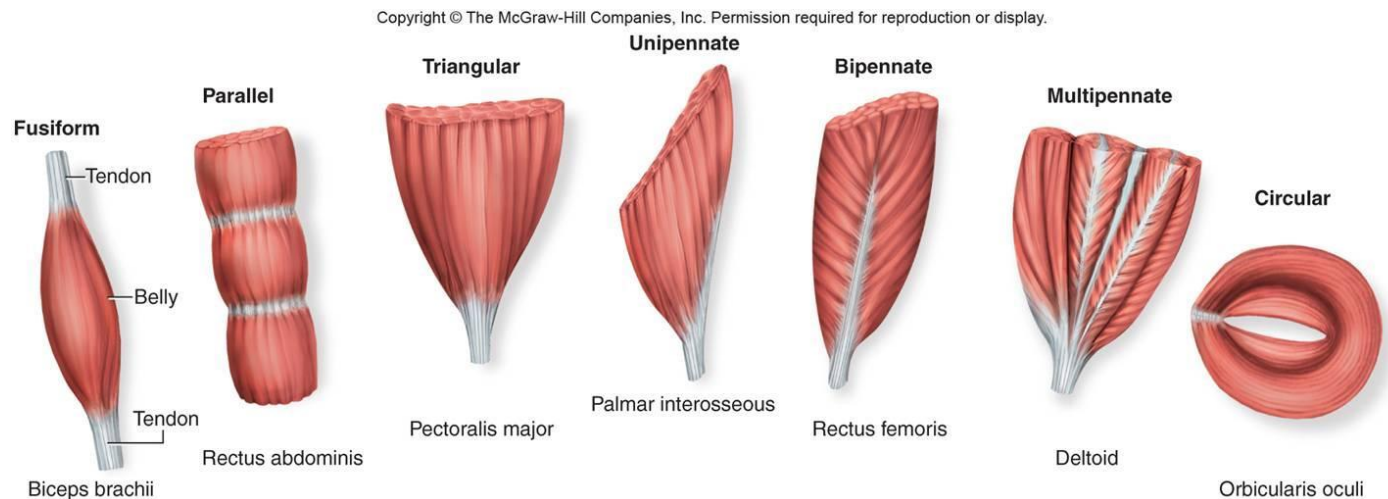


Figure 29. Fusiform, Parallel, Triangular, Unipennate, Bi ", Multi ", Circular, www.studyblue.com, 19/10/2014

5. Comparison of muscles features

Feature	Skeletal muscle	Cardiac muscle	Smooth muscle
Location	Skeletal muscles	Heart	Internal organs, blood vessels, eyes,
Action	Move the bones, generate heat	Pump blood	Produce movements in internal organs and structures
Striation	Present	Present	Absent

- **Topic8. Identification of the characteristics of muscles**

We can look at the main characteristics of:

- The muscles of the head
- The muscle of the neck
- The muscle of the fore and hind limbs
- The muscles of the thorax and abdomen

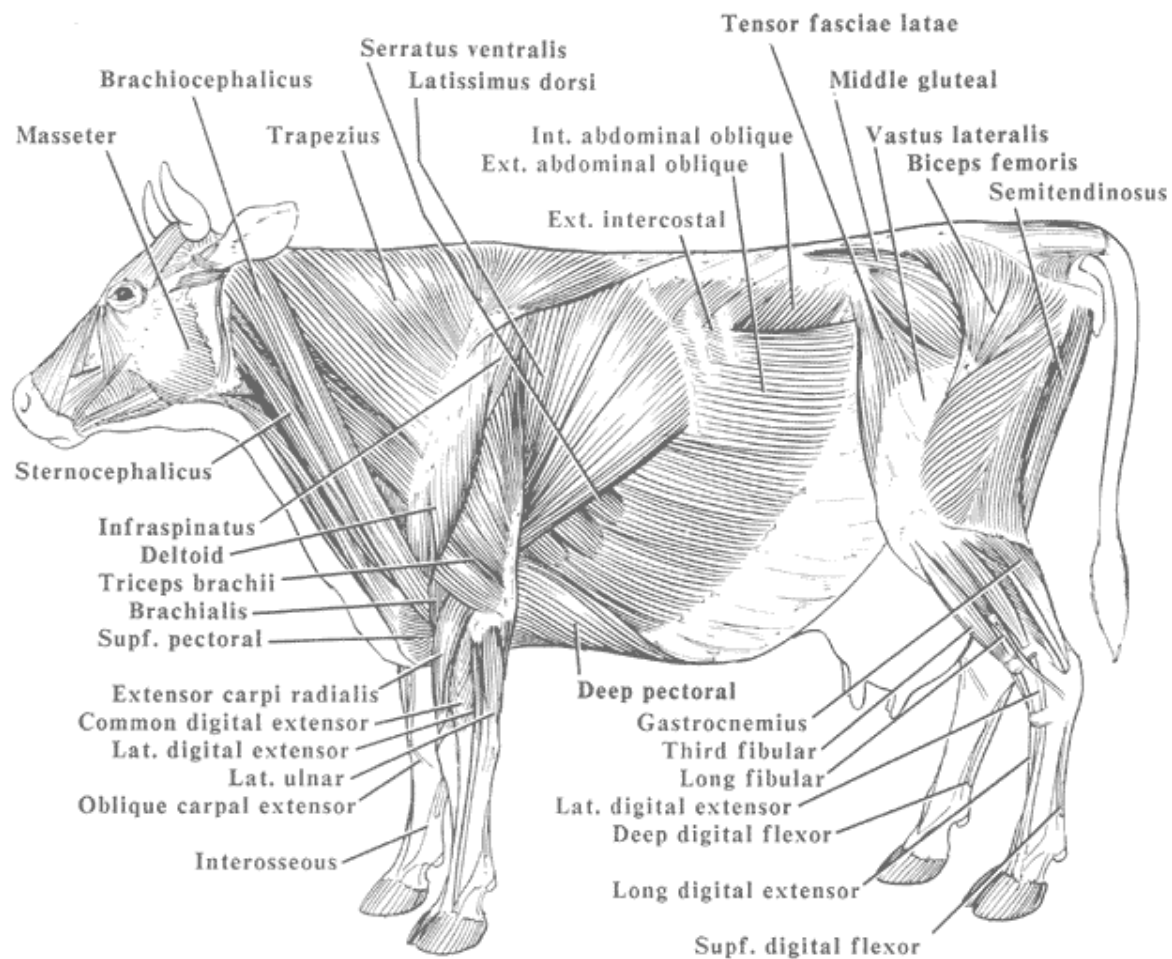


Figure30. Major superficial muscles

1. Main muscles of the head

The muscles of the head control facial expressions, enable chewing or mastication, move sensory structures such as the eyes and ears. Some of them are:

- Muscle of mastication
 - ✚ masseter muscle
 - ✚ Medial and lateral pterygoid muscles
 - ✚ Temporal muscle
- Orbicular muscles of the eye
- Orbicular muscles of the mouth
- Buccinator muscle
- Depressor muscle of the upper lip (is present only in ruminants and pigs)
- Depressor muscle of the lower lip
- Levator muscle of upper lip
- Malar muscle
- Zygomatic muscle

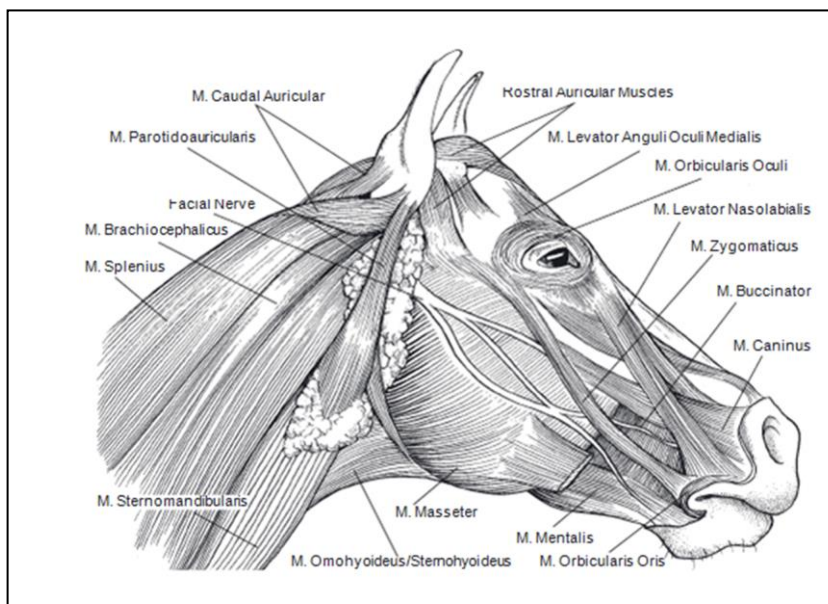


Figure31. Muscles of the head and neck

2. Main muscles of the neck

The muscles of the neck help support the head and allow the neck to flex, extend, and move the head laterally. Some of them are:

- Brachiocephalicus muscle
- Sternocleidomastoid muscle.
- Splenius muscle
- Trapezius muscle
- Omohyoid muscle

3. Dorsal abdominal muscles

- External abdominal oblique muscle
- Internal abdominal oblique muscle
- Transverse abdominal muscle
- The rectus abdominis muscle (straight abdominal muscle)
- Psoas muscle

4. Main muscles of fore limb

- Latissimus dorsi muscle
- Rhomboideus
- Omotransversarius
- Supraspinatus
- Infraspinatus
- Teres major and teres minor
- Trapezius muscle
- Serratus ventralis
- The pectoral muscles
- The deltoid muscle

- Brachium muscle (biceps brachii muscle and triceps brachii): they have opposite actions on the elbow joint. The triceps has three heads while biceps has two heads.
- Extensor carpi radialis muscles
- Deep digital flexor muscles.

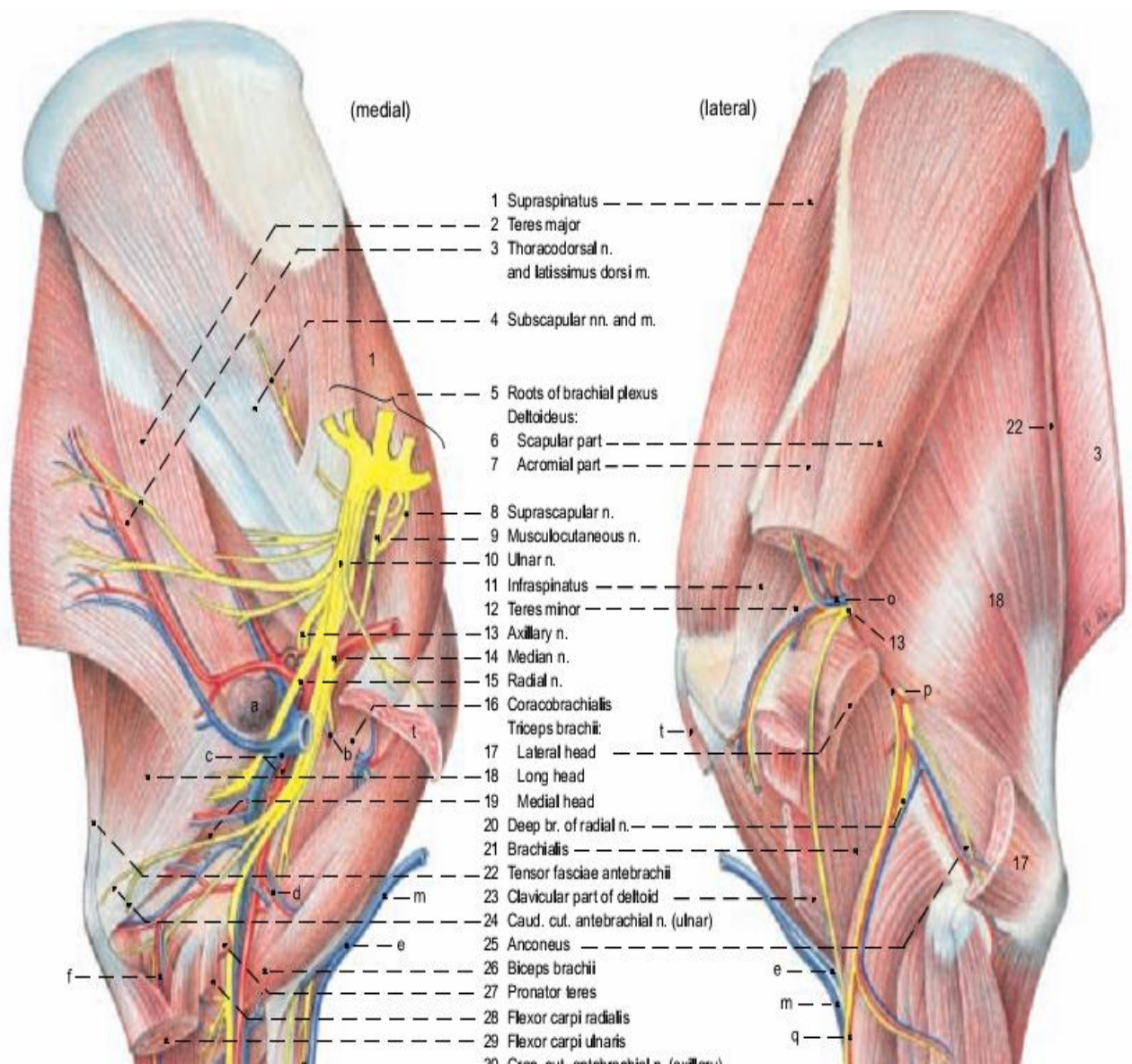


Figure 32. Muscles of fore limbs

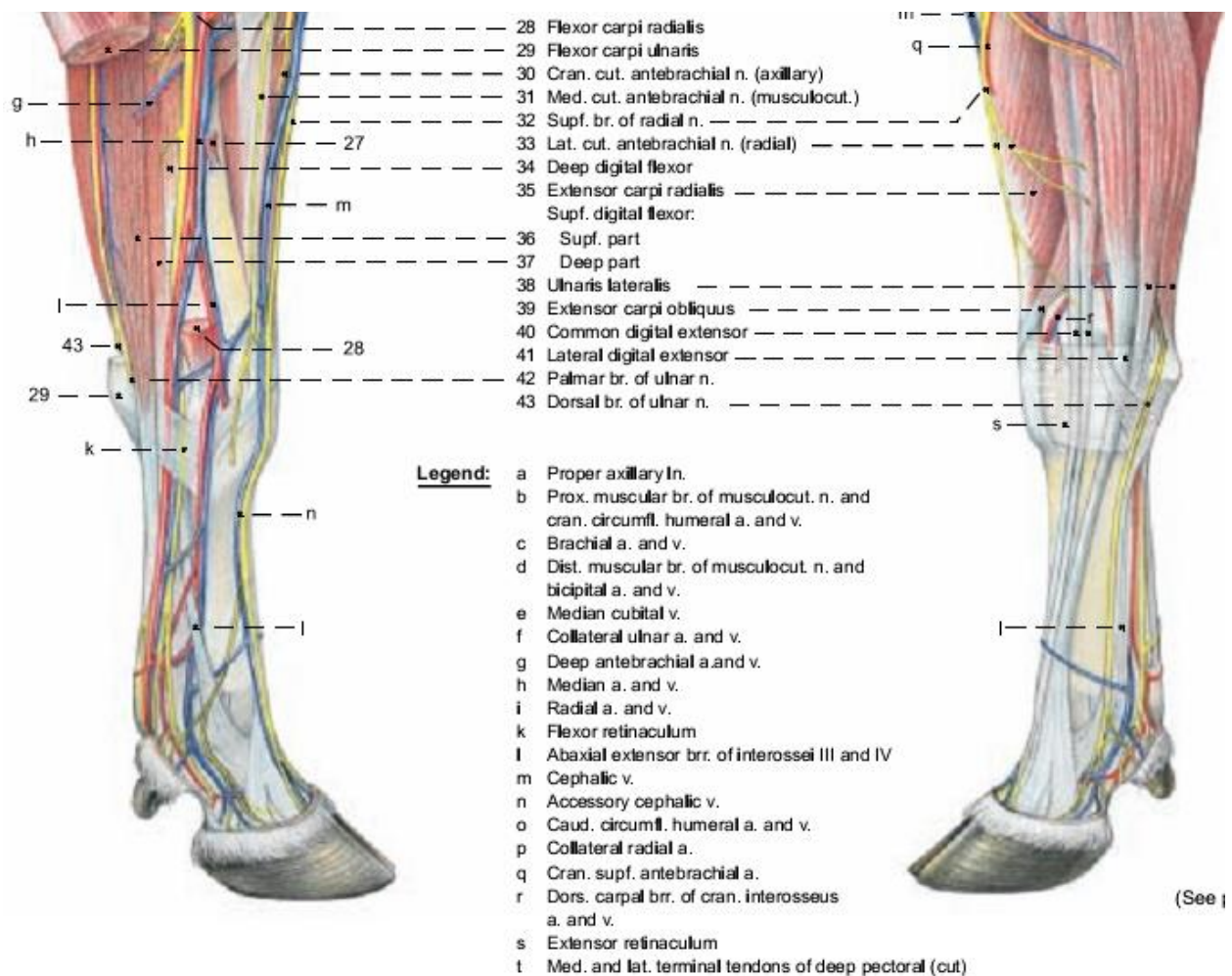


Figure33. Muscles of whole fore limbs

5. Main muscles of the hind limb

- Gluteal muscle
- Hamstring muscle group: Semimembranosus , semitendinosus muscle ,Biceps femoris muscle
- Quadriceps femoris
- Tensor fascia latae
- Gracillis
- Obturator externus
- Popliteus
- Gastrocnemius muscle

6. Main muscles of the thorax

The following list describes the main muscles of the thorax; for more details refer to the figure describing superficial muscles.

- External intercostals muscles
- Cutaneous muscle
- Internal intercostals muscles
- Transverse thoracic muscle
- Longissimus dorsi muscle
- Serratus dorsalis

LO.2.3. Describe integumentary system

- **Topic1. Characterization of the integumentary system for the domestic animals**

The integumentary system is consisting of the skin, hair, nails and exocrine glands. The skin is only a few millimeters thick yet is by far the largest organ in the body. Far from being just a covering to make sure that the body's underlying tissues aren't exposed, the skin serves a number of functions, ranging from helping the body eliminate waste to protecting the body from physical trauma.

1. Definition of terminology:

Integument is an outer protective covering such as the feathers or skin of an animal, a rind or shell.

2. Layers of the skin:

- **Epidermis/cuticle:** The epidermis is the outer layer of skin. The thickness of the epidermis varies in different types of skin.
- **Dermis/cutis or derma**

This is the second layer (underlying the epidermis). The dermis also varies in thickness depending on the location of the skin.

➤ **Hypodermis or subcutaneous tissue**

The subcutaneous tissue is a layer of fat and connective tissue that houses larger blood vessels and nerves. This layer is important in the regulation of temperature of the skin itself and the body. The size of this layer varies throughout the body and from individual to another.

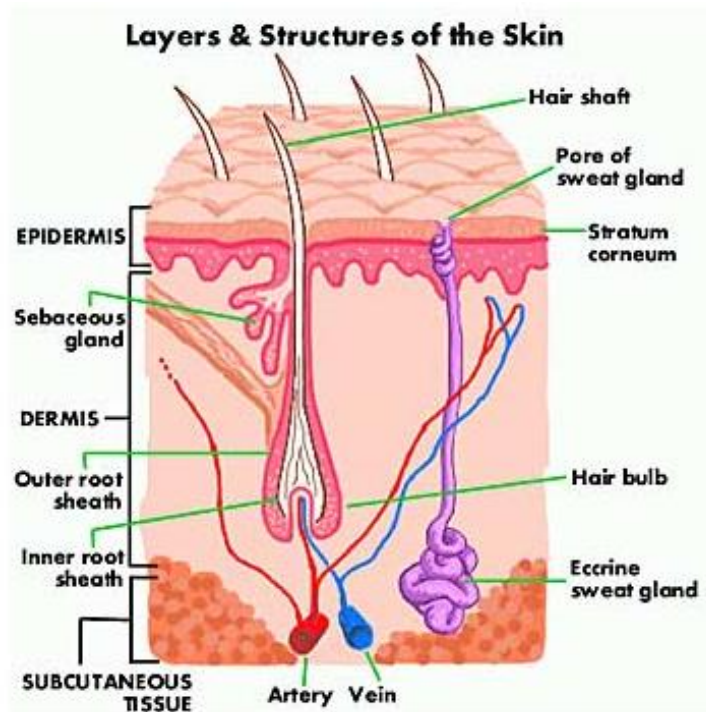


Figure 34. Layers and structure of the skin

3. Related structures of the integument

The integument is made of hair, glands of the skins, Claws and dewclaws, Hooves and horns

- a) **Hair**; it is composed of strong structural protein called keratin. This is the same kind of protein that makes up the nails and the outer layer of skin.

Each strand of hair consists of three layers:

- An innermost layer or medulla which is only present in large thick hairs.
- The middle layer known as the cortex. The cortex provides strength and both the color and the texture of hair.
- The outermost layer is known as the cuticle. The cuticle is thin and colorless and serves as protector of the cortex.

b) Glands of the skin

The skin has two basic types of glands:

- ✚ sweat glands (sudoriferous);
- ✚ oil glands (sebaceous).

c) Claws and dewclaws

Defined as narrow, arched structure that curves downward from the end of a digit in birds, reptiles, many mammals, and some amphibians. It is a hardened (keratinized) modification of the epidermis. Claws may be adapted for scratching, clutching, dig or climbing.

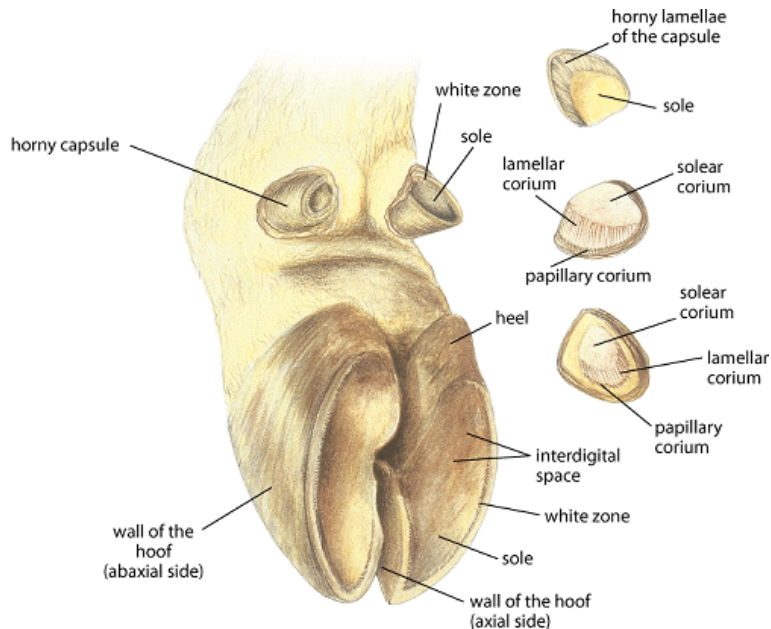


Figure35. Claws and dewclaws

d) Hooves and horns

A hoof is a short, thick structure that surrounds the end of the digit. It is present in various forms in the ungulates, which have a reduced number of digits. Hoofs are an adaptation for running.

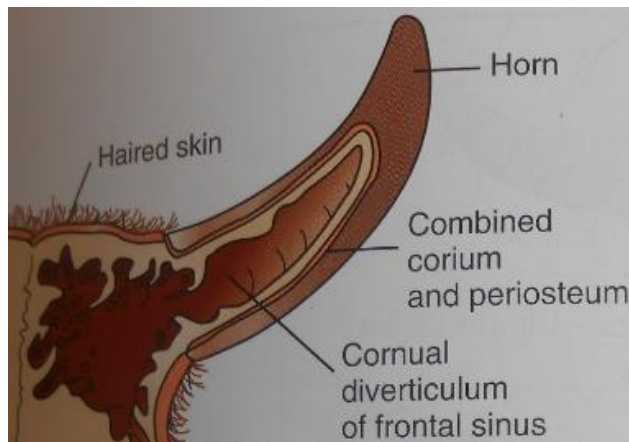


Figure36. Hooves and horns

LO.2.4. Describe circulatory apparatus

Introduction

The cardiovascular system consists of the heart and a system of vessels for distribution of the blood to the tissues of the body and to the lungs for exchange of gases. Whether or not the blood is oxygenated, vessels that carry blood away from the heart are called arteries, and vessels that carry blood toward the heart are called veins. Circulation to the lungs (**pulmonary circulation**) is functionally and anatomically separate from circulation to the rest of the body (**systemic circulation**).

- **Topic1. Structure of heart**

1. Heart

The heart is a cone-shaped hollow muscular structure. The base is directed dorsad or craniodorsad and is attached to other thoracic structures by large arteries, veins, and the pericardial sac.

Pericardium

The heart is partially surrounded by a serous membrane called the **pericardium**. The pericar-

dium, like other serous tissues (the pleura and peritoneum), creates a closed cavity (the **pericardial space**) that contains only a small amount of fluid for lubrication.

The inner layer, which is intimately adherent to the outer surface of the heart, is called **visceral pericardium**, or **epicardium**. The outer layer, called **parietal pericardium**, is continuous with the visceral layer at the base of the heart and is reinforced by a superficial fibrous layer (the **fibrous pericardium**).

Cardiac Anatomy

The heart wall consists of three layers:

- an outer serous covering called **epicardium**,
- an inner endothelial lining called **endocardium**, and
- a thick muscular layer called **myocardium**.

Each side has two chambers: an **atrium**, and a **ventricle**,

The atria are thin-walled chambers, each of which features an appendage called an **auricle**.

The myocardium between the two chambers is the **ventricular septum**. Between the atrium and the ventricle of each side is an **atrioventricular valve**, or **A-V valve**.

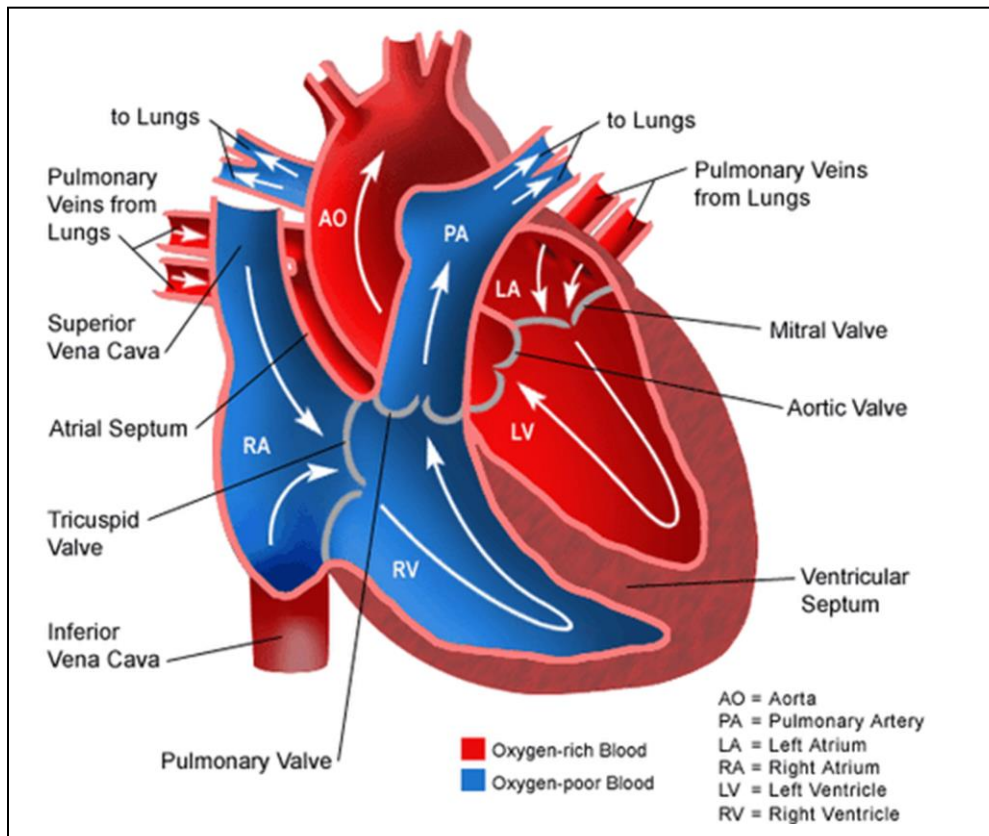


Figure37. Cardiovascular system

- **Topic2. Main blood vessels**

1. Aorta

The aorta continues as the:

- thoracic aorta
- abdominal aorta.
- Brachiocephalic trunk,
- subclavian arteries;
- common carotid arteries,
- bicarotid trunk.

The thoracic aorta is composed as following:

- Intercostals arteries and
- spinal branch

The **abdominal aorta** is called the **abdominal aorta** after it passes through the **aortic hiatus** of the diaphragm then dividing into two **external iliac arteries** (sup-plying the pelvic limbs) and two **internal iliacarteries** (supplying the gluteal and perineal region). Some species have a **median sacralartery**, a small midline continuation of the aorta that continues ventral to caudal vertebrae as the **median caudal artery**.

The abdominal aorta features paired **lumbar arteries** arising from its dorsal side, supplyingthe abdominal wall and epaxial muscles and giving off **spinal branches** that supply thespinal cord and spinal nerve roots of the lumbosacral region. Paired visceral branchesprovide arterial blood to the kidneys (**renal arteries**) and gonads (**testicular** or **ovarian arteries**). Three unpaired visceral branchessupply nearly all the abdominal viscera. Theseare, from cranial to caudal, the **celiac**, **cranial mesenteric**, and **caudal mesenteric arteries**.

The **celiac artery** arises shortly after theaorta passes through the diaphragm. This is a large unpaired artery that supplies the stomach (**left gastric artery**), the spleen (**splenic artery**),and the liver (**hepatic artery**). The exact branch-ing pattern of this artery depends to a greaextent upon the type of stomach; the ruminanthas a much more complex distribution of theceliac artery than do animals with a simple stomach. Immediately caudal to the celiac artery is the **cranial mesenteric artery**. This large, unpaired artery branches into a number of smaller arteries that supply blood to most of the small intestine and much of the large intestine.

2. Veins

With some notable exceptions, veins accompany arteries of the same name. These “satellite”veins are always larger than their respective arteries and frequently duplicated.

Cranial Vena Cava

The cranial vena cava drains the head, neck, thoracic limbs, and part of the thorax.

This has branches and sub-branches as following:

- Jugular veins (internal and external),
- subclavian veins, and vertebral veins.
- Caudal Vena Cava

The caudal vena cava is formed in the abdomen by the junction of the paired **internal** and *external iliac veins*. The caudal vena cava also receives lumbar veins, testicular or ovarian veins, renal veins, and various others from structures associated with the body walls. It receives a number of short hepatic veins directly from the liver.

Portal System

A portal system is one in which a vessel divides into capillaries, recombines to form another vessel, and then redivides into a second capillary bed. In the hepatic portal system, blood that has perfused the capillary beds of the viscera is brought to the liver by a single large vein, the **portal vein**, and then is redistributed into a second capillary bed within the substance of the liver. Tributaries to the portal vein include the gastric vein from the stomach, the splenic vein from the spleen, the mesenteric veins from the intestines, and the **pancreatic veins** from the pancreas. The portal vein enters the liver and immediately breaks up into smaller and smaller branches there, finally ending in the sinusoids of the liver.

- **Topic3. Lymphatic vessels and blood composition**

1. Lymphatic vessels

The lymphatic system is part of the circulatory system, comprising a network of lymphatic vessels that carry a clear fluid called lymph (from **Latin** *lympa* meaning *water*)) directionally towards the heart.

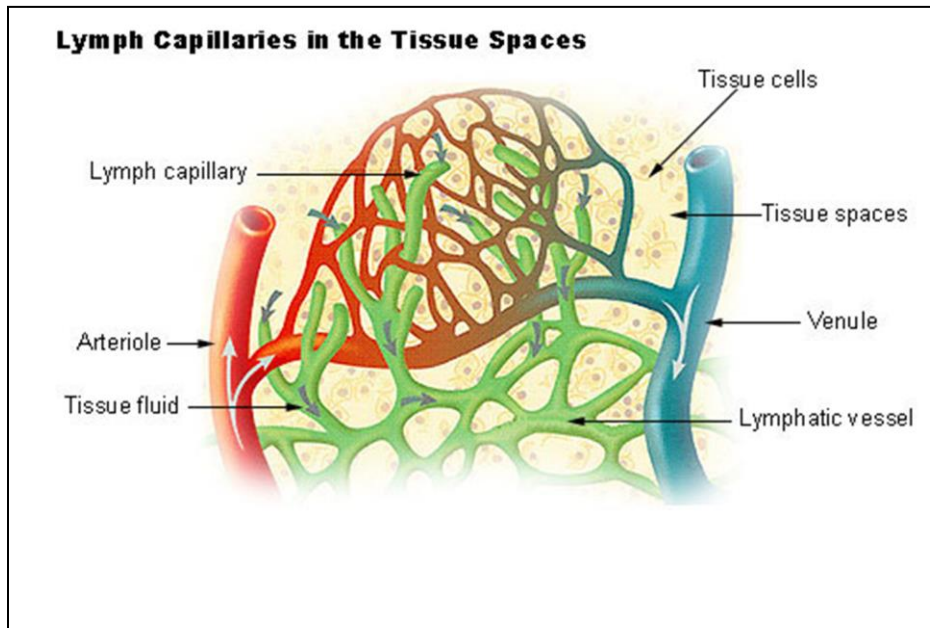


Figure38. Lymph capillaries in the tissue spaces

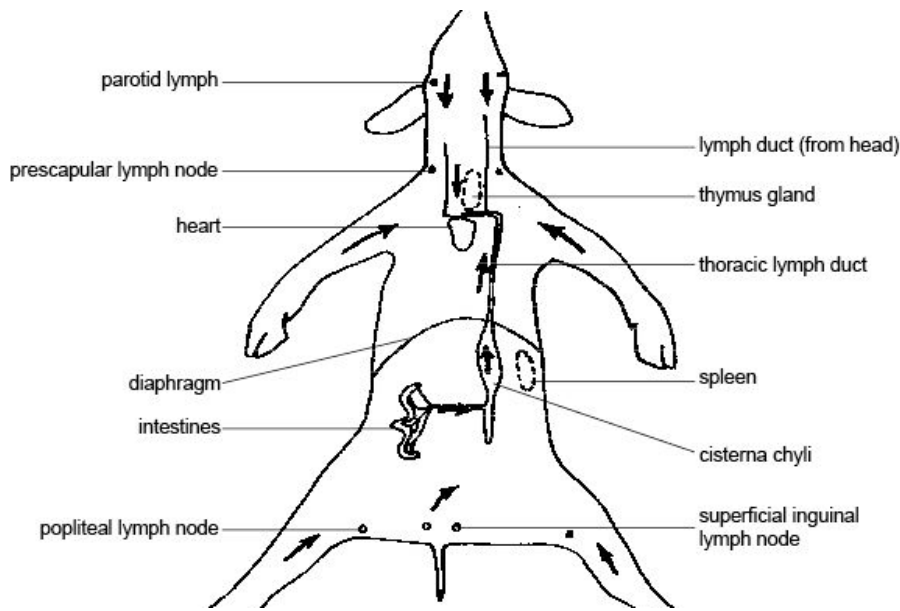


Figure39. The lymphatic system

Lymph is the fluid that circulates throughout the lymphatic system. The lymph is formed when the interstitial fluid (the fluid which lies in the interstices of all body tissues) is collected through lymph capillaries. It is then transported through lymph vessels to lymph nodes before emptying ultimately into the right or the left subclavian vein, where it mixes back with blood.

Since the lymph is derived from the interstitial fluid, its composition continually changes as the blood and the surrounding cells continually exchange substances with the interstitial fluid.

Lymph has a composition comparable to that of blood plasma, but it may differ slightly. Lymph contains white blood cells. In particular the lymph that leaves a lymph node is richer in lymphocytes. Likewise, the lymph formed in the digestive system called chyle is rich in triglycerides (fat), and looks milky white.

Lymph nodes

Lymph Node Structure

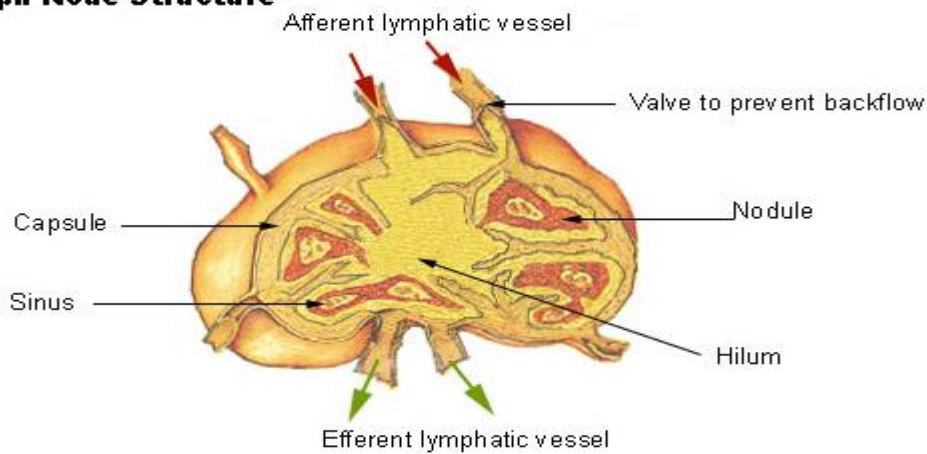


Figure40. Lymph node structure

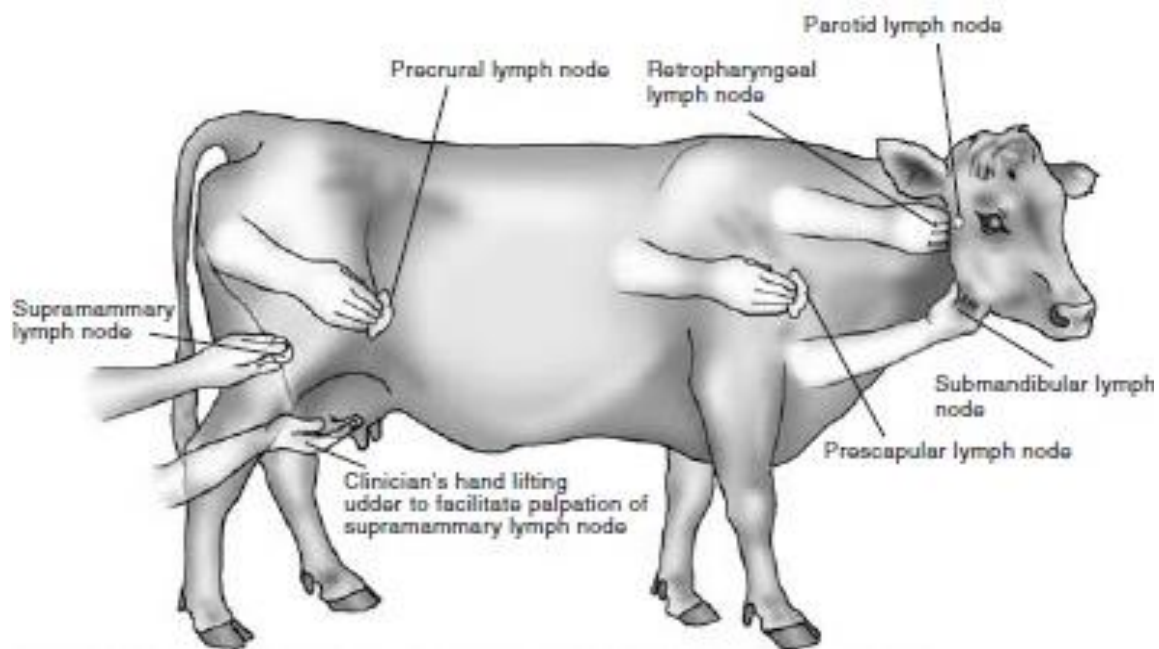


Fig41a. External lymph nodes in cattle

Visceral lymph node

A small oval **nodular** gland that filters lymph circulating in the lymphatic vessels of the thoracic, **abdominal**, and pelvic viscera. The **visceral lymph nodes** of the thorax include the anterior

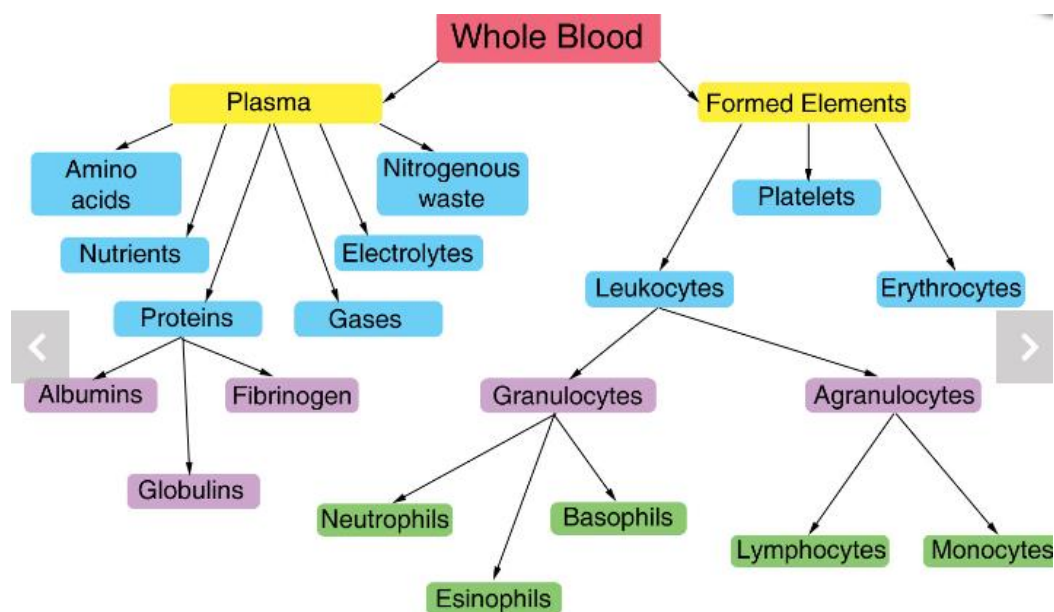
mediastinal nodes, posterior mediastinal nodes, and tracheobronchial nodes. The visceral lymph nodes of the abdomen and pelvis include those that follow the course of the celiac artery, superior mesenteric artery, and inferior mesenteric artery.

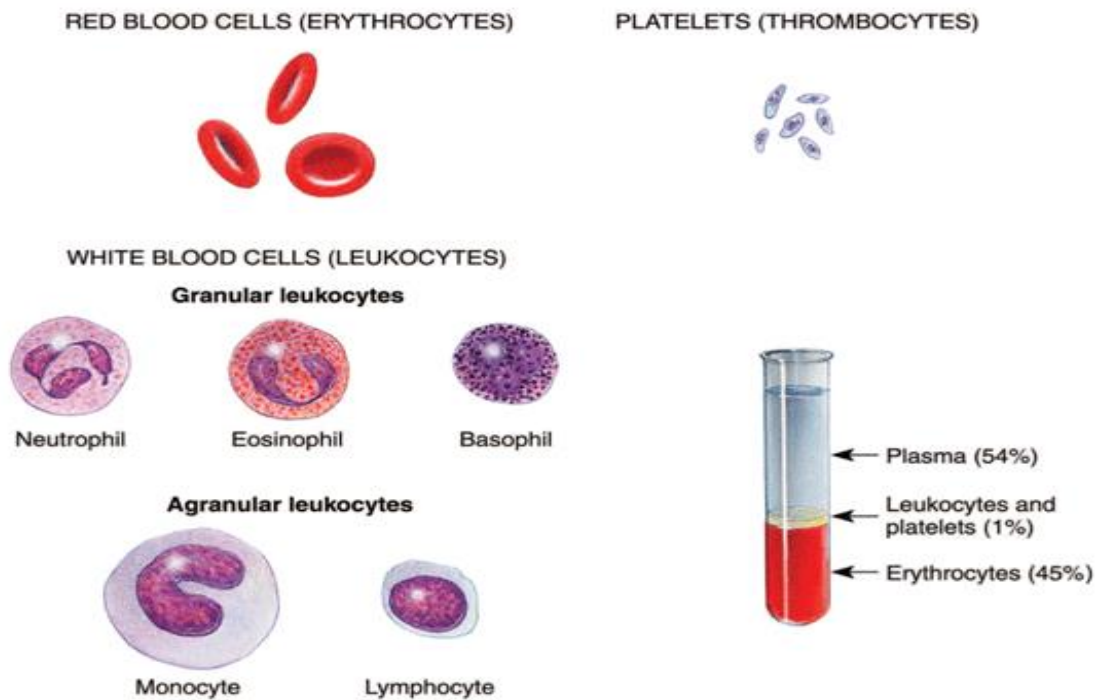
2. Blood composition

It has four main components:

- Plasma
- Red blood cells
- White blood cells
- Platelets.

Blood has many different functions: transporting oxygen and nutrients to the lungs and tissues.





- **Topic4. Synovial fluid and cerebrospinal fluid**

Fluids in the body are distributed in two compartments:

- The intracellular fluid (ICF) volume
- The extracellular fluid (ECF) volume.

The ECF is composed of interstitial fluid, plasma, lymph, and transcellular fluids such as synovial, pleural, abdominal, and cerebrospinal fluids.

1. Synovial fluid

Synovial fluid also called synovia, is a viscous, non-Newtonian fluid found in the cavities of synovial joints. With its egg white like consistency, the principle role of synovial fluid is to reduce friction between the articular cartilage of snovial during movement.

2. Cerebrospinal fluid

Cerebrospinal fluid (CSF) is a clear, colorless body fluid found in the brain and spinal cord. It is produced by specialised ependymal cells in the choroid plexuses of the ventricles of the brain, and absorbed in the arachnoid granulations.

CSF assists the brain by providing protection, nourishment, and waste removal. **CSF** provides hydromechanical protection of the neuraxis.

CSF production

- CSF is the 3rd major fluid of the body after blood and urine.
- CSF is produced at the Choroid plexus of the 4 ventricles by modified Ependymal cells.
- CSF produced in choroid plexuses of lateral, third and fourth ventricles and eliminated by being absorbed into the arachnoid villi -->dural sinus --> jugular system
- The CSF flows through the Subarachnoid space where the appropriate volume of the fluid is maintained (adults)
- The CSF is then Reabsorbed at the Arachnoid villus / granulation and is eventually reabsorbed into the blood
- Other sources of CSF production from capillary ultrafiltrate (Virchow-Robin spaces)
- Additionally some produced from metabolic H₂O production

CSF function

There are 3 major functions of CSF. It

- Supplies nutrients to nervous tissues
- Removes metabolic wastes
- Protects / cushions against trauma

Appearance

- CSF is Normally Crystal clear, colorless
- When its transparency is not clear. Appropriate descriptive Terms include: hazy, cloudy, turbid, milky, bloody,
- Unclear specimens CSF specimens may contain increased lipids, proteins, cells or bacteria.
- **Topic5. Spleen and its functions and main endocrine glands**

1. Spleen and its functions

The spleen is an organ in the upper far left part of the abdomen, to the left of the stomach. The spleen varies in size and shape between animals, but it is commonly fist-shaped, purple. The spleen plays multiple supporting roles in the body. It acts as a filter for a blood as part of the immune system. Old red blood cells are recycled in the spleen, and platelets and white blood cells are stored there. The spleen also helps fight certain kinds of bacteria that cause pneumonia.

2. Main endocrine glands

The endocrine system is a chemical messenger system comprising feedback loops of the hormones released by internal glands of an organism directly into the circulatory system, regulating distant target organs. While many parts of the body make hormones, the major glands that make up the endocrine system are the:

- Hypothalamus
- Pituitary
- Thyroid
- Parathyroids
- Adrenals
- Pineal body
- Ovaries
- Testes

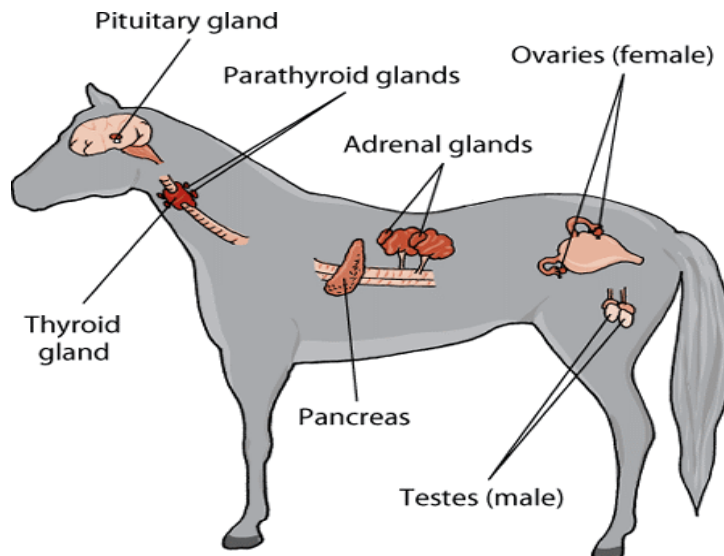


Figure41b. Glands in domestic horse

LO.2.5.Describe respiratory apparatus

- **Topic1. Main parts and structure of respiratory System**

The lungs are the main organs for respiration and the other organs are the nose, pharynx, larynx, trachea and bronchi collectively known as the respiratory passages.

1. Structure of upper respiratory tract

The upper portion of the respiratory tract includes the nose, the pharynx (throat), the larynx and the trachea.

a. Nose/ nasal cavity

Is the first part of the respiratory passages and comprise of the external nose, the paired nasal cavities, paranasal sinuses and the nasopharynx. Internally, it is divided into 2 cavities called the nasal vestibules. The external nose is supported by alar cartilage such that the variation in the shape of the nose in domestic animals is due to the form and size of the cartilage.

b. The larynx

Is an elongated musculo- cartilaginous structure that forms the connection between the pharynx and the trachea. It is located below the pharynx and behind the mouth.

Cavity of the larynx

Extends from the entrance of the larynx to the caudal border of cricoid cartilage. The entrance is bounded ventrally by the epiglottis, laterally by the lateral folds and dorsocaudally by the arytenoid cartilages. It is divided into 3 parts namely the vestibule(space in front of the rimaglottidis), the rimaglottidis (space between the vocal folds) and the caudal compartment.

c. The pharynx

As describe in the digestive system, it is a passage located behind the mouth and continues into the esophagus. The dorsal part is formed by the base of the skull and 1st few cervical vertebrae, the ventral part is formed by the larynx while the pterygoid muscles, the mandible and the dorsal part of the hyoid bone form the lateral parts. The pharynx is common to both the respiratory system (**nasopharynx**) and the digestive system (**oropharynx**).

d. The trachea

Is an elastic tube that extends from the larynx to the down through the neck region into the thorax, where it divides into two main bronchi that enter the lungs. It is composed of an outer fibrous tissue, incomplete cartilaginous rings, submucosa and mucosa. The muscle of the trachea is called the trachealis muscle and is attached dorsal to the cartilage rings.

2. Structure of lower respiratory tract

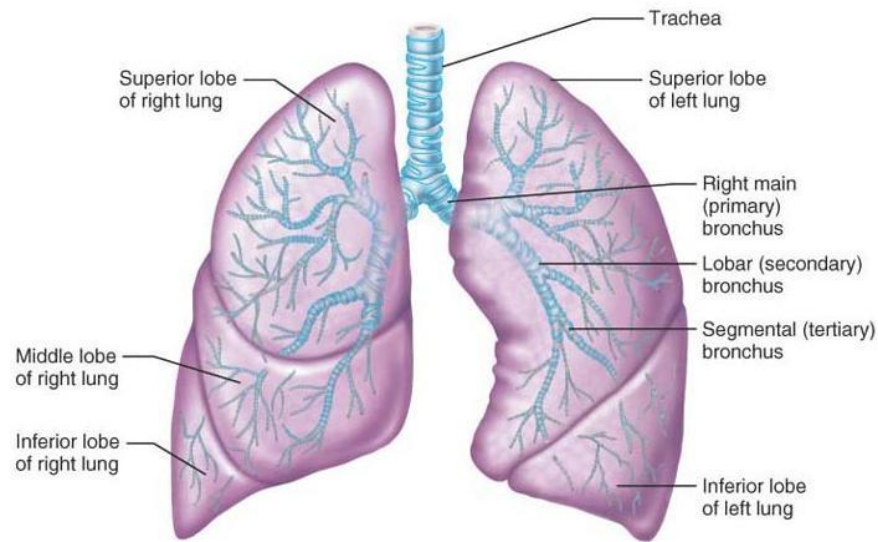


Figure 45. Structure of lower respiratory tract

The lower respiratory tract starts with bronchi, ends with the alveoli, and includes all the air passageways in between. Except for the two main bronchi that are formed by the bifurcation of the trachea, all the structures of the lower portion of the respiratory tract are located within the lungs.

Bronchial tree

It is the air passageways that lead from the bronchi to the alveoli. They enter the lung and each main bronchus divides into smaller bronchi, which divide into even smaller bronchi and finally into tiny bronchioles. The bronchioles continue to subdivide down to the smallest air passageway called alveolar ducts. The alveolar ducts end in a group of alveoli called alveolar sacs.

Alveoli

The alveoli are tiny, thin-walled sacs that are surrounded by networks of capillaries. Each alveolus is lined with a thin layer of fluid that contains a substance called surfactant.

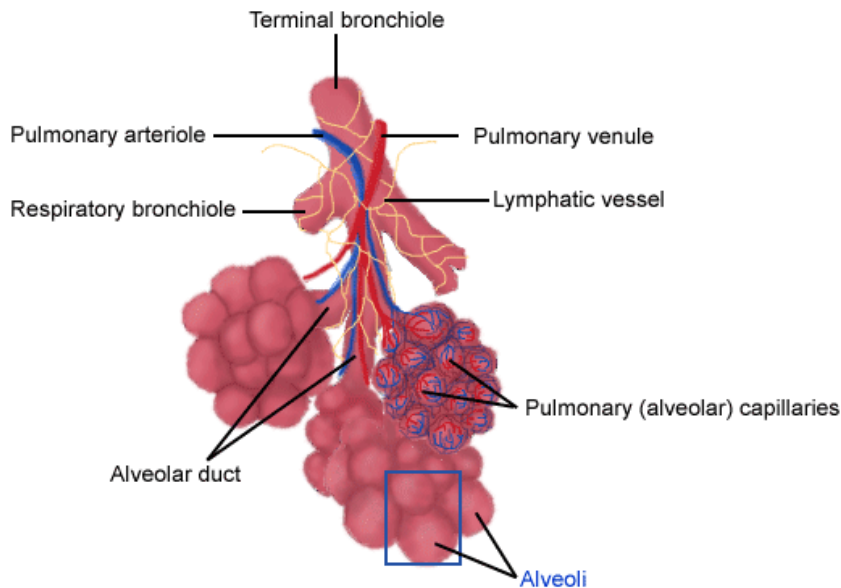


Figure 46. Structure of alveoli and alveolar sac.

3. Structure of the lungs

The lungs are the main organs of respiration and they occupy much of the thoracic cavity.

They are 2 lungs (right and left) which are separated by mediastinum. The right lung is larger than the left.

The lung is conical in shape and is divided into lobes by fissures and has:

- 2 surfaces (costal and visceral),
- 2 borders (dorsal and ventral),
- A base and an apex.

The cardiac notches are spaces on the lungs where the heart fits.

The right lung has 4 lobes namely the: cranial, middle, caudal and accessory lobes.

The left lung has 3 lobes: cranial, middle and caudal lobes.

Pleura

The pleura are a thin transparent serous membrane which encloses the lungs. It also lines the internal surface of the thoracic cavity.

- 2 pleural membranes are present each forming a sac.
- Each sac comprises of a parietal part and a visceral part.
- Parietal pleura assume different names depending on the region as: costal pleura, diaphragmatic pleura and mediastinal pleura.
- Visceral pleura/pulmonary pleura cover the surface of the lung.

Mediastinum

Mediastinum is the area between the right and left pleural sacs. It extends from the thoracic inlet to the diaphragm.

It's divided into:

- **The cranial mediastinum:** it is a space in front of heart that contains esophagus, blood vessels, lymph nodes, vagus nerve, phrenic nerve, thymus (in young).
- **Middle mediastinum:**(space occupied by heart) that contains the heart, origin of great blood vessels, esophagus, tracheal bifurcation, vagus, phrenic nerves.
- **The caudal mediastinum:**(space caudal to the heart) that contains the abdominal aorta, vena cava, esophagus, vagus and phrenic nerve.

- **Topic2. Particularities of poultry respiratory system**

The avian respiratory system is involved in the following functions:

- Absorption of oxygen (O₂)

- Release of carbon dioxide (CO₂)
- Release of heat (temperature regulation)
- Detoxification of certain chemicals
- Rapid adjustments of acid/base balance
- Vocalization

An understanding of the functions of the respiratory system begins with an understanding of the parts of the respiratory system.

Parts of the chicken respiratory system

As with any avian respiratory system, the chicken respiratory system begins at the head region. Parts of the respiratory system in this region include the nasal openings and nasal cavities and the pharyngeal region of the mouth. The **cranial larynx** (sometimes referred to as the **superior larynx** or **glottis**), located in this pharyngeal region, is the opening to the **trachea** (windpipe). The pharyngeal region also has the openings of the esophagus. The cranial larynx is normally open to allow air passage, but it closes when feed is passing down the throat so that the feed goes down the esophagus and does not enter the trachea.

After air passes through the cranial larynx, it continues through the trachea. The trachea is made up of cartilaginous rings that keep it from collapsing due to the negative pressure present when a chicken breathes in air.

After the syrinx, the trachea divides into two much narrower tubes called **bronchi**. In some respiratory diseases, tracheal plugs form and physically block the respiratory tract at the junction of the bronchi, thus suffocating the chicken.

Each bronchus (singular of *bronchi*) enters a **lung**. Chicken lungs are relatively small, are firmly attached to the ribs, and do not expand. Birds have an incomplete diaphragm and chest muscles and a sternum (keel) that do not lend themselves to expansion in the way that a mammal's chest muscles and sternum do. Consequently, a bird's lungs operate differently from those of a mammal. Mammalian lungs contain many bronchi that lead to small sacs called alveoli. Because an alveolus (singular of *alveoli*) has only one opening, air flows into and out of the alveolus but not through it to the outside of the lung. In comparison, air passes through a bird's lungs in one direction. (In fact, the mammalian respiratory system is described as tidal because air goes in and out like the tide, whereas the avian respiratory system is described as nontidal.)

LO.2.6. Describe urogenital apparatus

- **Topic1. Description of main parts and structure of urinary system**

1. The urinary system

The urinary system is made up of:

- two kidneys
- two ureters
- Urinary bladder
- Urethra

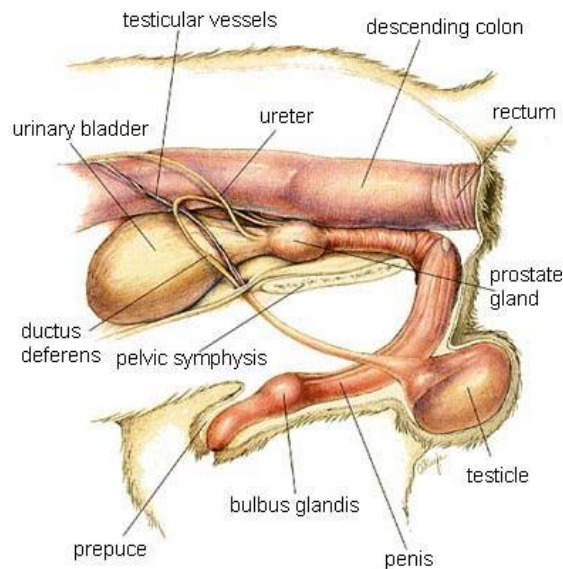


Figure47. Urinary system

Kidneys

The kidneys are bean –shaped in most animals and recovered

In cattle It is a lobulated kidneys divided into about 12 lobes that give it a lumpy appearance.

General shape elongated from to rear: 600 to 700gr., 22x12x5cm.

Strongly asymmetrical: the right is lighter, earlier, more fixed, and flatter than the left.

Right kidney flattened dorso-ventrally flat against the roof sublumbar in T13, L1, L2, L3.

Left kidney, twisted upon itself, floating beneath L3, L4, L5, but pushed right through the plane left the bag in the rumen. Bassinet very diverticulum: 15 to 20 cups styling thirty buds.

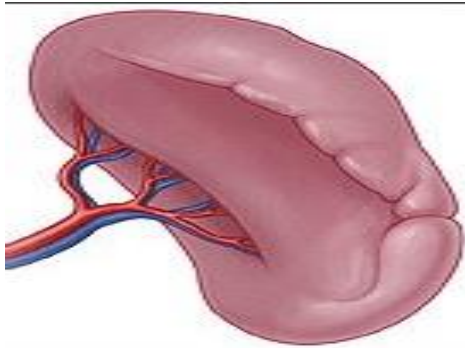


Figure48. Kidney in general



Figure49. Kidney of cattle

The urinary tract is made of kidney, Urethra, Urinary bladder, Ureter.

2. Structure of urinary system

We can consider the following image below to see the structure of urinary system

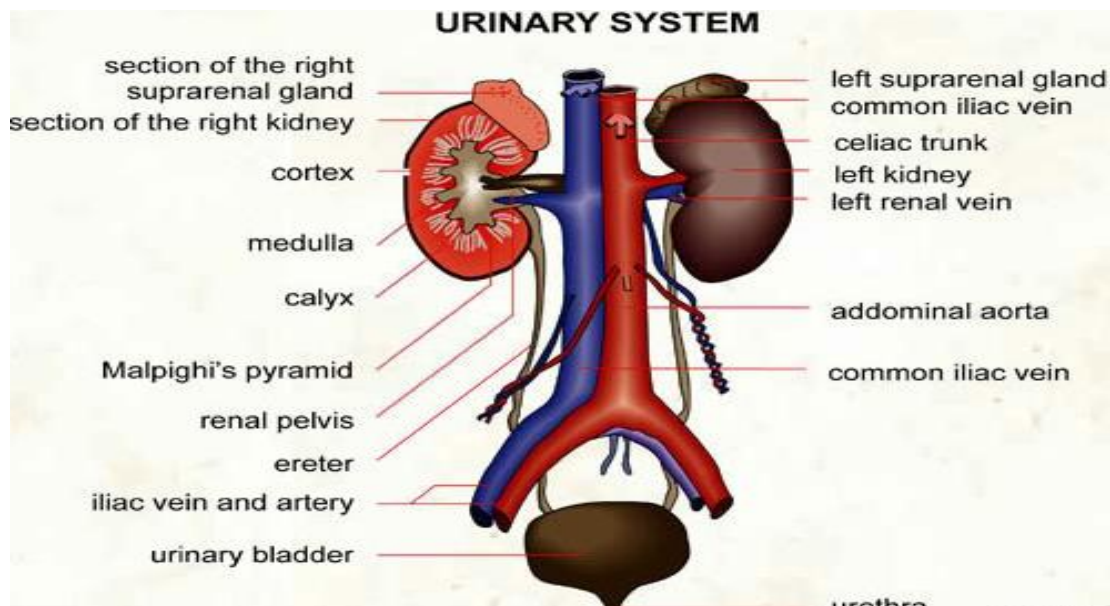


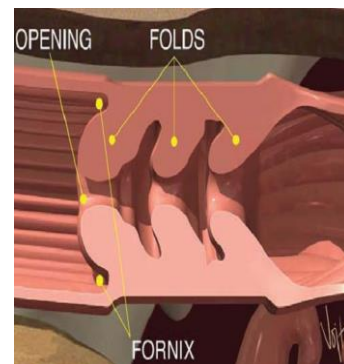
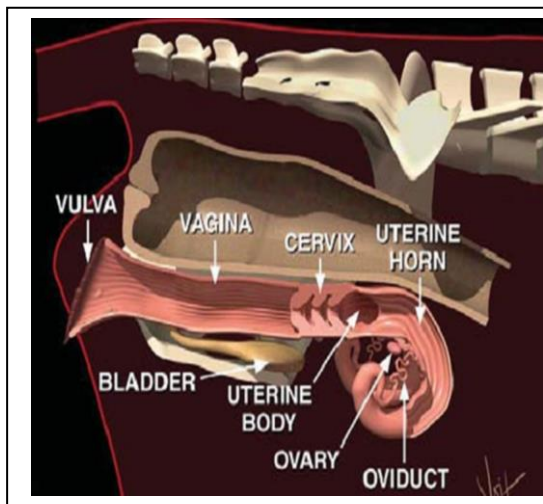
Figure50. Conformation of the bladder

- **Topic2. Identification of main parts of genital system**

1.1. Description of the urogenital apparatus for mammals and birds

The reproductive system in mammals is composed of:

- two ovaries,
- two oviducts,
- two uterine horns,
- a uterine body,
- cervix, vagina and vulva



Figures 51 and 52. Reproductive system of the female

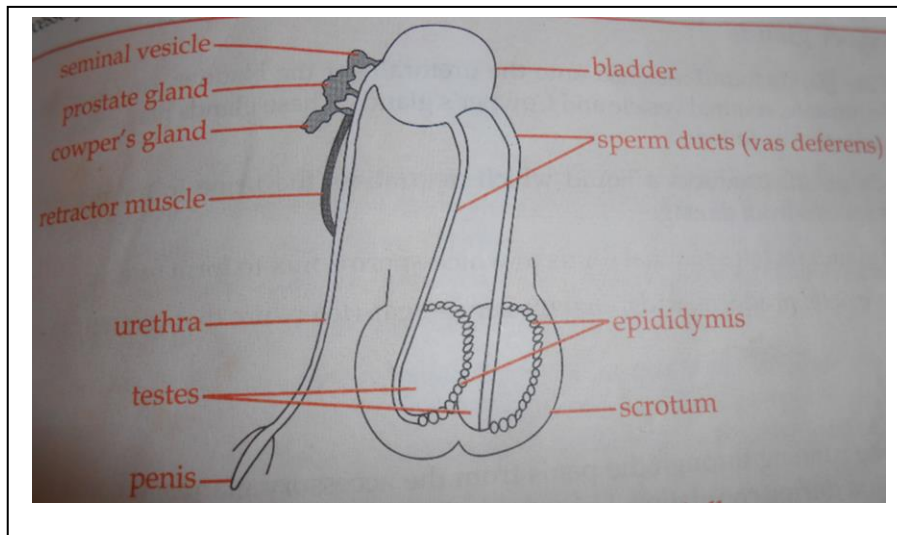


Figure53. Reproductive system of the male

1.2. Structure of the mammary glands

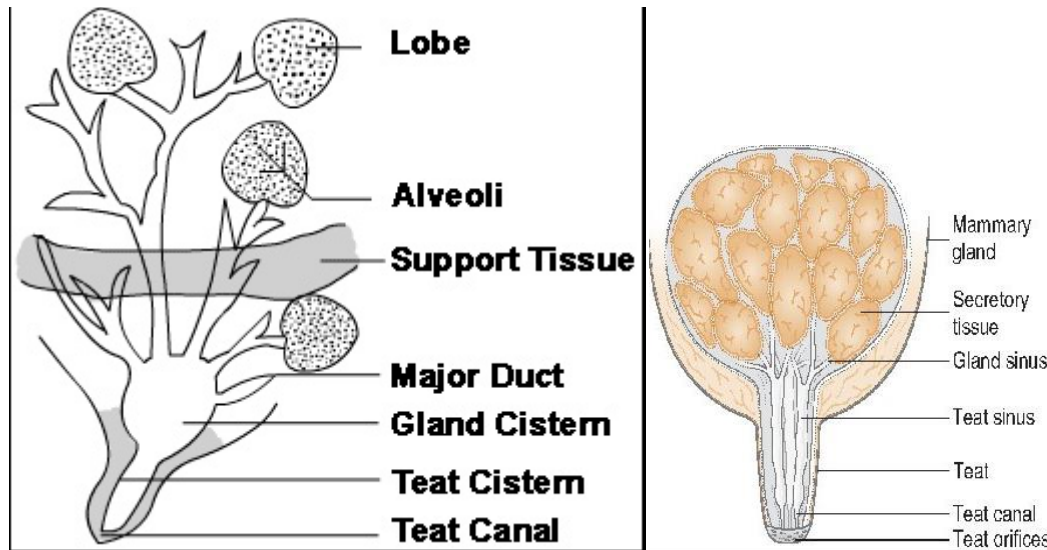


Figure 54. Internal structure of the mammary gland in cattle

- **Topic 3. Particularities of urogenital apparatus for poultry**

a) Male reproductive system

Example: The reproductive system of the gander consists of 3 distinct parts:

- ✚ The testicles: There are two bean-shaped testicles inside the body cavity which produce both spermatozoa and male hormones. They are highly vascularised and change in size and position according to whether the gander is sexually active or not.
- ✚ The vas deferens: These (there are two) follow the urethras and transport the spermatozoa from the testicles and the epididymis to the copulatory organ (penis). Vas deferens of gander have length of 15 cm up to 30cm. The vas deferens are the location of spermatozoa maturation and storage. They terminate at the seminal vesicles located in the cloaca wall.
- ✚ The copulative organ: Contrary to the rooster, the copulatory organ of the gander is well developed. It is invaginated, spiral-like and is about 15cm in length.

b) Female reproductive system

Example: The reproductive system of the goose

Like most other birds, the female possesses a unique reproductive system located on the left side of its abdomen. The functions of the reproductive system are to produce, fertilise and mature the oocyte. Once copulation or insemination has taken a place, **the oviduct** plays a role

in spermatozoa storage when a mature oocyte is released on an ovulated yolk, it is picked up by **the infundibulum** where fertilization occurs. The egg white or albumen is then secreted primarily in **the magnum**. The egg then moves to **the isthmus** where the shell membranes are formed. In **the uterus** or **shell gland**, water and thin albumen are added and the shell is formed. **The vagina** has a muscular component that helps to expel the egg through **the cloaca**.

LO.2.6. Describe digestive system

- **Topic1. Structure and main parts of the digestive system**

Digestive system is also called alimentary tract or gastrointestinal tract. It extends from the mouth to the anus and it comprises of the:

- mouth, tongue,
- salivary glands, teeth,
- lips, cheeks, gums,
- pharynx, esophagus,
- stomach, small intestines,
- large intestines, pancreas and
- liver

1. Mouth

It comprises of the **vestibule** and the **oral cavity proper** as well as the accessory structures such as **teeth, tongue** and the **salivary glands**.

2. Tongue/ linguae

The tongue consists of a free **apex**, a **body** and an attached **root**. The root is attached to the hyoid bone and the mandible.

Generally the shape of the tongue corresponds to the shape of the oral cavity

a. Extrinsic tongue muscles

Generally 4 pairs exist:

- ✚ **Geniohyoideus muscle**- runs from the incisive part of the mandible to the body of the hyoid bone. It is located below the tongue.
- ✚ **Genioglossus muscle**- Has a dorsal origin.
- ✚ **Hyoglossus muscle**- Arises from the basihyoid bone of the hyoid apparatus.
- ✚ **Styloglossus muscle**- Arises from the stylohyoid bone of the hyoid apparatus

b. Intrinsic muscle

Is in the form of bundles that run longitudinally, transversely and vertically.

Blood supply is dependind on the lingual branch of the linguofacial artery

c. Innervation of the tongue

Is complex and three nerves are involved:

- ✚ The lingual branch of the mandibular.
- ✚ The glossopharyngeal nerve (CN IX) provides innervation to the caudal 1/3 of the tongue.

Is a passage located behind the mouth and continues into the esophagus. The dorsal part is formed by the base of the skull and 1st few cervical vertebrae, the ventral part is formed by the larynx while the pterygoid muscles, the mandible and the dorsal part of the hyoid bone form the lateral parts.

3. The pharynx

The pharynx is common to both the respiratory system (**nasopharynx**) and the digestive system (**oropharynx**)

a. Nasopharynx

Is the dorsal part of the pharynx which is located above the soft palate. It communicates with the cavities of the middle ear through the auditory / **eustachian tubes**. It has a respiratory function.

b. Oropharynx

Is the ventral part of the pharynx that is located between the soft palate and the root of the tongue. It has a digestive function.

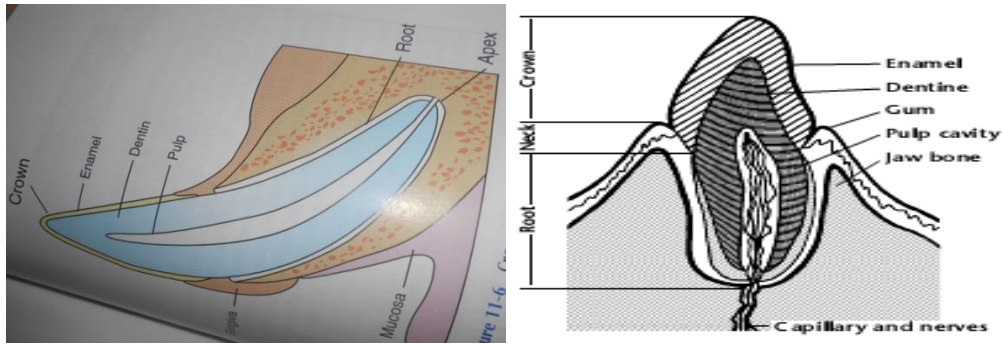
c. Laryngopharynx

Is considered as the 3rd component of the pharynx and is located dorsal to the larynx

4. Teeth

Teeth are part of the masticatory apparatus, located in the alveolar sockets of upper and lower jaws. Five main parts exist:

- Enamel is the exposed portion of a tooth which is covered by a hard material. Also called crown or body of tooth.
- Root is the part which is located deep in the alveolar socket. It is covered by a yellowish material called cement.
- Neck is the junction between the crown and the root
- The bulk of the tooth is formed by dentin.
- Pulp cavity is central canal within the dentin



Figures 55 and 56. Teeth

Classification of teeth

According to the location in the oral cavity as:

- Incisors- located on the front.
- Canines
- Premolars
- Molars
- Molars and premolars are also called cheek teeth.

Table2. Dentition formulation in different species:

Nr	Dog	Cattle	horse	Pig
Incisors	3/3	0/4	3/3	3/3
Canines	1/1	0/0	1/1	1/1
Pre-molars	4/4	4/4	4(3)/3	4/4
Molars	2/3	3/3	3/3	3/3
Total	42	32	40 or 41	44

NB: Diastema is a space between 2 teeth. Also called interdental space

a. The esophagus

It is a muscular tube which extends from the mouth to the stomach and it is divided into the:

- cervical.
- Thoracic and abdominal parts (very short).

The structure of the esophagus consists of an outer coat (serosa), a muscular layer which is striated muscle at the origin. In the cat, pig, and horse it becomes smooth muscle in the thorax and abdomen. There is a sphincter between esophagus and stomach: cardia

5. The stomach

5.1. The monogastric stomach

It is also called the ventriculus and is located between the esophagus and the small intestine. It is divisible into the cardia, body, fundus and pyloric parts. The surface of the stomach with a greater area is called the greater curvature while the one with a small area is called the lesser curvature.

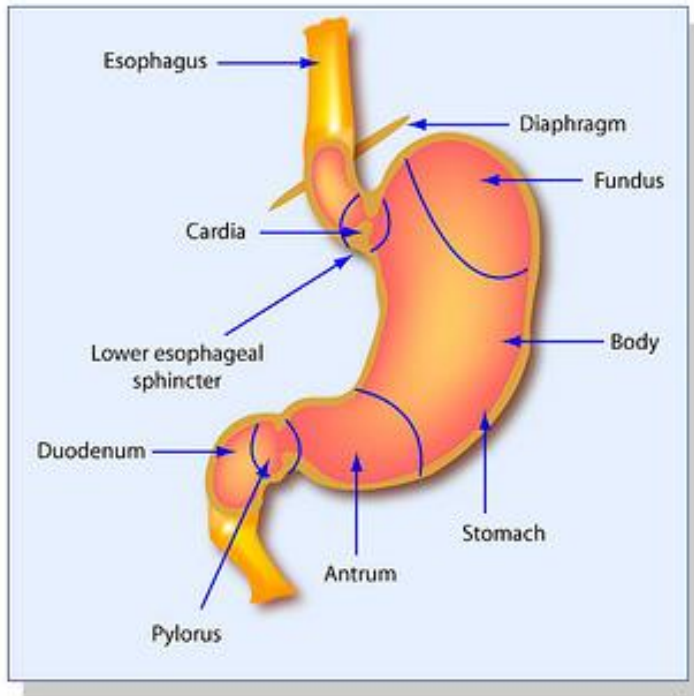


Figure57. Monogastric stomach

The cranial part of the stomach

The caudal part is related to the intestines, left kidney, pancreas and the greater omentum. The spleen is attached to the greater curvature of the stomach.

Blood supply- is from the celiac artery and is mainly concentrated along the greater and lesser curvatures.

Small intestines

The small intestine is divided into:

➤ Duodenum — Mesoduodenum

- ✚ cranial flexure
- ✚ Descending duodenum
- ✚ Caudal flexure
- ✚ Ascending duodenum

✚ duodenal-jejunal flexure

- Jejunum — mesojejunummesentery
- Ileum — mesoileum characterized by the antimesenteric vessel; ileocecal fold with ileal (ileocolic) orifice

Large Intestines

- **Cecum** (blind end; no appendix) with the following parts:
 - ✚ cecocolic orifice;
 - ✚ ileocecal fold
 - ✚ ileal (ileocolic) orifice
- **Colon** — mesocolon with the following regions:
 - ✚ ascending colon
 - ✚ right colic flexure
 - ✚ transverse colon
 - ✚ left colic flexure
 - ✚ descending colon
- **Rectum** — mesorectum
- **Anal canal** (retroperitoneal) divided into following parts:
 - ✚ anus = external opening
 - ✚ sphincters :
 - ✓ internal anal sphincter (smooth m.), and
 - ✓ external anal sphincter (striated muscle)

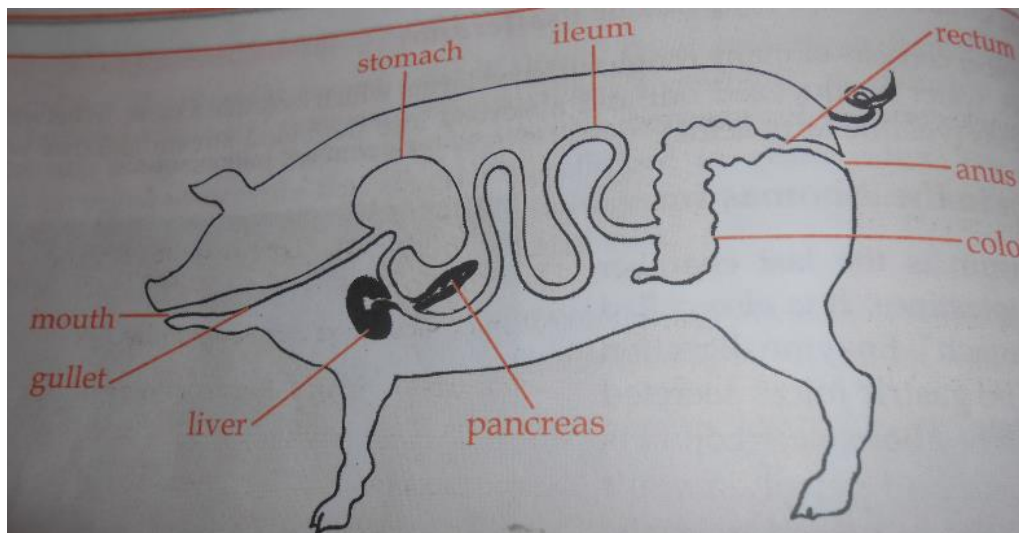


Figure 58. Digestive tract of pig (monogastric)

5.2. Ruminant stomach

It is a compound stomach composed of 4 chambers:

- **Rumen:** It can be palpated in the left paralumbar fossa and extends from the level of 8th rib to the pelvic inlet. Internal surface of the rumen has infoldings which form projections called **pillars**.

Note: The reticular groove- it starts from the cardia to the reticulo- omasal orifice. It encloses a tube that by- passes the rumen to the abomasum.

- **Reticulum** Internal surface has a **honey comb** appearance. It is in contact with the left abdominal wall at the level of the 6th and 7th intercostal spaces.
- **Omasum** : Situated at the level between 7th and 11th rib in the bovine and to the right of the median plane.
- **Abomasums:** Is the true stomach. It lies mostly to the left side.

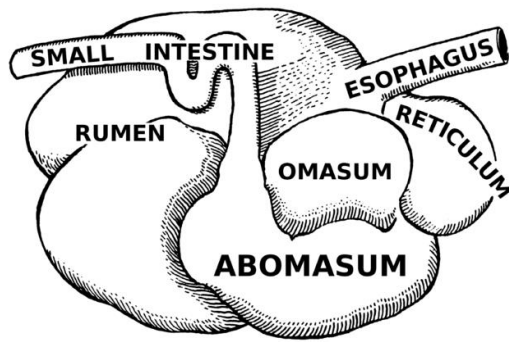


Figure59. **Stomach and adnexa**

- Has 2 parts namely a fundus and a pylorus. Internal surface is glandular and has **cardiac, fundic** and **pyloric glands**. It Occupies about $\frac{3}{4}$ of the abdominal cavity and fills most of the left side.

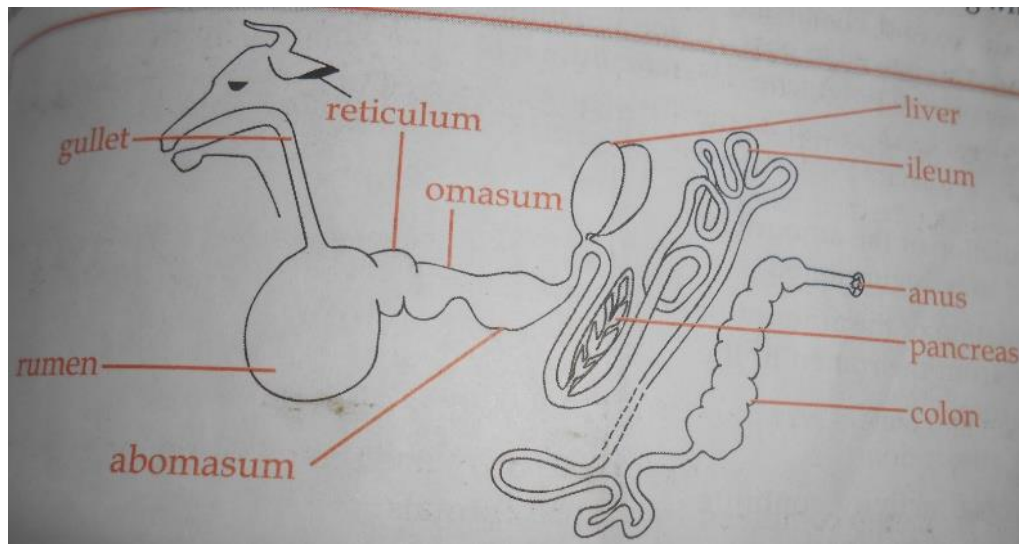


Figure60. Digestive tract of cattle

5.3. Structure of poultry stomach

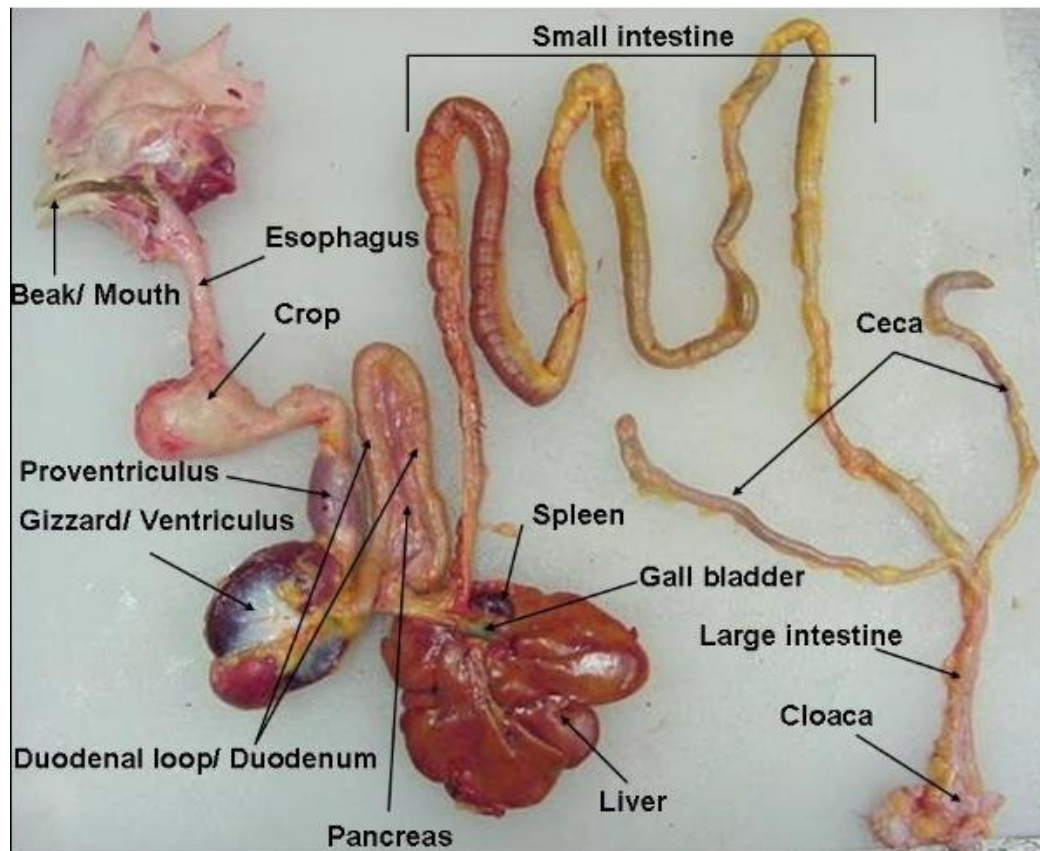


Figure61. The digestive tract of a domestic chick

- **Topic2. Particularities of digestive system anatomy for the calf**

Immature ruminants, such as young, growing calves from birth to about 2 to 3 months of age, are functionally non ruminants. The reticular groove (sometimes referred to as oesophageal groove) in these young animals is formed by muscular folds of the reticulum. It shunts milk directly to the omasum and then abomasums, by passing the reticulorumen. The rumen in these animals must be inoculated with rumen microorganisms, including bacteria, fungi and protozoa. Immature ruminants must undergo reticulorumenomosal growth, including increases in volume and muscle. In a calf at birth, the abomasums is the largest compartment of the stomach, making up more than 50% of the total stomach area. The reticulorumen and omasum account for 35% and 14% of the total stomach area. As ruminants develop, the reticulorumen and omasum grow rapidly and account for increasing proportions of the total stomach area.

Because immature ruminants do not have a functional rumen, feeding recommendations differ for developing ruminants compared with adult ruminants.

- **Topic3. Description of organs and main glands related to digestive system**

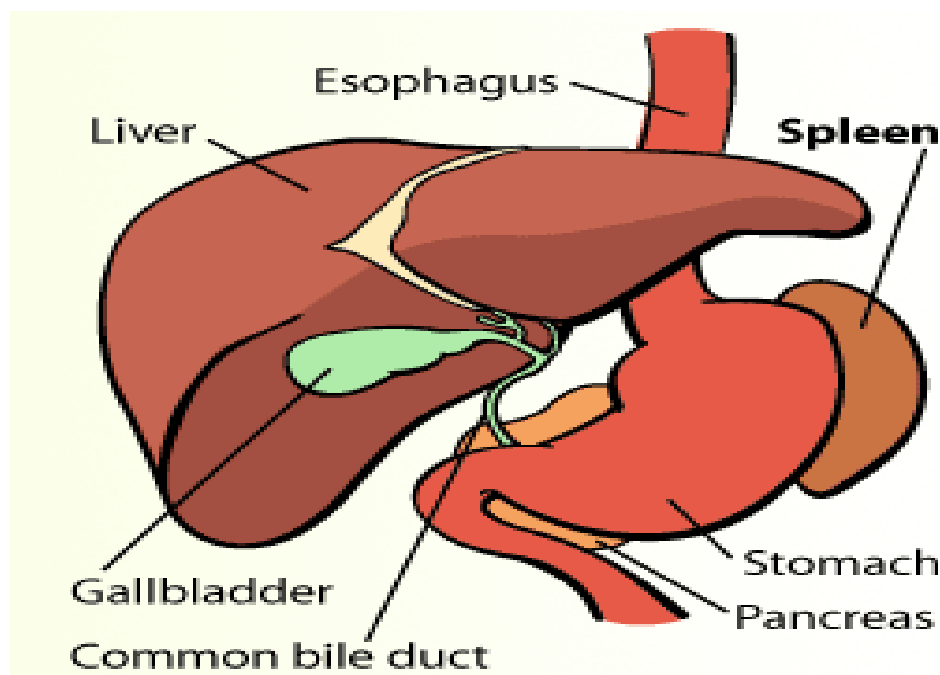
1. The liver

Is the largest solid gland of the body.

Lies to the right of the median plane and is related to the caudal surface of diaphragm.

It extends from the 6th to the last intercostal space.

Visceral surface is related to the stomach, intestines, gall bladder, pancreas etc .



2. Pancreas

The **pancreas** is an organ of the digestive system and endocrine system of vertebrates. The pancreas has both an endocrine and digestive exocrine function. As an endocrine gland, it functions mostly to regulate blood sugar levels, secreting the hormones insulin, glucagon, somatostatin and pancreatic polypeptide. As a part of the digestive system, it functions as an exocrine gland secreting pancreatic juice into the duodenum through the pancreatic duct. This juice contains bicarbonate, which neutralizes acid entering the duodenum from the stomach;

and digestive enzymes, which break down carbohydrates, proteins and fats in food entering the duodenum from the stomach.

3. Salivary glands

Generally in domestic animals, there are 3 pairs of salivary glands namely the:

- ✓ **parotid**,
- ✓ **mandibular** and
- ✓ **sublingual**.

However in the dog, a 4th pair called the **zygomatic gland** exists.

LO.2.8. Describe nervous system

Topic1. Identification of main parts of nervous system

The Nervous system has three major functions:

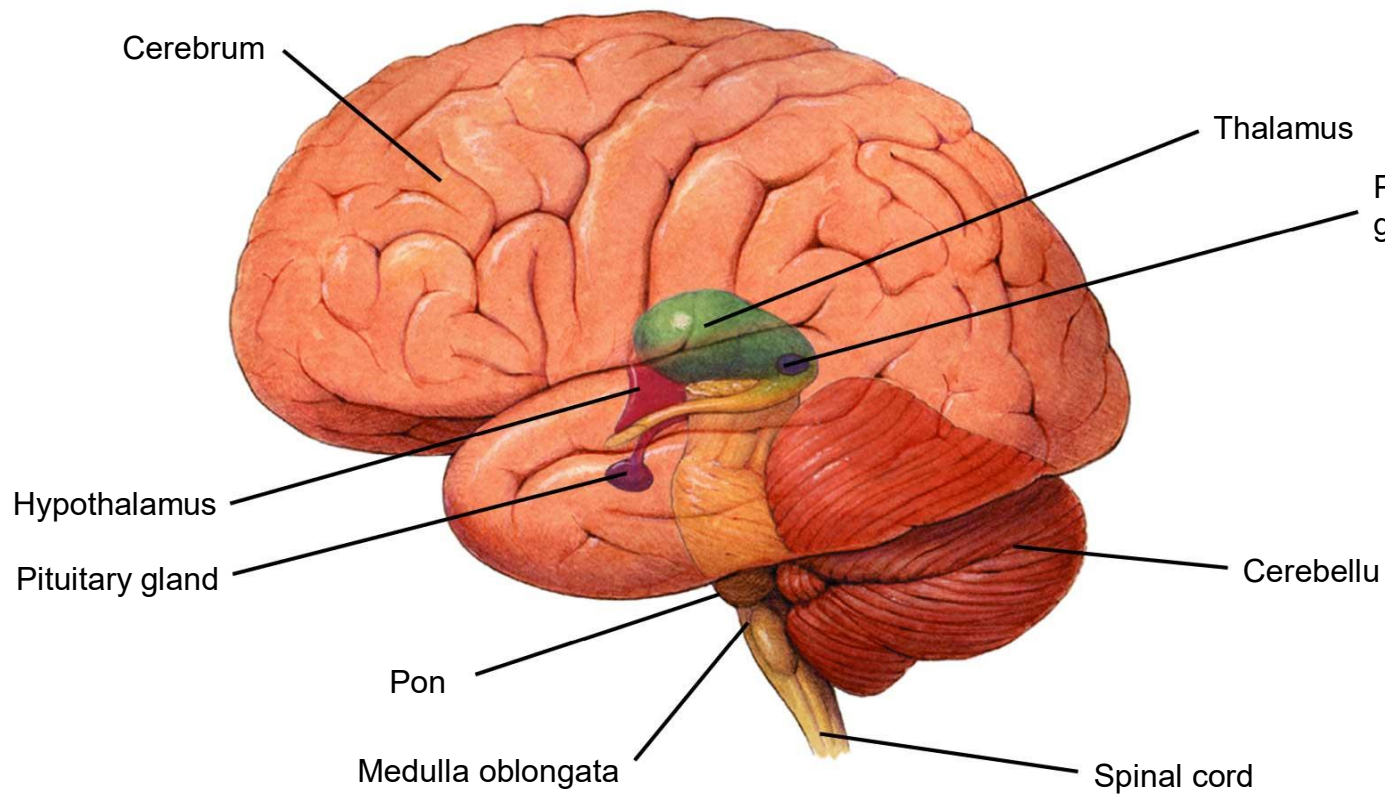
- **Sensory**: monitors internal & external environment through presence of **receptors**
- **Integration**: interpretation of sensory information (information processing); complex (higher order) functions
- **Motor**: response to information processed through stimulation of **effectors**. This response is conducted in 2 ways such as **muscle contraction** and **glandular secretion**

General organization of nervous system

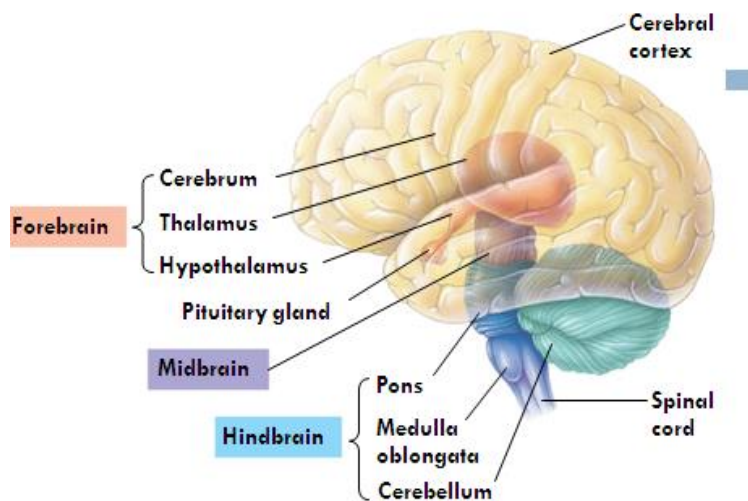
Nervous system have two anatomical divisions such as:

- **Central Nervous System**: Brain and spinal cord
- **Peripheral Nervous System**: peripheral nerves, autonomic ganglia and dorsal root ganglia of the spinal cord.

1. Central nervous system (CNS): Brain and Spinal cord



Brain: is divided into forebrain (cerebrum, thalamus and hypothalamus); midbrain / brain stem and hindbrain



❖ Forebrain

1. Cerebrum

cerebral cortex: frontal, parietal, temporal and occipital lobe

Grey matter: on outer surface, white matter inner surface

Cerebral cortex: is highly folded to increase the surface area for holding more neurones for more complicated coordination.

2. Hypothalamus: osmoregulation, temperature regulation, lactation and controlling the activities of other endocrine glands.

❖ **Midbrain:** controls cranial reflexes e.g. pupil reflex

❖ **Hindbrain:** cerebellum

(1) It receives impulses from semi-circular canals, utricle and saccule about the position of head and from the proprioceptors (stretch receptors) in muscles, tendons and joints about the muscular movement and also from motor centre of cerebral cortex.

(2) After processing the information received, the cerebellum coordinates the muscular activities to perform precise body movements. Coordinates reflexes in the body to maintain equilibrium.

➤ **Hindbrain – medulla oblongata**

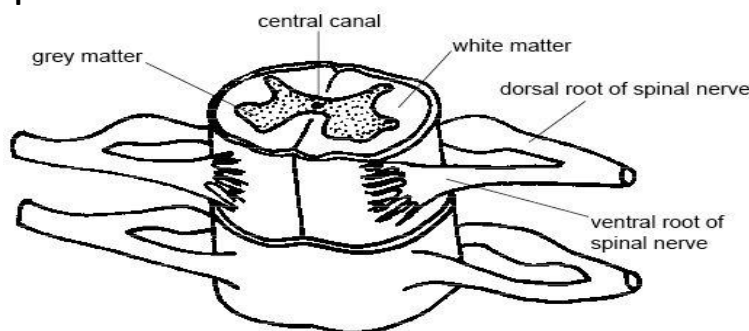
(1) **cardiovascular centre:** controls cardiovascular function e.g. heart beat rate ,

(2) **respiratory centre:** controls respiratory function e.g. ventilation rate

(3) **vasomotor centre:** controls vasomotor function e.g. blood pressure

(4) It is also the control centre for many involuntary actions e.g. swallowing, sneezing, coughing, blinking of eyes. It helps to maintain the equilibrium state of the body.

❖ **Spinal cord**



➤ relays these sensory impulses to the brain

➤ relay the motor impulses from the brain to the limb muscles (e.g. leg muscles) via the spinal nerves to effect coordinated movement and to keep body in equilibrium posture.

➤ a passage for nerve fibres to allow the 2-way conduction of nerve impulses to and from the brain and the limb muscles (e.g. leg muscles).

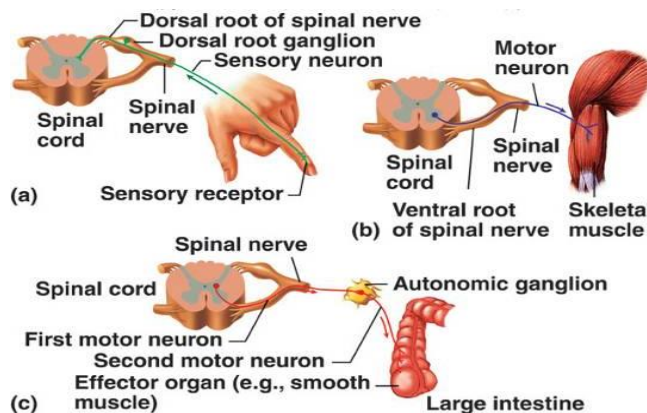
- The spinal cord is the site for control of somatic reflexes (e.g. withdrawal reflex) which are involuntary actions.

❖ The meninges

The meninges refer to the membranous coverings of the brain and spinal cord. There are three layers of meninges, known as the dura mater, arachnoid mater and pia mater. These coverings have two major functions: Provide a supportive framework for the cerebral and cranial vasculature.

2. Peripheral nervous system (PNS):

- All the neural tissue outside CNS
- Afferent division (sensory input)
- Efferent division (motor output): Somatic nervous system and Autonomic nervous system



Blood Brain Barrier

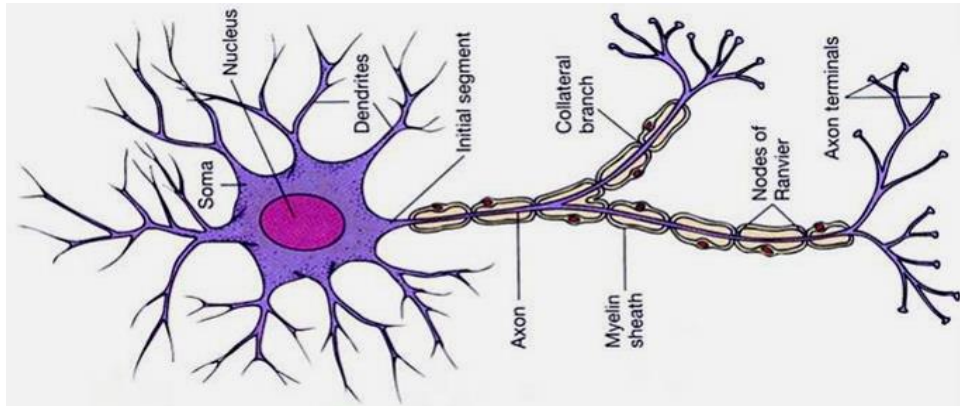
- ❖ There is a secure barrier between the blood and the CSF fluids that surround the brain called the Blood Brain Barrier.
- ❖ This barrier is due to the tight fitting endothelial cells that prevent filtration of larger molecules.
- ❖ The purpose of the Blood Brain Barrier is to protect the brain from chemicals, and other harmful substances. In this process, Antibodies and medications also blocked.
- ❖ Testing for those substances normally blocked - can indicate the level of disruption by diseases: ie meningitis and multiple sclerosis.

Structure of neuron

Neuron is type of neural cells in the nervous system. For processing, transfer, and storage of information, the neuron consists of:

- **The cell body, or perikaryon:** contains the nucleus and the main concentration of organelles
- **The dendrites:** their number varies in a great range, theoretically from one to several hundreds; they are usually short and conduct impulses to the perikaryon

- **The axon (neurite):** it is mostly very long and always single, it conducts the impulses away from respective cell .(in the periphery the axons /in some neurone also dendrites/ run gathered together in groups termed as nerves)
- **Twig-like branchings or terminal arborizations:** the telodendria, which touch the perikarya, dendrites or axons of one or more neurons in sites called **synapses**



Classification of neurons

❖ Structural classification based on number of processes coming off of the cell body

- **Anaxonic neuron:** It has no anatomical clues to determine axons from dendrites. Its functions are unknown
- **Multipolar neuron:** has multiple dendrites & single axon. It is the most common type.
- **Bipolar neuron:** Is characterised by two processes coming off cell body, one dendrite & one axon. This type of neuron is only found in eye, ear & nose.
- **Unipolar (pseudounipolar) neuron:** single process coming off cell body, giving rise to dendrites (at one end) & axon (making up rest of process).

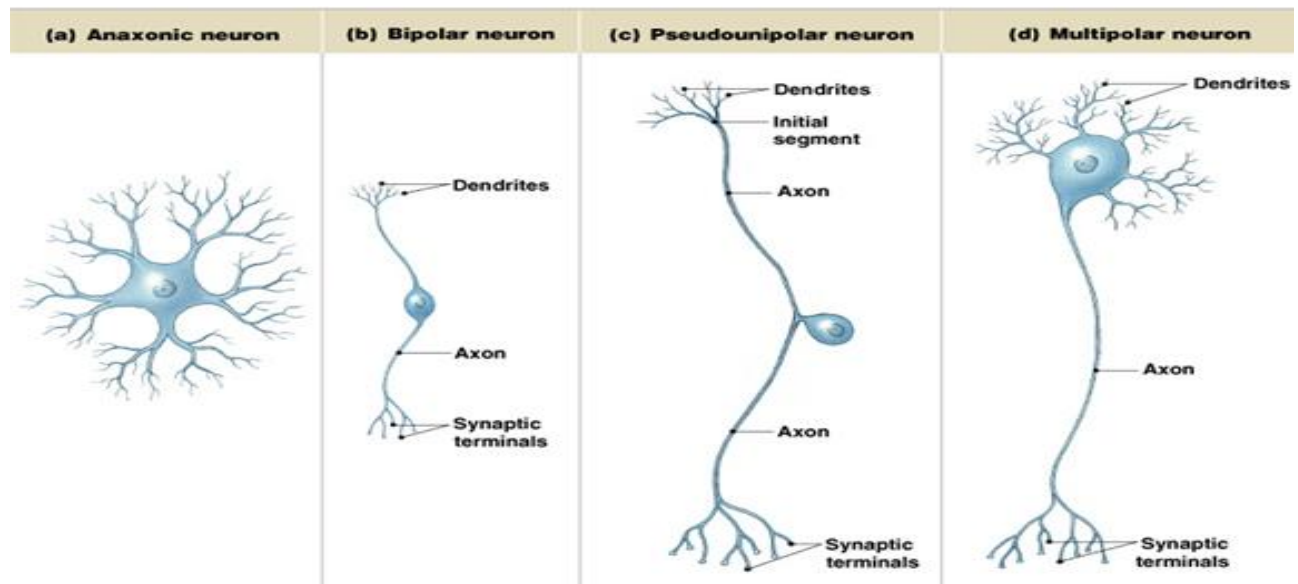


Table 3: Functional classification based on type of information & direction of information transmission

Sensory (afferent) neurons	Carry impulses from the sensory receptors(Cutaneous sense organs) ✓ they are proprioceptors that detect stretch or tension ✓ transmit sensory information from receptors of PNS towards the CNS ✓ most sensory neurons are unipolar, a few are bipolar
Motor (efferent) neurons	Carry impulses from the central nervous system ✓ transmit motor information from the CNS to effectors (muscles/glands/adipose tissue) in the periphery of the body ✓ all are multipolar
Association (interneurons)	✓ transmit information between neurons within the CNS; analyze inputs, coordinate outputs ✓ are the most common type of neuron (20 billion) ✓ are all multipolar ✓ Found in neural pathways in the central nervous system ✓ Connect sensory and motor neurons

Topic2.Orthosympatic and parasympatic system

1. The parasympathetic nervous system (PSNS)

The parasympathetic nervous system (PSNS) is one of the two divisions, the other being the **sympathetic**, that together are called the **autonomic nervous system**, which is a division of another system called **the peripheral nervous system (PNS)**.

The autonomic nervous system is responsible for regulating the body's unconscious actions. The parasympathetic system is responsible for stimulation of "rest-and-digest" or "feed and breed activities that occur when the body is at rest, especially after eating, including **sexual arousal, salivation, lacrimation** (tears), **urination, digestion** and **defecation**. Its action is described as being complementary to that of the **sympathetic nervous system**, which is responsible for stimulating activities associated with the **fight-or-flight response**.

 Nerve fibres of the parasympathetic nervous system arise from the **central nervous system**. Specific nerves include several **cranial nerves**, specifically the **oculomotor nerve, facial nerve, glossopharyngeal nerve**, and **vagus nerve**. Three **spinal nerves** in the **sacrum**, commonly referred to as the **pelvic splanchnic nerves**, also act as parasympathetic nerves.

 Owing to its location, the parasympathetic system is commonly referred to as having "craniosacral outflow", which stands in contrast to the sympathetic nervous system, which is said to have "thoracolumbar outflow"

2. The orthosympathetic nervous system (SNS)

The sympathetic nervous system (SNS) is one of the two main divisions of the **autonomic nervous system**, the other being the **parasympathetic nervous system**. **The enteric nervous system (ENS)** is now usually referred to as separate from the **autonomic nervous system** since it has its own independent reflex activity. There are two kinds of **neurons** involved in the transmission of any signal through the sympathetic system: pre-ganglionic and post-ganglionic.

The sympathetic nervous system is described as being antagonistic to the parasympathetic nervous system which stimulates the body to "feed and breed" and to (then) "rest-and-digest".

3. Relationship with the parasympathetic nervous system

Together with the other component of **the autonomic nervous system**, the parasympathetic nervous system, the sympathetic nervous system aids in the control of most of the body's internal organs. Reaction to **stress**—as in the flight-or-flight response—is thought to counteract the **parasympathetic system**, which generally works to promote maintenance of the body at rest.

LO.2.9. Describe sensory organs

Topic1. Sense organs

1. Sense organs

Sense organs are grouped into five categories:

- Touch organs: skin or touch sense
- Vision organs: eyes
- Hearing organs: ears
- Smell organs: nose
- Taste organs: mouth

2. Functions of the sensory organ

Sensory receptors are concentrated in the sense organs:

- **Eyes:** have Photoreceptors = sense of light
- **Ears:** is an organ of hearing and balance

Sound = vibration in air detected by mechanoreceptors
- **Nose:** ability to detect chemicals detected by chemoreceptors in nasal passageway and send impulses to CNS through sensory nerves
- **Mouth:** How food tastes is strongly influenced by smell

Taste = ability to sense chemicals by chemoreceptors in taste buds mostly on tongue (sweet, sour, salty and bitter. Sensitivity is different on different parts of tongue)
- **Skin or touch sense:** Skin is the largest largest sense organ containing pain receptors, thermoreceptors, and mechanoreceptors
- Different parts of skin have different sensitivity because there's a different numbers of receptors at different locations

Learning unit 3: Assess anatomo- physiological parameters of the main functions

LO.3.1. Select material, tools and equipment to assess anatomo- physiological parameters

Topic1. Selection of tools used to assess anatomo-physiological parameters

Adequate use of tools and equipment requires proper selection of them considering the activity engaged. The followings are:

1. Tools used to the pulse rate and heart beat: fingers, sphygmomanometer, stethoscope, chronometer, recording material.
2. Tools used to assess the respiration rate: Stethoscope. Clock.
3. Tools used to assess the body temperature: Thermometers(mercury or digital thermometers), clock, recording material
4. Tools used to assess the rumen contraction and sounds: Stethoscope, hands, clock

LO.3.2. Identify normal physiological parameters of the main functions

Introduction: One cannot become a clinician if he/she is not able to assess physiological parameters of an animal. There are several parameters but in this manual a few of them are discussed.

The followings are main physiological parameters of the main functions:

- **Temperature:** The body can only work properly at a certain temperature. The animal body maintains itself at a constant temperature, within a small range, in order for the systems to work properly. This normal body temperature is different in different types of animals.
- **Pulse rate : Physiological factors affecting the pulse rate in normal animals**

The following are some influencing factors on pulse rate in almost all animal species.

-  Species.
-  Size: higher in small than in large animals

- ✚ Age: higher in young than adult animals
 - ✚ Sex: male slightly lower than female animals
 - ✚ Parturition and Late stage of pregnancy : relatively more pulse rate
 - ✚ Exercise: increase pulse rate
 - ✚ Ingestion of food: cause momentary increase in frequency of pulse
 - ✚ Posture: pulse rate reduced about 10% when animal is recumbent than when standing
- Heart beat
 - Respiratory rate
 - Rumen sounds: You should hear/feel the rumen turnover as a strong contraction wave accompanied by a noise.

✚ **Topic1. Normal physiological parameters of the main functions for different species and age**

1. Normal temperature

Table4. Normal Body Temperatures

Animal	Normal temperature (°C)
Cattle	38.5
Calf	39.5
Sheep	39.0
Goat	39.5
Pig	39.0
Piglet	39.8
Chicken	42.0
Rabbit	36.6-38.9

Note: Body temperature may be 1°C above or below these temperatures.

2. Normal pulse rate

Table5. The number of blood waves per minutes

Animal Species	Range (Pulse rates/ min)
piglet	104
chick	200-400
Pig	60-100
Cattle	48 - 84
Calf	100 - 140
Sheep	68 - 80
Goats	70-80
Rabbit	140 - 180

3. Normal heart beat

Table6. Systolic and diastolic blood pressure for some animals

Animal	Systolic (Top number)	Diastolic (Bottom Number)
Human	120	80
Dog	110-160	110-160
Cat	110-160	110-160
Giraffe	280	180
Rats	129	91

4. Normal rumen sound

The normal rate of rumen sounds is **2** or **3** strong contractions per **2 minutes**.

5. Normal respiratory rate

Table7. The normal respiratory rate in different species

Animal	Range(breaths per min)
Cattle	10– 30
Calf	15– 40

Rabbit	30 – 45
Chicken	15 – 30
Sheep and Goat	20 – 30
Pig	8 – 18
Piglet	25-40

LO.3.3. Assess the pulse rate and heart beat

Topic1. Description of terminologies for pulse and heart Beat

1. Definition of terminologies

➤ **Pulse rate:**

In medicine, a pulse represents the tactile arterial palpation of the cardiac cycle by trained fingertips. The pulse may be palpated in any place that allows an artery to be compressed near the surface of the body, such as at the neck, wrist, at the groin, behind the knee, near the ankle joint, and on foot.

Pulse rate is the number of heart beats per minute. Example: The resting pulse rate for an average adult is between 60 and 80 beats.

➤ **Heart rate** is the speed of the heart beat measured by the number of contractions(**beats**) of the heart **per minute(bpm)**

➤ **Bradycardia** is a low heart rate, defined as below 60 bpm at rest .

➤ **Tachycardia** is a high heart rate, defined as above 100 bpm at rest.

➤ **Heart frequency** or **cardiac frequency** is the rate at which the heart beats

➤ **Arrhythmia** or **irregular heartbeat** is improper beating of the heart, whether irregular, too fast or too slow.

➤ **Cyanosis:** In medicine, a bluish discoloration of the skin due to poor circulation or inadequate oxygenation of the blood.

➤ **Hypervolemia or fluid overload:**

 In medicine, it is an increased volume of circulating blood in the body or

 A condition in which the liquid portion of the blood (plasma) is too high.

Hypervolemia can be caused by failure of the heart, kidney or liver or by a high-salt diet.

➤ **Hypovolemia or volume depletion:**

 In medicine, it is a decreased volume of circulating blood in the body or

✚ A condition in which the liquid portion (plasma) is too low. Causes of hypovolemia include diarrhoea and excessive bleeding.

2. Description of the pulse

In medicine, the pulse may be defined as “the rhythmic, periodic thrust felt over an artery in time with the heartbeat.” The important factors to note in taking the pulse are: (1) frequency, (2) rhythm, and (3) quality. Frequency is determined by counting the number of heartbeats occurring in one minute. Rhythm typifies a normal pulse seen in a series of rhythmic beats that follow each other at regular intervals. Quality is best described as the tension on the arterial wall; it is an indication of the volume of blood flow.

Normally, the arteries examined for pulse must be:

- Superficially situated.
- of medium size.
- Lying in adherence with solid mass as bone.

The common sites for examining pulse in domestic

The site for pulse taking differs among different animal species.

Table8. The common sites for examination in different animal species

Animal Species	Site for Pulse examination (taking)
Horse	The external maxillary artery
Ox	Middle coccygeal artery.
Sheep, Goat, Dog, Cat, Small pigs	Femoral artery
Dog and Cat	Brachial artery
Large pig	Coccygeal artery
Human	brachial artery, radial artery, femoral artery, popliteal artery, posterior tibial artery, dorsalis pedis artery, carotid artery

- **Topic2. Assessment of pulse rate for different species and different age**

A. Aspects of examination of the pulse

The following are different aspects of the pulse examination: Rate, Rhythm, and Quality.

1. The rate or frequency

Means the number of blood waves (beats) felt in minute time. This varies among different animal species. **Pathological changes of pulse rate**

There are several diseases and pathological conditions which have an influence on one's pulse. Below are some cases.

- ✓ **Bradycardia (Abnormally slow pulse rate):** Heart disease, Organophosphates, Calcium channel or beta blocking agents, Vagal response, Myocardial infarction, Pain, Intracranial pressure, depression (CNS depressing drugs/medications), Athletic conditioning, Hypothermia.
- ✓ **Tachycardia (Abnormally fast pulse rate):** Exercise, Hypoxia, Fever, Infection, Hypovolemia, Hyperthyroidism, Emotional upset, Stimulating drugs/medications, Myocardial infarction, Pain, Hyperthermia.

There are other factors which influence the pulse rates and among others we can talk of: Age (newborns have higher pulse rates), Time of Day (heart rate is usually lower in the morning), Gender (females have lower pulse rate), Body Build (the pulse rate is influenced by the body mass), Body Temperature (if body temperature raises up or decreases), Exercise (heart rate increases with exercise, resting heart rate decreases with regular aerobic exercise), Excessive Blood loss decreases the HR, Some medicines and/or drugs (some medication also have big influence on the HR either positively or negatively).

2. Rhythm

The rhythm of the pulse is judged by observation of the interval occurring between successive waves. According to pulse rhythm, we have two main classifications.

- **Rhythmic or Regular:** Individual pulse beats are separated by intervals of equal duration.
- **Arrhythmic or Dysrhythmia or Irregular:** The interval is not regular.

3. Quality

Quality is best described as the tension on the arterial wall; it is an indication of the volume of blood flow. Quality means, the strength of pulse and it normally varies according to kind of animal.

Based on the pulse quality, we can classify pulse as:

- Strong: normal
- Full/bounding: stronger than normal (commonly associated with aneurysms)
- Weak/thread: difficult to feel (too much loss of blood)

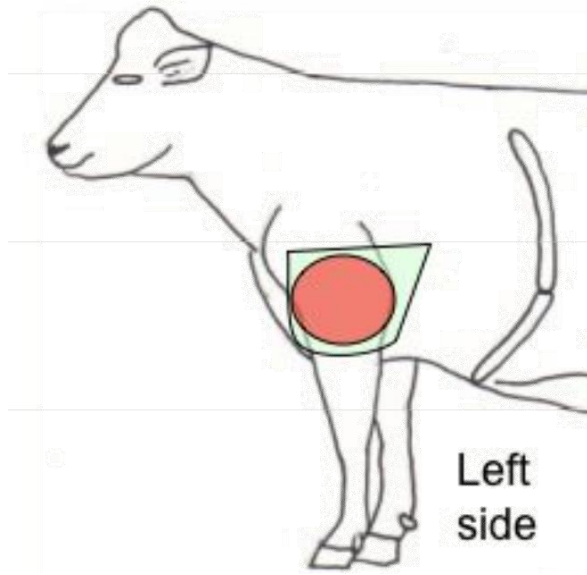
Some illustration of pulse rate feeling in humans (These can serve for practicals in class)

	Radial pulse. This is also known as the pulse on the inside of the wrist. Use the pads of three fingers. Place these just below the wrist creases at the base of the thumb. Press lightly until you feel a pulse (blood pulsing under your fingers). If necessary, move fingers around until you feel the pulse.
	Carotid pulse. Alternatively, to feel a pulse on the side of the neck, place two fingers, preferably your index and middle finger, in the hollow between the windpipe and the large muscle in the neck. Press

		lightly until you feel a pulse.
		Recording rate, strength and rhythm (of the carotid artery). Use a watch or clock with a second hand. Make a note of the rate of the pulse, which is the number of beats per minute. Check the strength of the pulse to see if it is strong or weak and if the rhythm is regular or irregular.

B. Heart Beat

The heart contracts and relaxes rhythmically.



Blood Pressure

Blood pressure is defined as the force exerted by circulating blood on the arterial walls. It is one of the principle vital signs in both humans and animals. Blood pressure is divided into two main components which are:

- **Maximum (systolic) pressure** – pressure in the artery when the left ventricle is contracting to force the blood into aorta and other arteries.
- **Minimum (diastolic) pressure** – pressure in the artery when the ventricles are relaxing and the heart is filling up, receiving blood from veins.

We talk of high or low blood pressure taking referring to normal values. Blood pressure is more significant in some companion animals (dog, cat, horse) and in human.

The blood pressure is measured with **sphygmomanometer**. The sphygmomanometer uses the height of a column of mercury to reflect the circulating pressure. The blood pressure values are expressed in millimeters of mercury (mm/Hg).

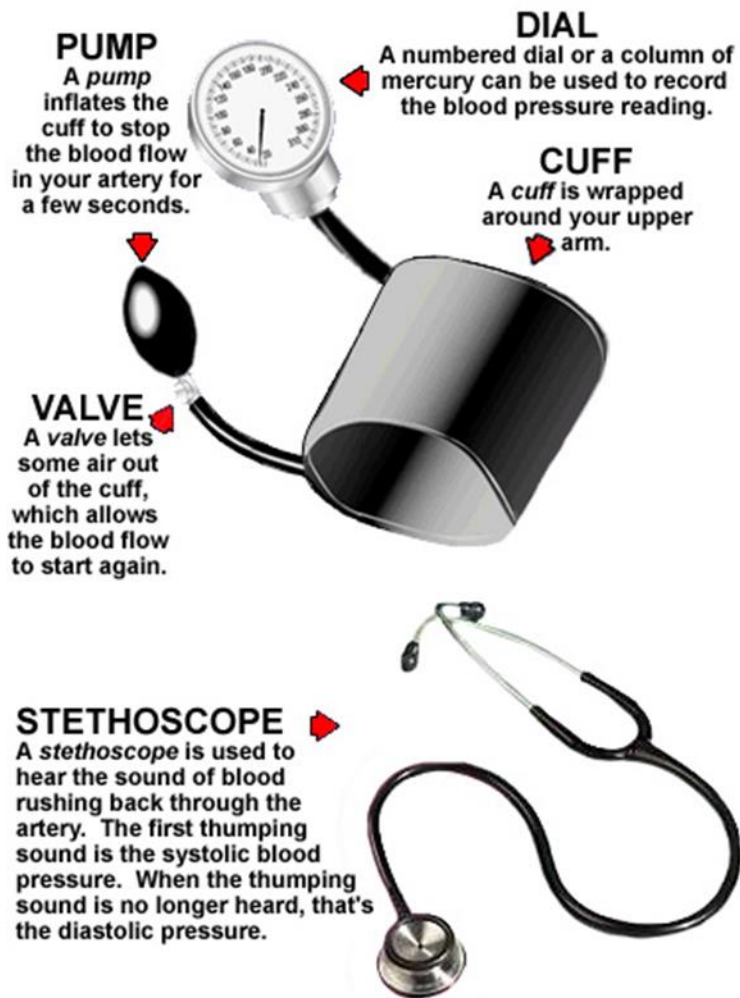




Figure65. Different Types of Sphygmomanometer

LO.3.3.Assess the respiration rate

✚ Topic1. Description of terminologies for respiration

1. **Respiration rate** is the rate at which breathing occurs This is usually measured in breaths per minute.
2. **Tachypnea** or **fast breathing** is abnormally rapid breathing
3. **Bradypnea** is abnormally slow breathing rate

Breathing consists of drawing air into the lungs (inspiration) and expelling it from the lungs (expiration). The respiration rate is the number of times per minute that air is inhaled and exhaled. When animals breathe, air flows into the lungs, which lie freely in the thoracic (chest) cavity. If the rib and chest increase in size, the lungs expand, due to air pressure within them and the inspiration of air through the nostrils or mouth. Air is exhaled from the lungs by the contraction of the thoracic wall and the action of the diaphragm, a flat muscle that aids in the breathing process.

Respiration is the act of breathing, or more specifically, the acts of taking in oxygen, using it in the body tissues, and giving off carbon dioxide.

Topic2. Assessment of respiration rate for different species and different age

In examining respiration in an animal, you place your hand, palm toward the animal, on the ribs or flank and count the number of times it rises and falls. Respiration rate also can be determined in larger animals by observing the in and out motion of the ribs, preferably at a distance, with the animal standing.

The respiration rate is subject to body size, age, exercise, excitement, environmental temperature and the degree of fullness of the digestive tract. Fat show animals may have a respiration rate twice that of a thinner animal. Injury or disease also may cause changes in the respiration rate, temperature, and pulse.

The following points are noted or given attention:

➤ **Type:**

It means the way in which the respiratory movement are shared between the thoracic and abdominal walls, the Diaphragm play an important role in respiratory action. The normal Types of respiration according to species:

- **Abdominal:** (in cattle). The abdominal muscles predominate in this type of respiration.
- **Costal:** (in dog and cat). The costal muscles predominate.
- **Costo abdominal:** (in horse). The abdominal & costal muscles are similarly sharing in Respiration.

➤ **Rate or frequency:**

It means the numbers of respiratory movement per minute. The rate should be counted for at least one minute. To count Respiration Rate, count each Inhalation and Exhalation as one respiration. Count for 30 seconds and multiply by 2.

Factors accelerating respiratory rate

➤ Physiological:

- ✚ Exposure to high atmospheric temperature
- ✚ Just after exercise
- ✚ Ingestion

➤ Pathological:

- ✚ Fever
- ✚ Anemia
- ✚ Severe cardiac diseases
- ✚ Various pulmonary diseases
- ✚ Obstruction of upper respiratory passage
- ✚ Conditions making respiration painful (pleurisy or peritonitis)

Some abnormalities associated with respiratory rate

✚ **Hyperpnoea:** this is defined as increased pulmonary ventilation. Increased respiratory rate can be associated or not with the increase of the amplitude (width).

✚ **Polypnoea:** is the increased respiratory frequency with reduction in depth of movement.

✚ **Oligo-pnoea:** is defined as the retarding of the respiratory rate. Some pathological causes are: Stenosis of the upper respiratory passage, Uremia, in space occupying lesions of the brain.

➤ Respiratory rhythm:

This means the regularity in intervals between successive respirations. Each respiratory cycle consists of three phases: **Inspiration, Expiration, Pause.**

➤ **Respiratory depth:**

It means degree of movement of both abdominal & thoracic muscles. In deep breathing the movements of muscles are clearly visible.

Dyspnoea: Means deviations from normal respiration in its rate, type, depth accompanied by pathological sounds. This condition can clinically be divided into:

1. Simple dyspnoea.
2. Aggravated dyspnoea:
 - ✓ Inspiratory dyspnoea.
 - ✓ Expiratory dyspnoea.
 - ✓ Mixed dyspnoea.

LO.3.5. Assess the body temperature

 Topic1. Description of related terminologies

1. **Hyperthermia** is the condition of having a body temperature greatly above normal.
2. **Hypothermia** is the condition of having abnormally low body temperature.
3. **Fever** is an abnormally high body temperature, usually accompanied by shivering, headache, etc.

1. The normal body temperature

There are a number of ways by which animals control the temperature of the body:

- Hair, wool, walking, running, shivering and the burning of energy in feed keep the body warm.
- Sweating, panting, wallowing in mud, and lying in the shade cool the body.

Topic2. Assessment of body temperature for different species and different age

A. Measuring body temperature

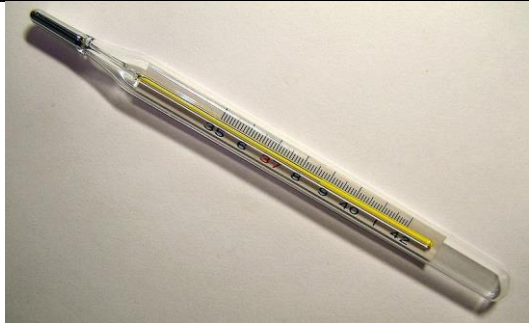
We use a thermometer to measure the temperature of the body. The unit of measurement is degrees centigrade (°C). We measure the body temperature of animals by placing a thermometer in the anus.

The thermometer

In veterinary, we use different types of thermometers which are mainly mercury and digital thermometers. Both are almost similarly used. However, there some minor differences. In this manual, we focus more on the use of mercury thermometers.

- Look at your thermometer. Notice the silver line of the mercury inside it and the scale with numbers marked along it.
- Before you use it you must make sure that the mercury level is below 35°C. If it is not, shake the thermometer to make the level go down.
- Every time you use the thermometer clean it with cold water and soap or disinfect it afterwards.

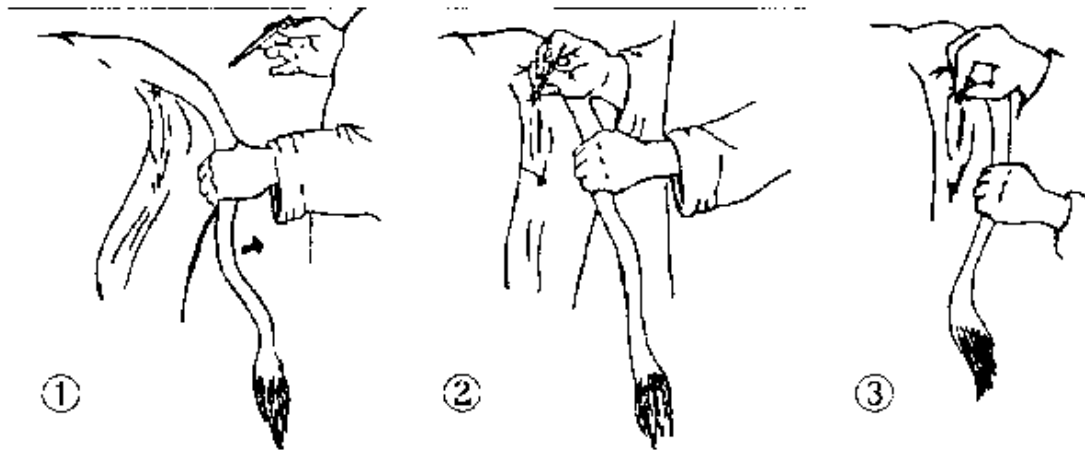
Do not wash the thermometer in hot water as this will burst it. Do not leave your thermometer in the sun as this may burst it. Carry the thermometer in a case in your pocket or bag. Do not use your veterinary thermometer for people.

	
A medical/clinical thermometer showing the temperature of 38.7 °C	Temperature taking in human, using digital thermometer

How to take the body temperature of animals

- Control the animal.
- Move the tail to the side.
- Put the thermometer gently into the anus, as far as possible.
- Hold the thermometer at an angle so that it touches the wall of the rectum. Keep a firm grip on the thermometer, if the animal defecates or coughs the thermometer could come out or go into the rectum.
- Hold the thermometer in place for half a minute. If you do not have a watch count slowly up to 30 (one, two, three, thirty).
- Remove the thermometer and wipe it if necessary and read it. Do not touch the bulb as this could change the reading.

How to take the body temperature of animals



Figures 66, 67 and 68. Animal's places where body temperature is taken.

If you suspect that the animal has a high temperature use your thermometer to check it. Remember that a high temperature is one sign of ill health. When an animal has a high temperature it has a fever.

B. Physiological factors affecting the body temperature

- Female, pregnant, young animals have a relatively higher temperature than male, non-pregnant, old animal.
- In all healthy animals the temperature varies during the day.
- High atmospheric temperature increases the normal body temperature.
- Excitation, forced exercise increase the temperature.
- The normal body temperature increase after feeding.

C. Abnormal body temperature:

1. Sub normal temperature (hypothermia):

- a) **Physical:** The sphincter of anus is relaxed -The thermometer has not been inserted deep enough -Defecation takes place just before or during the insertion-Administration of a cold fluid enema.

- b) **Pathologically:** In cases of: anemia, hemorrhage, hypocalcaemia, hypothyroidism, GIT parasites, mal nutrition , shock , parturition .
- c) Sub normal temperature most frequent in fatal diseases just before death (Temperature of collapse).

2. Elevated body temperature (Hyperthermia)

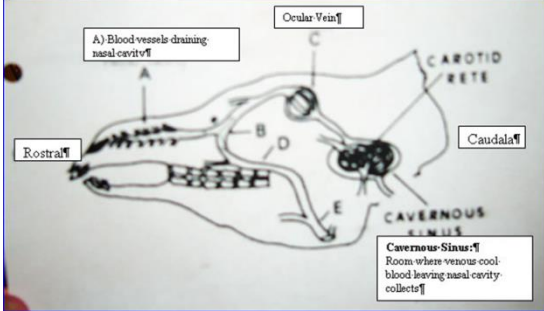
It is elevation of body temperature above the normal range. The following phenomena are met with it:

- ✚ Chill.
- ✚ Uneven distribution of the external temperature of the body.
- ✚ Loss of appetite & impaired digestion:
 - ✓ The secretions of digestive juices are lessened.
 - ✓ Peristalsis suppressed (constipation).
 - ✓ Thirst increased
- ✚ Mental depression.
- ✚ Albuminuria

D. Thermoregulation in other domestic animals

The body temperature is influenced by many environmental factors for which poanimals must cope with to be able maintain normal temperature. The methods of thermoregulation vary among different animal species.

Animal species	Thermoregulation	Images
Dogs	Smaller dogs may maintain slightly higher temperatures while larger dogs may maintain slightly lower temperatures. The following are methods dogs use to maintain steady body temperatures: - Panting: method of cooling is evaporative cooling from the respiratory tract - Skin and Fur: Sweat glands are found in the dermis along with sebaceous glands which feed oil into hair follicles in the epidermis to lubricate the skin. Dogs can achieve pilo erection, raising of the guard hairs, by contracting or lengthening muscle fibers in the dermis. A dog's fur insulates it against cold and heat with the degree of insulation increasing with fur thickness. - Sweating: Although dogs have sweat glands, located primarily in the pads of their feet and in their ear canals, sweating plays a minimal role in their thermoregulation	 Figure69. A panting dog

Sheep	- Non-Behavioral: Non-behavioral mechanisms include the carotid rete, countercurrent heat transfer, utilization of brown fat in neonates, panting, shivering and non-shivering thermogenesis, sweating, and insulation/building a wool coat - Behavioral: huddling or scattering, seeking shade, seeking water, seeking shelter, decreasing/increasing feed consumption, seeking cool/warm surfaces, and increasing or decreasing activity level	 Figure70. Carotid rete
Horses	- Sweat glands: The horse uses sweat glands to cool down at a time when external or internal temperatures are too hot. When the outside temperature is too high for the air to cool the blood through the skin, the sweat glands secrete fluid. - Hair coat: The coat, in horses, changes twice a year through the mechanism called photoperiodism, adapting to different seasonal base temperatures. The longer the coat, the lesser chance water has to get to the skin. Through regular coat brushing the greasy substance gets	 Figure71. Water running down the long winter hair, the undercoat staying dry

	removed, and the water-repelling effect gets impaired. The practice of clipping the hair of a horse's coat eliminates, completely, the thermoregulatory factor of the coat.	
Cattle and Pig		
Birds	Heat Production: - Shivering: this is the primary means for increasing heat production for birds. The large flight muscles (pectoralis) as well as the leg muscles play an important role in generating heat by shivering - Spread-Wing Postures: this a behavioural mean for heat production in bird. In some kind of birds, this helps to dry the wings after wetting. In addition to helping wing feathers to dry, other suggested functions for these postures include regulating body temperature ("thermoregulation"). Spread-wing postures appear to serve for both thermoregulation and drying in Turkey Vultures. Heat loss: As birds don't have sweat glands, heat loss is done by evaporation can occur only via	 Figure72. A bird tucking head and neck

	respiratory system. The following are the other ways birds eliminate excess heat. - Cloacal evaporation and thermoregulation: a bird is capable of evaporating enough water from the cloaca to be important for thermoregulation - Behavioural ways of thermoregulation in birds are: ✓ Plumage: (1) number of feathers varies seasonally, (2) position of feathers controlled by dermal muscles ✓ Posture - at low temperatures, birds can (1) withdraw feet into plumage to reduce heat loss (2) tuck head & neck under wing to reduce heat loss. ✓ Leg and feet: (1) heat loss is limited in cold weather because of a counter-current mechanism that 'saves' heat (2) can serve as heat 'radiators' during hot weather: - increased blood flow - storks & vultures defecate on legs to increase heat loss by evaporation.	
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LO.3.6. Assess the rumen movement rate

Topic1. Rumen movements

The rumen moves regularly and contracts about once every minute. By putting your fist on the left flank (in the hollow behind the ribs) you will be able to detect the contractions. Regular contractions are a sign of good health.

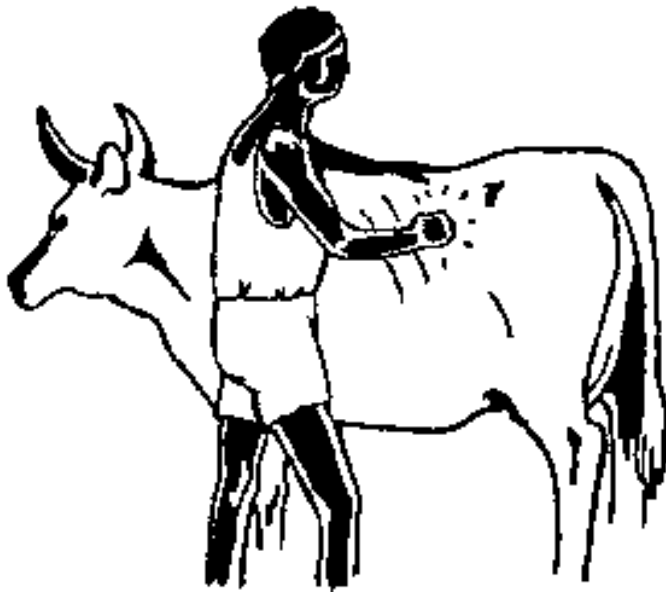


Figure73. Palpation of the rumen

Topic1. Assessment of rumen contraction and sounds

The assessment of the rumen contraction is done by palpation and auscultation. The auscultation is done using bear ear and/or by use of a stethoscope and an attention is paid to the nature, strength and frequency of rumen sounds, which in health cattle take the form of a periodic rustling sound, increasing, to a crescendo then falling away.

The following are variant types of sounds which can be heard:

- **The normal rate** of rumen sounds is **2 or 3** strong contractions per **2 minutes**.
- **Hypermotility**: increase in the rate of rumen movements and occurs during vagus stimulation.
- **Hypomotility**: decrease in the rate of rumen movements and occurs when a ration poor in fibrous structure is fed, during forestomach disorders (indigestion).
- **Atony** : stop of rumen movements and occurs during severe forestomach disorders (traumatic reticuloperitonitis, rumen acidosis, etc.).

1. Types of ruminal contractions

Ruminal contraction consists of two main types or phases of contraction. There are both primary and secondary rumen contractions.

a) Primary contraction: Also called A-wave or backward moving

Action

- A biphasic contraction of the reticulum
- Anterior pillar contracts lifting the anterior sac.
 - Anterior fold rises to form barrier
- Contraction moves across dorsal sac to dorsal blind sac from contraction of longitudinal pillar and dorsal coronary pillar
- Dorsal blind sac contracts and dorsal sac relaxes from dorsal coronary pillar
- Ventral sac contracts along longitudinal pillar
- Ventral sac relaxed and Ventral blind sac contracts
 - Ventral contraction absent during rumination

Functions of the primary contraction

- Mixing and inoculation of digesta
- Particle sorting across the reticuloruminal and anterior folds
- **Duration of contraction**
 - Fed animal – 30 to 50 seconds
 - Fasted animal – 12 to 18 seconds

b) Secondary contraction: Also called the B-wave or forward-moving contraction

Usually occurs after a primary contraction

Action

- Contraction of the ventral blind sac continuing up through the dorsal blind sac using the dorsal coronary pillar
- Contraction proceeds across dorsal sac forcing gas pocket to the cardiac sphincter

Function: Eructation

Duration: 30 seconds

Factors affecting ruminal contractions:

- **Feeding:** Increases frequency and amplitude of contractions

Activity	Contractions/min	Amplitude (mm Hg)
Resting	1.2	18.2
Feeding	2.0	22.1
Ruminating	1.1	10.4
Fasting	0.3	Weak

- **Diet:** Feeding a finely ground forage reduces rate amplitude of contractions. This requires 2-6 weeks to adapt.
- **Volatile fatty acids:** acetic, propionic and butyric acids given mixture will inhibit primary contraction.
- **Metabolic problems:** Hardware disease, hypocalcemia, or hyperglycemia will inhibit ruminal contraction.

LO.3.7. Estimate the age in ruminant

Topic1. Types of age estimation in ruminant

There are 4 types:

1. General appearance of body
2. Hoof
3. Based on dentition
4. Based on horn ring

Estimating cattle age using dentition

How to age sheep, goats and cattle

The age of animals can be determined by examination of the front teeth. You will not be able to determine the exact age, especially in older animals.

1 .How to hold (restrain) the animals to check their teeth

1.1. How to hold sheep and goat to check their teeth



Figure74. Teeth of the sheep

1.2. How to hold cattle to check its teeth



Figure75. Teeth of the cattle

Temporary (milk) and permanent teeth

Young animals, like children, have temporary or milk teeth which will be replaced by permanent teeth.

Young ruminants have 20 temporary teeth; adult ruminants have 32 permanent teeth.

Temporary (milk) teeth:

- Upper jaw No front teeth 6 back teeth
- Lower jaw 8 front teeth 6 back teeth

Permanent teeth:

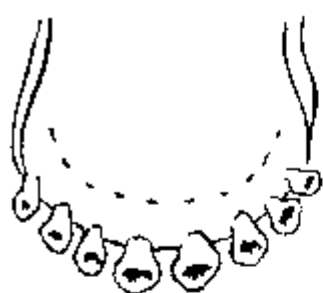
- Upper jaw No front teeth 12 back teeth
- Lower jaw 8 front teeth 12 back teeth

Remember that you will not be able to determine the exact age of the animal from its teeth, but there will be a few months either way.

Age of goats and sheep

- (1) Animal under one year old (no permanent teeth)
- (2) One year old (2 permanent teeth)
- (3) Two years old (4 permanent teeth)
- (4) Three years old (6 permanent teeth)
- (5) Four years old (8 permanent teeth)
- (6) Old animal, more than four years old

Figure76.Teeth of goats and sheep to estimate age



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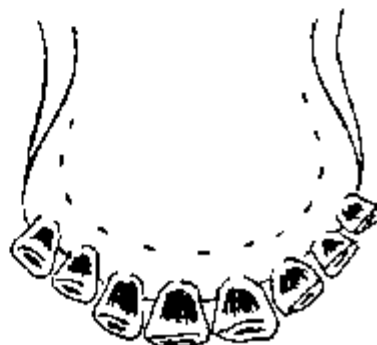
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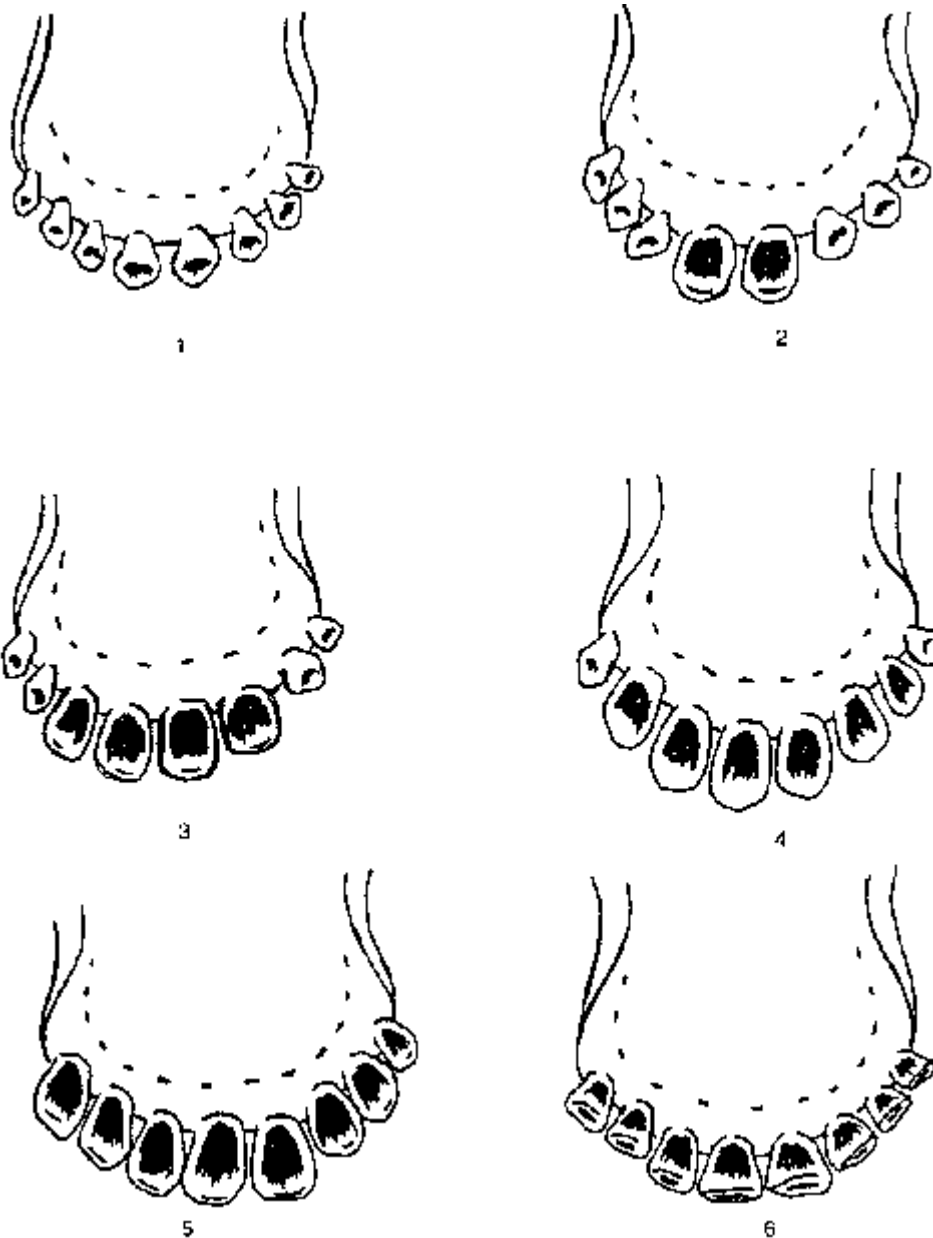


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Age of cattle

- (1) Under two years old (No permanent teeth)
- (2) Two years three months (2 permanent teeth)
- (3) Three years old (4 permanent teeth)
- (4) Three years six months (6 permanent teeth)
- (5) Four years (8 permanent teeth)
- (6) Old animal, over four years old.

Figure77. Teeth of cattle to estimate age



Estimating cattle age using horn method

The rings on the horns are less useful as guides:

- ✚ At 10 or 12 months, the first ring appears.
- ✚ At 20 months to 2 years, the second ring appears.
- ✚ At 32 months, the third ring.
- ✚ At 40 to 44 months, the fourth ring.
- ✚ At 54 to 60 months, the fifth ring and so on.

But at the 5th year, the three first rings are indistinguishable and the 8th year all the rings.

LO.3.8. Assess the urine and feces

✚ Topic1. Physical assessment of faeces and urine

A) Definition of terminologies

1. **Anuria:** A condition in which the kidneys do not produce urine
2. **Polyuria:** The production of an abnormally large amount of urine; one symptom of diabetes
3. **Hemoglobinuria:** The presence of haemoglobin in the urine
4. **Hematuria:** The presence of blood in the urine
5. **Hematochezia:** The presence of fresh blood in stools, often due to lower gastrointestinal bleeding
6. **Melena:** A passage of dark, tarry stools containing blood as the result of upper gastrointestinal bleeding
7. **Diarrhea:** The watery excrement that comes from said bowel movements.

B) Physical assessment of faeces and urine

The accumulation of faeces and urine in dairy barns can be related to a variety of problems such as poor cow hygiene, mastitis and lameness, which are important for the welfare and productivity of the cows. Cow faeces can contain infectious bacteria, contribute to the spread of diseases, and pose the risk to human health.

B1) Assessment of urine

A urine test checks different components of urine, a waste product made by the kidneys. A regular urine test may be done to help find the cause of symptoms. The test can give information about the health and problems the animal may have.

A regular urinalysis often includes the following tests:

- ✚ **Color:** Many things affect urine color including fluid balance, diet, medicines and diseases. How dark or light the color is tells you how much water is in it.
- ✚ **Clarity:** Urine is normally clear; bacteria, blood, crystals or mucus can make urine look cloudy
- ✚ **Odor:** Urine does not smell very strong, but it has a slightly” nutty” odor. Some diseases cause a change in in the odor of urine.
- ✚ **Etc**

B2) Assessment of faeces

Bowel elimination (defecation) is a natural process by which the soiled waste products of digestion faeces or stool) are eliminated from the bowel.

Characteristics of normal faeces

1. **Color:** Varies from dark to black color. Food and medicines can affect the color
2. **Odor:** Aromatic; affected by ingested food and animal’s bacteria flora
3. **Consistency:** formed, soft, semi-solid, moist
4. **Presence of foreign body can be observed.**
5. **Frequency:** varies with diet

Common bowel elimination problems

- ✓ **Constipation:** Abnormal frequency of defecation and abnormal hardening of stools.
- ✓ **Impaction:** Accumulated mass of dry faeces that cannot be expelled.
- ✓ **Diarrhea:** Increased frequency of bowel movement as well as liquid consistency and increased amount; discomfort and incontinence.
- ✓ **Incontinence:** Involuntary elimination of faeces.
- ✓ **Flatulence:** Expulsion of gas from the rectum
- ✓ **Hemorrhoids:** Dilated portions of veins in the anal canal causing itching and pain and bright red bleeding upon defecation.

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