Dairy production

Level –III

Learning Guide-18

Unit of Competence: Identify and describing Anatomy, Physiology and Behavior of Dairy Animal

Module Title: Identifying and describing Anatomy, Physiology and Behavior of Dairy Animal

LG Code: AGR DRP3 M05 LO1 LG18

TTLM Code: AGR DRP3 TTLM 1119v1

LO 1: Describe different planes of references of animal body and directional terms

Instruction Sheet 1	Learning Guide 18

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Defining and describing the science of veterinary anatomy and physiology.
- Identifying the different planes of reference of the body.
- Using appropriate directional terms in the description of locations of body parts

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- The science of veterinary anatomy and physiology are defined and described
- The different planes of reference of the body are identified
- Appropriate directional terms are used in the description of locations of body parts

Learning Instructions:

1. Read the specific objectives of this Learning Guide 47.
2. Follow the instructions described in number 1 to 7.
3. Read the information written in the “Information Sheet (**1, 2,and3**) in page **2,5,and 7** respectively
4. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
5. Accomplish the **“Self-check (1, 2, and 3)** in page**, 4, 6, and 8** respectively.
6. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” **in page --.**
7. Do the “LAP test” in page **-** (if you are ready). Request your teacher to evaluate your performance and outputs. Your teacher will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your teacher shall advice you on additional work.

Information sheet-1	Defining and describing the science of veterinary anatomy and physiology

1.1 Veterinary science

The term **anatomy** has come to refer to the science that deals with the form and structure of all organisms. Literally, the word means *to cut apart*; it was used by early anatomists when speaking of complete dissection of a cadaver.

In contrast to anatomy, which deals primarily with structure, **physiology** is the study of the integrated functions of the body and the functions of all its parts (systems, organs, tissues, cells, and cell components), including biophysical and biochemical processes.

When anatomy and physiology courses are taught separately, the approach to the laboratory portion of each course is considerably different. Study in a typical **gross anatomy** laboratory is based primarily on dissection of animal cadavers.

The science of anatomy has become so extensive that it is now divided into many specialized branches. This text chiefly describes **gross (macroscopic) anatomy**. This is the study of the form and relations (relative positions) of the structures of the body that can be seen with the unaided eye. **Comparative anatomy** is a study of the structures of various species of animals, with particular emphasis on those characteristics that aid in classification.

Our approach to the study of anatomy will be chiefly by systems—**systematic anatomy**. To name the study, the suffi x -ology, which means branch of knowledge or science, is added to the root word referring to the system. Table 1-1

Table 1-1. Nomenclature for Systematic Anatomy		
System	***Name of Study***	***Chief Structures***
Skeletal system	Osteology	Bones
Articular system	Arthrology	Joints
Muscular system	Myology	Muscles
Digestive system	Splanchnology	Stomach and intestines
Respiratory system	Splanchnology	Lungs and airways
Urinary system	Splanchnology	Kidneys and urinary bladder
Reproductive system	Splanchnology	Ovaries and testes
Endocrine system	Endocrinology	Ductless glands
Nervous system	Neurology	Brain, spinal cord, and nerves
Circulatory system	Cardiology	Heart and vessels
Sensory system	Esthesiology	Eye and ear

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. _____ is refer to the science that deals with the form and structure of all organisms. (3pts)
2. _____is the study of the integrated functions of the body and the functions of all its parts? (3 points)

Note: **Satisfactory rating – 6 points** **Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

1. _____

_____

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2. _____

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Information sheet-2	Identifying the different planes of reference of the body

2.1 Identifying planes of reference of the body

Plane is a flat surface, real or imaginary, passing through the animal, or part of it.

Types of planes:

1. **Median or longitudinal**: is an imaginary plane dividing the body into equal right and left halves. It divides the head, body of the limb longitudinally into equal right and lefthalves.
2. **Sagittal:** is any plane parallel to the medial plane and passing through the head, body or limb parallel to the median plane.
3. **Transverse or segmental**: is a plane passing perpendicular to the median plane or at right angles to its long axis or an organ or limb and divides the body into cranial and caudal segments.
4. **Frontal (or coronal)**: is a plane passing perpendicular to both the median and transverse planes.

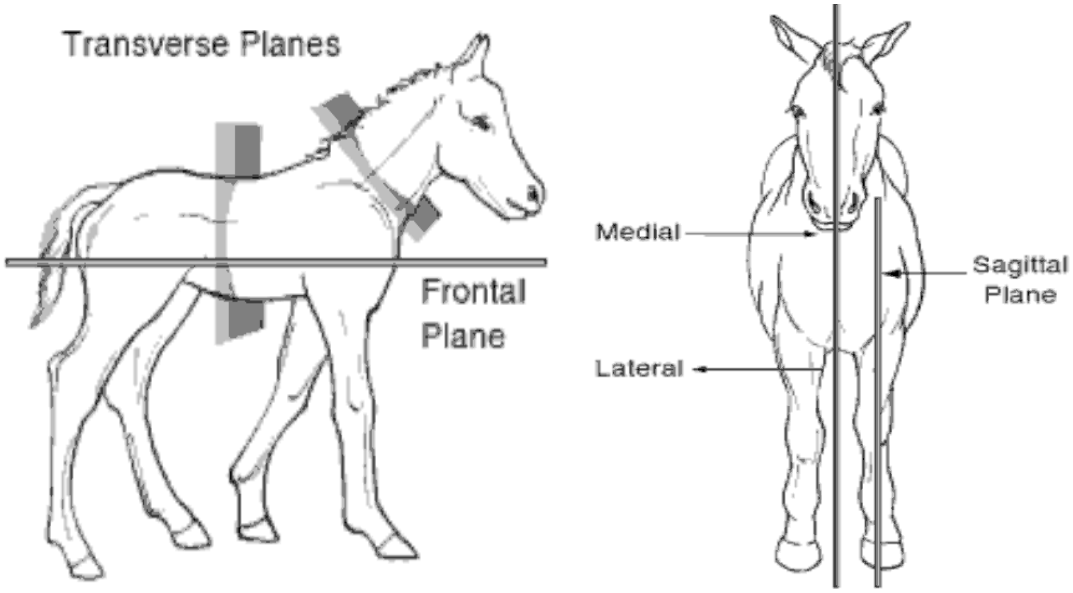


Fig. 1. Plane of reference of the body

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is any plane parallel to the medial plane and passing through the head, body or limb parallel to the median plane?(3 pts)
2. What is a plane passing perpendicular to both the median and transverse planes?(3 pts)

Note: **Satisfactory rating – 6 points** **Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1.

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2.

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Information sheet-3	Using appropriate directional terms in the description of locations of body parts

3.1 Directional terms

***Cranial**:* is the head-end of the body. It refers a surface towards or relatively near to the head. On the limbs, it only applies to structures above the carpus and tarsus.

Caudal: is the tail-end of the body. It refers to the surface towards or relatively near the tail. On the limbs, again it applies to structures above the carpus and tarsus.

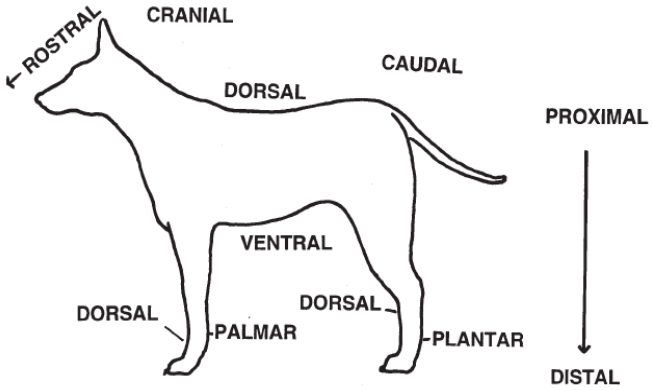


Figure 1-D: Terms of the oral cavity, body and limbs

***Dorsal**:* the opposite surface to the preceding (i.e. towards or relatively near to the top of the head, back of the neck, trunk or tail). On the limbs, it applies to the upper or front surfaces of the carpus (knee), tarsus (hock), metapodium (homologous to the hand and foot), and digits.

Ventral: refers to the surface directed towards the ground/towards or relatively near to the underside of the head or body.

Deep and ***internal*** indicate proximity to the center of an anatomical structure. The humerus (arm bone) is deep in relation to all other structures in the arm.

Superficial and ***external*** refer to proximity to the surface of the body. Hair is superficial to all other structures of the body.

Proximal means relatively close to a given part, usually the vertebral column, body, or center of gravity. Proximal is generally used in reference to an extremity or limb. The carpus or knee is proximal to the foot.

Distal means farther from the vertebral column, and like proximal, it is generally used in reference to portions of an extremity. The hoof is distal to the carpus or knee.

Medial is an adjective meaning close to or toward the median plane. The heart is medial to the lungs; it is closer to the median plane than are the lungs. The chestnut is on the medial aspect (inside) of a horse's limb; it is on the side closest to the median plane.

Lateral is the antonym of medial; it means away from the median plane. The ribs are found lateral to the lungs, that is, farther from the median plane.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. _____ is refers a surface towards or relatively near to the head? (3 pts)
2. _____ refers to the surface directed towards the ground/towards or relatively near to the underside of the head or body (3pts.)
3. _____is an adjective meaning close to or toward the median plane (3pts)

Note: **Satisfactory rating – 9 points** **Unsatisfactory - below 9 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1.

- _____
- _____
- _____

2.

- _____
- _____

3. _____

Reference

https://www.kenhub.com/en/library/anatomy/integumentary-system

https://www.ncbi.nlm.nih.gov/books/NBK27092/

http://aevm.tamu.edu/files/2010/06/Anatomy_and_Physiology.pdf

https://craftx.org/sites/all/themes/craft_blue/pdf/Anatomy_and_Physiology_of_Animals.pdf

Dairy production

Level –III

Learning Guide-19

Unit of Competence: Identify and describing Anatomy, Physiology and Behavior of Dairy Animal

Module Title: Identifying and describing Anatomy, Physiology and Behavior of Dairy Animal

LG Code: **AGR DRP3 M05 LO2 LG19**

TTLM Code: **AGR DRP3 TTLM 1119v1**

LO 2: Identify the structures and locations of the different body systems

Instruction Sheet 1	Learning Guide 19

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- ❖ Identifying and recognizing components of the integumentary system.
- ❖ Recognizing Components of musculo-skeletal system with their respective locations.
- ❖ Identifying components of the digestive system including the accessory digestive organs.
- ❖ Identifying components of the respiratory system with their respective locations.
- ❖ Identifying components of the circulatory system with their respective locations.
- ❖ Identifying components of the uro-genital system with their respective locations
- ❖ Identifying the form and structure of the mammary gland.
- ❖ Identifying and describing components of the immune system
- ❖ Identifying and recognized components of the nervous system

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Components of the integumentary system are identified and recognized in different animal species
- Components of musculo-skeletal system with their respective locations are recognized in different animal species
- Components of the digestive system including the accessory digestive organs; with their respective locations, are identified in different species
- Components of the respiratory system with their respective locations are identified in different species
- Components of the circulatory system with their respective locations are identified in dairy animals
- Components of the uro-genital system with their respective locations and the form and structure of the mammary gland are identified
- Components of the immune system are identified and described for different animal species
- Components of the nervous system are identified and recognized in different animal species

Learning Instructions:

1. Read the specific objectives of this Learning Guide 19.
2. Follow the instructions described in number 1 to 7.
3. Read the information written in the “Information Sheet (**1, 2, 3, 4, 5, 6, 7, 8 and 9)** in page **13, 16, 21, 25, 29. 37, 44, 48 and 53** respectively
4. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
5. Accomplish the **“Self-check** (**1, 2, 3, 4, 5, 6, 7, 8 and 9)** in page **15, 20, 24, 28, 36, 43, 47, 52 and 56** respectively.
6. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 **in page -**
7. Do the “LAP test” in page __ (if you are ready). Request your teacher to evaluate your performance and outputs. Your teacher will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your teacher shall advice you on additional work.

Information sheet-1	Identifying and recognizing components of the integumentary system

1.1 integumentary system

The **integumentary system** is the body system which surrounds you, both literally and metaphorically speaking. You look anywhere on animal body you see and if you look around in the outside world. It is the system that can instantly tell us whether it is young or old animal.

1.1.1 Components

The integumentary system is composed of the following parts:

1. Skin
2. Skin appendages
    - Hairs
    - Nails
    - Sweat glands
    - Sebaceous glands
3. Subcutaneous tissue and deep fascia
4. Mucocutaneous junctions
5. Breasts

a) **Skin**

The skin is the largest component of this system. It is an **extensive sensory organ**, which forms an outer, **protective coat** around the entire external surface of the body. In fact, it is the largest organ of the human body, covering an area of 2 square meters. It has a thickness between 1.5 and 5 mm, depending on location.

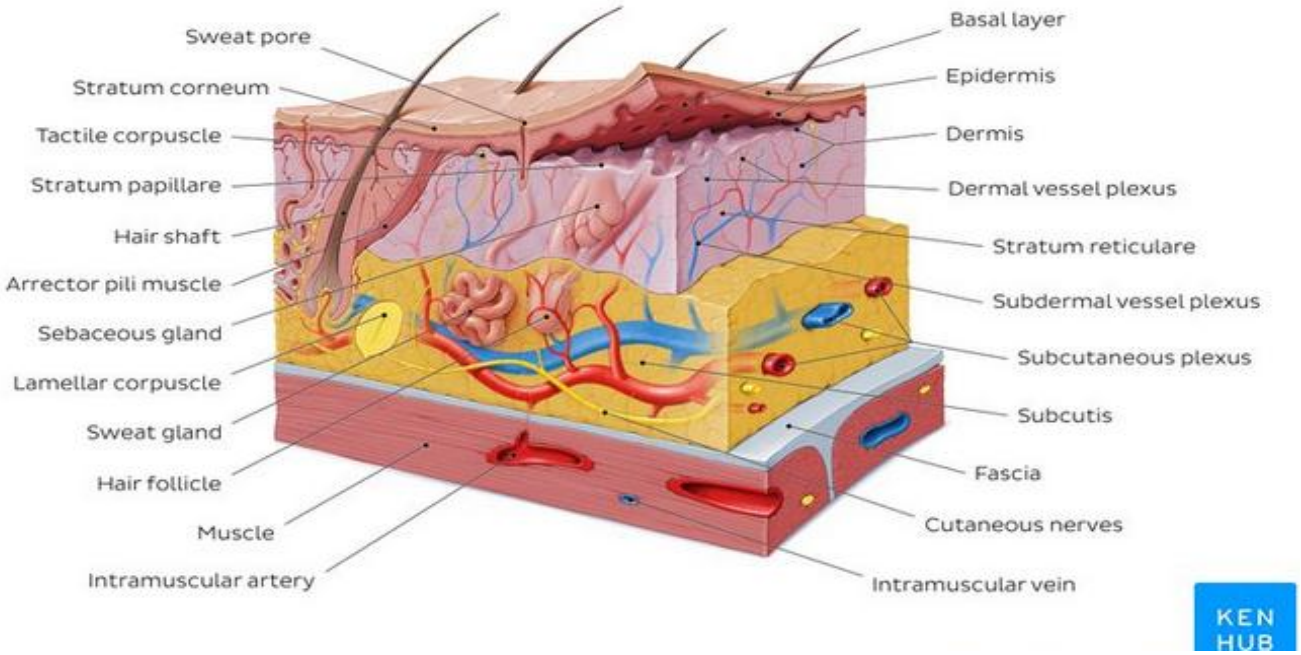
Layers

The skin is anatomically organized as follows, from superficial to deeper layers:

- Epidermis
    - Stratum corneum

- Stratum lucidum
- Stratum granulosum
- Stratum spinosum
- Stratum basale

- Dermis
  - Papillary dermis
  - Reticular dermis



Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the components of integumentary system? (4pts)
2. _____is the largest component of this system and it is an extensive sensory organ**?** (3pts)
3. What are anatomically organized skin layer from superficial to deep? (6pts)

Note: **Satisfactory rating – 13 points** **Unsatisfactory - below 13 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1

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Information sheet-2	Recognizing Components of musculo-skeletal system with their respective locations

2.1. Recognizing the components of musculoskeletal system

The musculoskeletal system is composed of / comprises

a) Muscles/ muscular system and
b) Skeleton/ skeletal system

a) The skeletal system

Osteology is the study of the bones that make up the skeleton, or framework of the body. The skeleton gives a basis for the external structure and appearance of most vertebrate animals as we know them. All mammals share a basic body plan with striking similarities in skeletal structure. Differences reflect adaptations to specific lifestyles.The skeleton of a living animal is made up of bones that are themselves living structures. They have blood vessels, lymphatic vessels, and nerves; they are subject to disease; they can undergo repair; and they adjust to changes in stress.

The skeleton consists of the framework of hard structures which protect and support its soft tissues. It includes bones, cartilages and ligaments.

The skeleton can be divided into cranial (head) and post-cranial parts. The latter can be divided into three parts:

***1*) Axial skeleton**– is composed of bones of the vertebral column, ribs and sternum.

2) Appendicular skeleton- comprises bones of the limbs including the pelvic and pectoral girdles.

3) Splanchnic or visceral skeleton–consist bones developed within some soft organs; e.g. os penis of the dog.

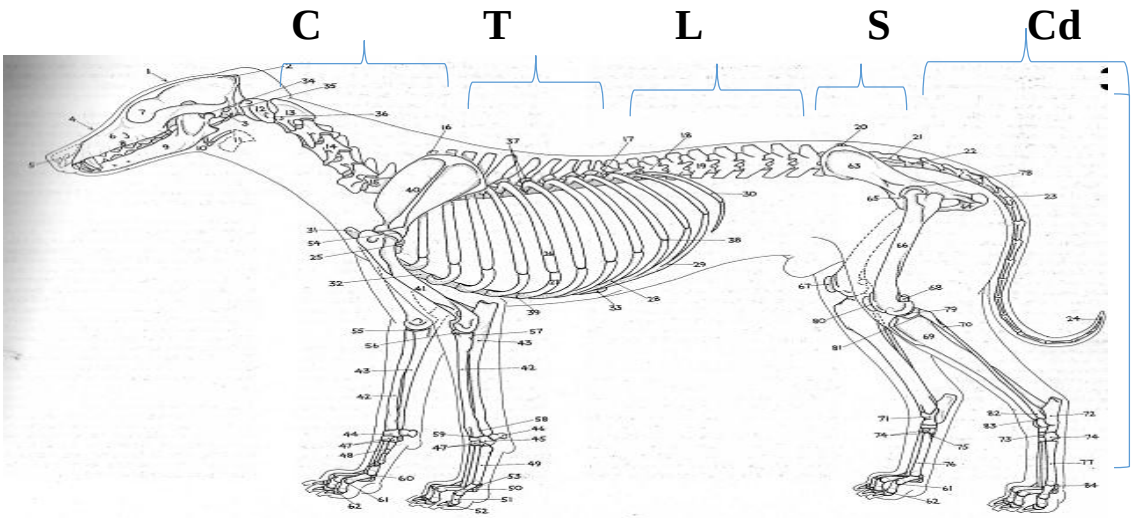


Fig.3. Skeleton of dog indicating the different regions of back bone

Components of the axial skeleton

The axial skeleton consists of a series of unpaired, median irregular bones of the vertebral column (the vertebrae) which extend from the skull to the tail. The vertebral column is divided into five different regions, each of these regions are designated by the following letters.

- **C** Cervical vertebrae: neck region
- **T** Thoracic: chest
- **L** Lumbar: loin
- **S** Sacral: pelvis, fused vertebrae
- **Cd** Caudal (coccygeal): tail

A vertebral formula for a given species consists of the letter symbol for each region followed by the number of vertebrae in that region in the given species. Vertebral formulas of common domestic animals and humans are shown in the following table.

Species	Cervical	Thoracic	Lumbar	Sacral	Caudal
Horse	7	18	6	5	15–20
Ox	7	13	6	5	18–20
Sheep	7	13	6–7	4	16–18
Goat	7	13	7	4	12
Hog	7	14–15	6–7	4	20–23
Dog	7	13	7	3	20–23
Chicken	14	7	14 (lumbosacral)		6
Human	7	12	5	5	4

A typical vertebra consists of:

(1) **Body**- cylindrical mass articulating cranially (convex) and caudally (concave) with other vertebrae.

(2) **Arch** - two lateral halves which, together with the body, form the vertebral foramen containing the spinal cord and its vessels. The base of the arch (pedicel) has vertebral notches for the passage of spinal nerves and vessels.

(3**) Processes**

a) **Articular processes**, two anterior and two posterior articulate with adjacent vertebrae.

b) **Spinous process** projects from the middle of the arch for the attachment of muscles and ligaments

c) **Transverse process**, two project laterally from the arch.

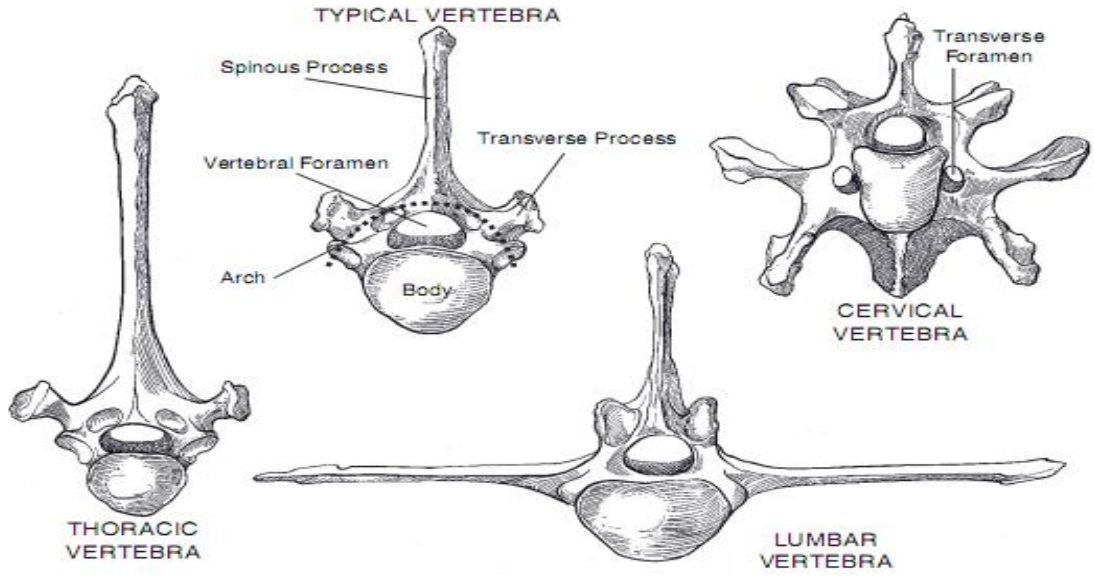


Fig.4 typical vertebra

Bones of the appendicular skeleton

Thoracic Limb		Pelvic Limb	
Part of Limb	***Bones***	***Part of Limb***	***Bones***
Thoracic (shoulder) girdle	Scapula, clavicle, coracoid	Pelvic girdle	Sacrum pelvis: ilium, ischium, pubis
Brachium (arm)	Humerus	Thigh	Femur
Antebrachium (forearm)	Radius, ulna	Crus (true leg)	Tibia, fibula
Carpus (knee)	Carpal bones	Tarsus (hock)	Tarsal bones
Metacarpus (cannon and splint bones)	Metacarpal bones	Metatarsus (cannon and splint bones)	Metatarsal bones
Phalanges (digit)	Proximal, middle, and distal phalanges	Phalanges (digit)	Proximal, middle, and distal phalanges
	Proximal and distal sesamoid bones		Proximal and distal sesamoid bones

b) The muscular system

There are three types of muscle tissues

- **Skeletal muscle tissue –**These are usually attached to the bones of the skeleton (hence the term *skeletal-muscle*) and are under voluntary control of the animal. Under the microscope, skeletal muscle fibers exhibit a characteristic striped pattern arising from the orderly arrangement of the contractile proteins within the cells. As a consequence, skeletal muscle is also called ***striated muscle***.
- **Smooth muscle-**is composed of muscle cells that have no striations visible with a microscope. Smooth muscle is found in systems of the body with autonomic function. Thus, smooth muscle is a major component of the wall of organs of the digestive and urogenital systems and most blood vessels.
- **Cardiac muscle tissue-** is characterized by fibers with visible striations, so it is considered a type of striated muscle. However, cardiac muscle, like smooth muscle, contracts intrinsically and is not under voluntary control. Cardiac muscle is restricted to the heart, where it constitutes most of the thickness of the wall. Its rhythmic contraction is responsible for the circulation of blood.

The bulk of muscle in the body is skeletal muscle and it is responsible for producing voluntary movements of the limbs, trunk and head.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the components of musculoskeletal system? (5pts)
2. What is the composed of muscle cells that have no striations visible with a microscope? (5pts)
3. What are the typical vertebra consists in animal skeleton? (5 pts)

Note: **Satisfactory rating – 15 points** **Unsatisfactory - below 15 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information sheet 3	Identifying components of the digestive system including the accessory digestive organs

3.1 Identifying organs of digestive system

The digestive system consists of a muscular tube lined with mucous membrane that is continuous with the external skin at the mouth and anus. Its primary functions are: prehension, mastication, digestion and absorption of food and elimination of solid wastes Organs of the digestive system extend from mouth and end in anus. They include: mouth, pharynx, and esophagus, fore stomach (ruminants), glandular stomach, small intestine, large intestine, rectum and the accessory glands (salivary glands, liver and pancreas)

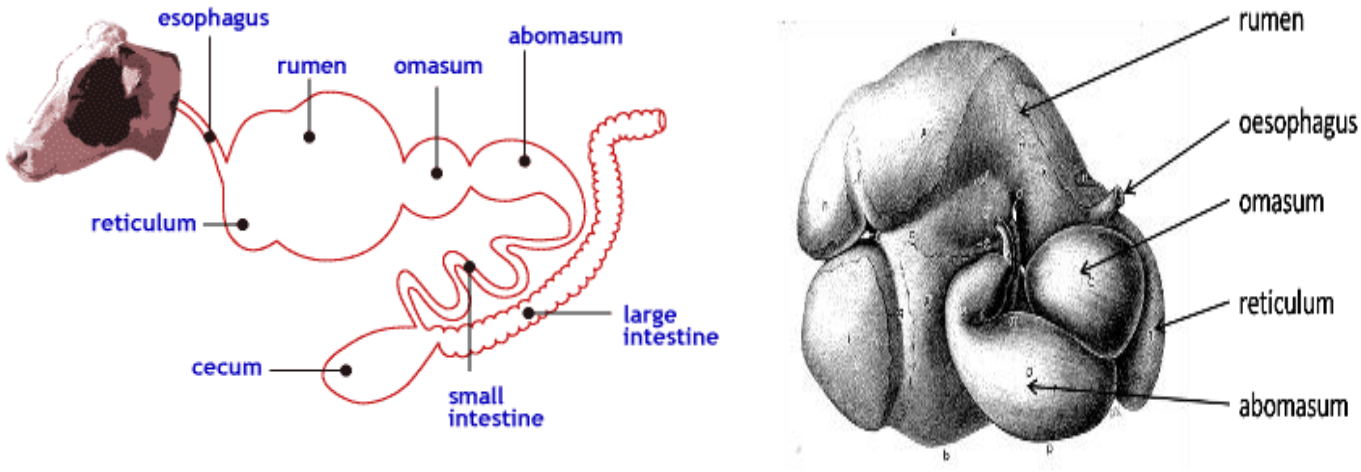


Fig 3.1. Anatomy of the ruminant stomach

For the most part, the digestive system of ruminants is very similar to that of other mammals, but the stomach is considerably different from the so-called "monogastric" condition.

The ruminant stomach is actually a single stomach modified by marked expansions of the esophageal regions into three distinct and voluminous diverticula, the rumen, reticulum and omasum, collectively known as the *fore stomach* which comprise a series of chambers where feed is subjected to digestion by microorganisms before passing through the digestive tract to the smaller glandular portion of the stomach in the ruminants, the abomasum.

3.1.1. Partition of stomach in Ruminant

A. Rumen

The rumen is an enormous space filled with chewed and half-chewed materials the cow has ingested, swallowed, regurgitated, and swallowed again (often several times). A combination of mechanical mastication and cellulase enzymatic action on the hard cellulosic material of the bovine diet permits the breakdown of these otherwise-indigestible materials. The cow who "chews her cud" is methodically grinding the food into smaller and smaller bits, allowing the symbionts more and more surface area on which to work.

If you examine it first by holding it up to the light you'll see that projecting from the wall are numerous finger-like projections. These are the ruminal papillae, which are somewhat conical in three dimensional views.

Observing the papillae at low power, you should see several interesting histological features. First, they're covered with *stratified squamous epithelium*. Moreover, it's keratinized, which is a little unusual by the standards of non-ruminant animals, but it's normal here. Despite keratinization, absorption occurs across the epithelium in the rumen. Note that there are no glands present in either the mucosa or sub mucosa.

B. **Reticulum**

It's sometimes described as a "honeycomb." Notice that in the reticulum, there *is* muscular mucosa, of rather odd type. It consists of bands of smooth muscle which run through the *tops* of the ridges of the honeycomb, and which are more or less isolated from the lower levels, nearer the wall. It can be shown in gross specimens that this smooth muscle is continuous with that of the esophagus. The contraction of the muscular mucosae serves to contract the openings of the honeycomb, somewhat like a purse-string closes a purse.

C. **Omasum**

This organ has a number of colorful layman's names applied to it, among them "many-plies" and "the butcher's Bible," the latter referring to its similarity to the leaves of a book in gross appearance. The omasum has muscular mucosa which underlies the epithelium; but in addition to muscular mucosae, there is an excursion of smooth muscle from the *tunica muscular* up between the folds of the muscular mucosae. What at first glance

appears to be a "spine" of muscle running up through each of the "leaves" of the mucosa can be resolved on careful examination as a three-layered structure: muscularis mucosae on the outside, with tunica muscularis inside it. If you follow the central strand of muscle outwards you should find where it comes off the inner layer of the tunica muscularis. As with the previous divisions, the epithelium is stratified squamous, and there are no glands.

D. Abomasum

This portion is the true glandular stomach of ruminants. Its histology is very similar to the fundic region of the stomach of monogastric animals. The surface epithelium here is simple columnar, not stratified squamous. There are gastric pits (foveolae) and below those, there are gastric glands of the fundic type. The glands contain parietal cells (which make hydrochloric acid) and chief or zymogenic cells which make digestive enzymes.

The submucosa of this region is much more developed than in the previous divisions of the stomach. The abomasum, unlike the rumen, reticulum, and omasum, does *not* absorb nutrients. As with monogastric animals, it prepares food for enzymatic breakdown and absorption in the small intestine.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the four compartment in ruminant's digestive system? (6pts)
2. _____is the true glandular stomach of ruminants? (6 pts)

Note: **Satisfactory rating – 12 points** **Unsatisfactory - below 12 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information sheet 4	Identifying components of the respiratory system with their respective locations

4.1. Recognizing parts of respiratory

The **respiratory system** includes the:

- mouth and nostrils
- trachea
- Lungs and smaller airways (bronchi and bronchioles).

4.2. The upper respiratory tract consists of the nostrils, nasal cavity, pharynx, larynx and the trachea

Nostrils: Also called nares are Paired, external dilatable openings which are used for

Advantage

The lateral aspect of the nose is covered with typical hairy skin, which contains both sebaceous and sweat glands. The hairless region of the most rostral parts of the nose in species other than the horse contains no sebaceous glands but does have numerous sweat glands, which keep the region around the nostrils moist. This area is the planumnasale in the sheep and goat, planumrostrale in the pig, and planumnasolabiale in the cow. The grooves and bumps in the plana are distinctive enough to allow nose prints to be used for positive individual identification.

Nasal Cavities: - are Paired cavities Separated soft palates from mouth by the hard palate and Nasal Septum, and from mouth by. Mucosal-lined Turbinate Bones (Conchae) Form passages called meatuses. Functions of Mucosa

a. Warm and humidify air
b. Cool blood to brain
c. Olfaction

The nasal cavity is separated from the mouth by the hard and soft palates and separated intotwo isolated halves by a median nasal septum.

Pharynx: - is a Common pathway for air and food lying caudal to the oral and nasal cavities. Openings into the pharynx include the two caudal nares (choanae), two auditory tubes from the middle ears, the oral cavity, the larynx, and the esophagus.

The walls of the pharynx are supported by striated muscles whose actions assist in deglutition (swallowing) and phonation.

Larynx- is the gatekeeper to the entrance of the trachea. It maintains a rigid, boxlike shape via a series of paired and unpaired cartilages that are moved relative to one another by striated laryngeal muscles.

Trachea- extends from the caudal end of the larynx to the bronchi. It is formed by a series of C-shaped hyaline tracheal cartilages that provide cross-sectional rigidity to resist collapse and are joined one to another by elastic annular ligaments that permit the trachea considerable flexibility to follow movements of the neck. The dorsal side of the trachea is completed by connective tissue and the m. trachealis, a smooth muscle whose tone affects the diameter of the trachea.

The trachea passes caudad as far as the base of the heart, where it divides into two principal bronchi, one for each lung. it supplies the cranial lobe of the right lung. The principal bronchi branch into secondary (also called lobes) then tertiary bronchi, subsequent branches becoming smaller and smaller forming bronchioles. The bronchiole eventually branches into several alveolar ducts, which terminate in clusters of air sacs, the alveoli where the exchange of gases with the blood takes place.

4.1. Identifying regional anatomy of lung

Lungs- Each lung is roughly conical, with the base resting against the cranial side of the diaphragm and the apex in or close to the thoracic inlet. The medial aspect of each lung features an indentation, the hilus, where the principal bronchus, pulmonary vessels, lymphatics, and nerves enter and leave the lung. In ruminants and the pig, the left lung is divided into cranial (apical) and caudal (diaphragmatic) lobes, with the cranial lobe having a further division into cranial and caudal parts.

The right lung in these animals is divided into four lobes *fig 4.1*: cranial and caudal lobes as on the left, plus a middle lobe between these and a ventro-caudal accessory lobe near the midline

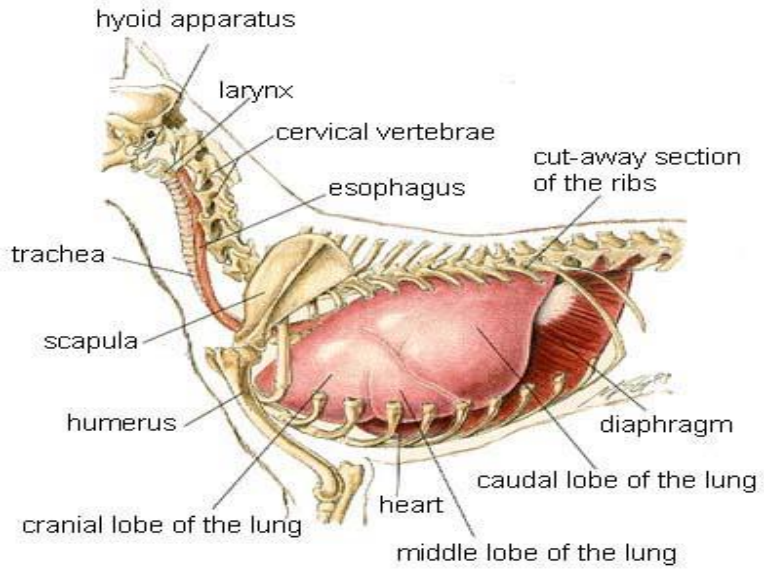


Fig. 4.1. Regional anatomy of lung

Lungs are a pair of spongy respiratory organs situated on the thoracic cavity separated from each other by the mediastinum.

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the main parts of respiratory system? (4pts)
2. _____is extends from the caudal end of the larynx to the bronchi? (3pts)
3. What is the gatekeeper to the entrance of the trachea? (3pts)

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

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Information sheet 5	Identifying components of the circulatory system with their respective locations

5.1. The component of Cardiovascular System

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.

The systemic circulation is a subdivision of the cardiovascular system consisting of all vessels associated with all organs other than the parts of the lungs where exchange of gases oxygen and carbon dioxidetakes place. When blood returns from the systemic circulation, it enters the right side of the heart. The right side of the heart pumps blood into the pulmonary circulation.

The pulmonary circulation consists of vessels associated with the parts of the lungs where the exchange of gases takes place. From the pulmonary circulation, blood reenters the heart on the left side, and from here it is pumped out into the systemic circulation to begin the loop again.

5.1.1 Heart

The heart is a cone-shaped hollow muscular structure. The ***base*** is directed dorsad or cranio-dorsad and is attached to other thoracic structures by large arteries, veins, and the pericardial sac. The ***apex*** of the heart is directed ventrad and is entirely free within the pericardial sac. In the living animal, the right side of the heart is on the right side of the body

a) Structure of heart

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.

- The ***epicardium*** is actually the visceral layer of pericardium.
- The ***endocardium*** is a layer of simple squamous endothelial cells which lines the chambers of the heart, covers the heart valves, and is continuous with the lining of the blood vessels.
- The ***myocardium*** consists of cardiac muscle which is also called involuntary

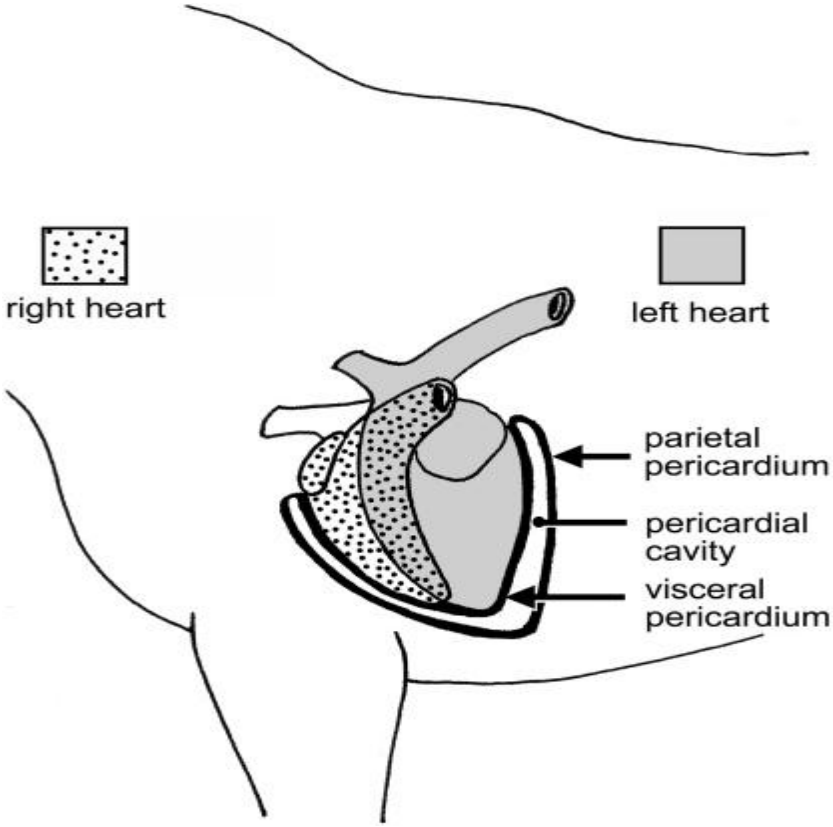


Fig. 5.1 Layers of heart

The heart is divided into right and left sides, which correspond to the low-pressure (pulmonary circulation) and high-pressure (systemic circulation) systems mentioned earlier. Each side has two chambers: an ***atrium***, which receives blood by way of large veins, and a ***ventricle***, which pumps blood from the heart through a large artery. The atria are thin-walled chambers, each of which features an appendage called an ***auricle***.

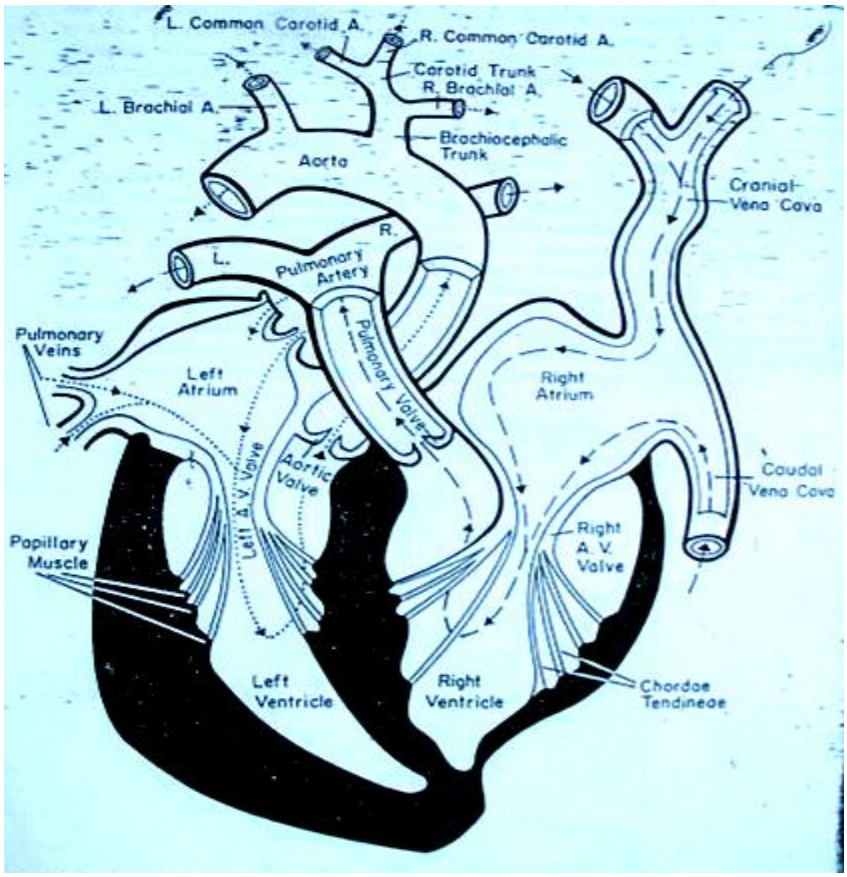


Fig. 5.2 parts of heart

5.1.2. The blood vessels

Arteries: Vessels that carry blood away from the heart are called ***arteries***.

Veins: Vessels that carry blood toward the heart are called ***veins***.

Lymph vessels or **lymphatics:** In addition, a system of vessels which carry tissue fluid or lymph to large veins are called ***lymph vessels***, or ***lymphatics***.

Blood vessels resemble the branching of a tree, in that the arteries start as large vessels and divide into smaller and smaller branches. The smallest arteries are called arterioles. The arterioles in turn are, continuous with the smallest blood vessels, capillaries. Capillaries again unite to form venules, which in turn unite to form larger and larger veins. The largest veins finally empty into the atria of the heart.

a) ARTERIES

Arteries are tubular structures which carry blood away from the heart. The ***largest arteries*** are known as elastic arteries because a large portion of the arterial wall consists

of elastic tissue. This elasticity is important in maintaining blood pressure during diastole, the period during which the ventricles are relaxed.

Smaller arteries contain a large amount of smooth muscle in the arterial wall in place of the elastic tissue. This smooth muscle controls the size of the vessel and consequently the amount of blood that can flow through it during a given period of time.

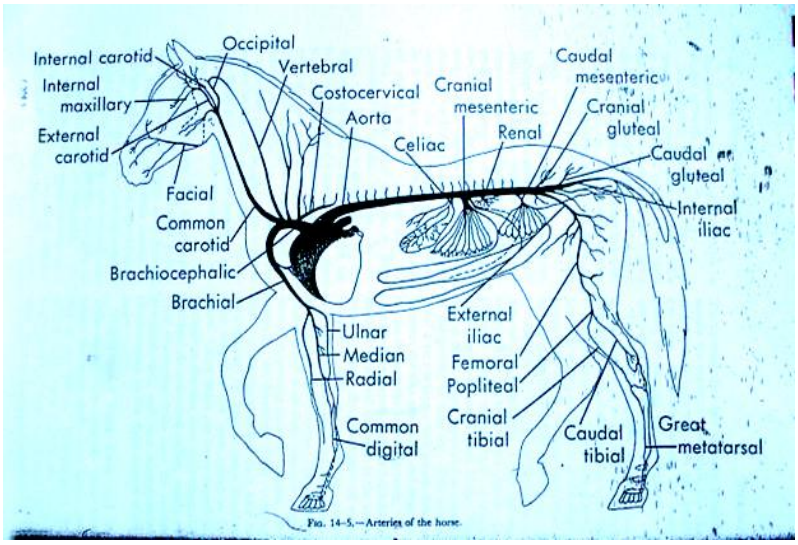


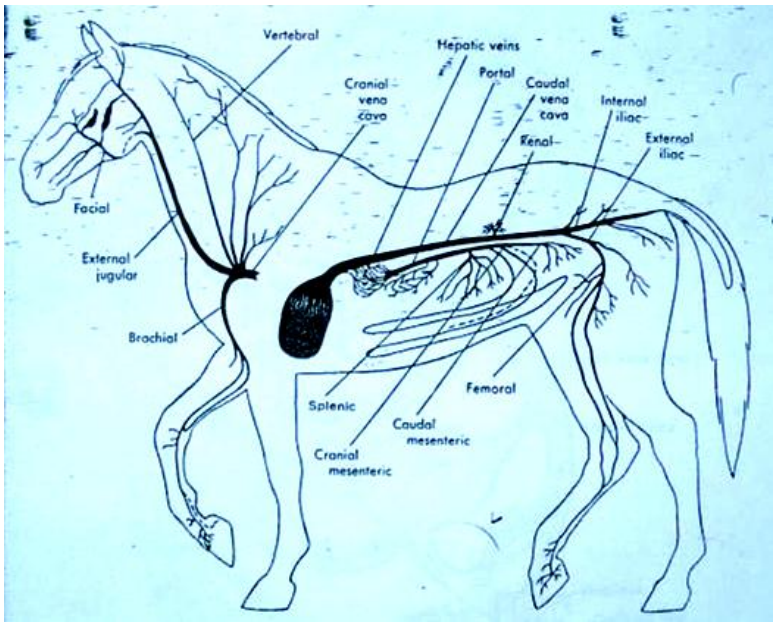
Fig. 14-5.—Arteries of the horse.

←*Fig 5.4 Arteries of the horse*

Arterioles, the smallest arteries, are very muscular immediately before giving rise to capillaries. The heavy, circular, smooth muscle surrounding the terminations of the arterioles is important because it controls the amount of blood each capillary receives. Tension of the muscle around the arterioles also aids in maintaining blood pressure throughout the arterial system. In case of shock, the arterioles dilate to relax, and a large part of the blood volume is lost within the capillary beds, particularly those of the viscera.

b) Veins

Veins are larger than the arteries they accompany and have much thinner walls, with only a slight amount of muscle tissue present. Valves, usually consisting of two cusps each, are scattered at irregular intervals throughout the venous and lymphatic systems. A valve frequently is present where two or more veins unite to form a larger vein.

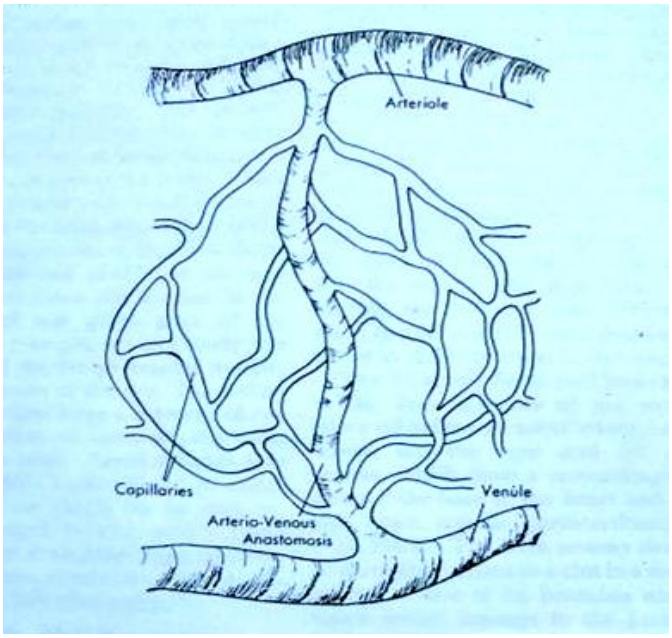


←*Fig 5.5 Veins of the horse*

The valves are always directed to blood will flow only toward the heart. These valves are prevent blood being forced back into capillary beds and also permit muscle contractions and movement of body parts to aid the flow of blood toward the heart. Blood pressure in veins is quite low, since very little arterial pressure is transmitted through the capillaries to the veins. This situation may be compared to water from a river entering a lake with considerable force, while the water leaving the force found at the inlet.

All veins are tributaries to larger veins which eventually enter the right or left atrium of the heart.

c) Capillaries



←Fig 5.5 Capillary bed interposed between an arteriole and a venule, showing an arterio-venous anastomosis.

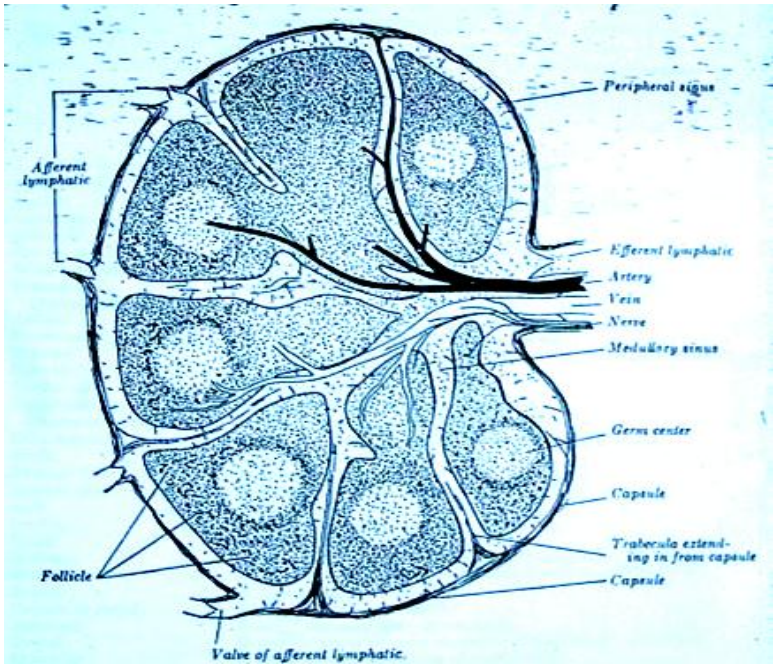
Capillaries are tiny tubes almost entirely composed of endothelium, a continuation of the simple squamous epithelium which lines the heart and blood vessels. These thin-walled vessels are only large enough in diameter to accommodate a single file of erythrocytes. The wall acts as a semi-permeable membrane which permits water, oxygen, and nutrients to leave the blood stream for tissue cells and permits waste products from tissue cells to enter the blood. Much of the fluid that passes out of the capillaries into tissue spaces again returns to the blood stream by passing back through the capillary walls.

5.1.2 Lymph nodes

Lymph nodes, also called lymph glands, are discrete nodular structures scattered along the course of lymphatic vessels. These lymph nodes serve as filters for the lymph and act as one of the first body defenses against infection by producing lymphocytes and antibodies.

Each lymph node is surrounded by a connective-tissue capsule that blends with the surrounding connective tissue and acts as a means of holding it in place. The capsule also sends numerous connective-tissue septa (or trabeculae) into the substance of the node. The node is divided into a cortex and a medulla, which contain large numbers of lymphocytes. Those in the cortex are arranged in dark-staining groups known as primary nodules. Within the primary nodules are light-staining areas called secondary nodules

because they are located within the primary nodules. Secondary nodules are areas of rapid cell multiplication and for this reason are also called germinal centers. Lymphocytes in the medullary portion of the lymph nodes are arranged in cords rather than nodules.



←*Fig* 5.*7 Diagram of a typical lymph node*

In addition to the lymphocytes, lymph nodes also contain plasma cells that are sometimes classified with the connective tissue cells. Plasma cells are believed to be an important source of antibodies produced by the animal body. They are somewhat larger than lymphocytes, with dark-staining granules in the nucleus that often are arranged in the form of a cart wheel or the form of the dial of watch. The cytoplasm is rich in RNA (ribonucleic acid) granules, suggesting extensive protein synthesis.

Immediately deep to the capsule is a space, the lymph sinus of the cortex that communicates with other lymph sinuses located in the cortex and in the medulla.

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the component of Cardiovascular System? (2pts)
2. What are components of blood vessels? (3pts)
3. The heart wall consists of three layers. What are they? (4 pts)

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

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Name: _____ Date _____

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Information sheet 6	Identifying components of the uro-genital system with their respective locations

6.1. Component uro-genital system

The urogenital system is compose of two systems

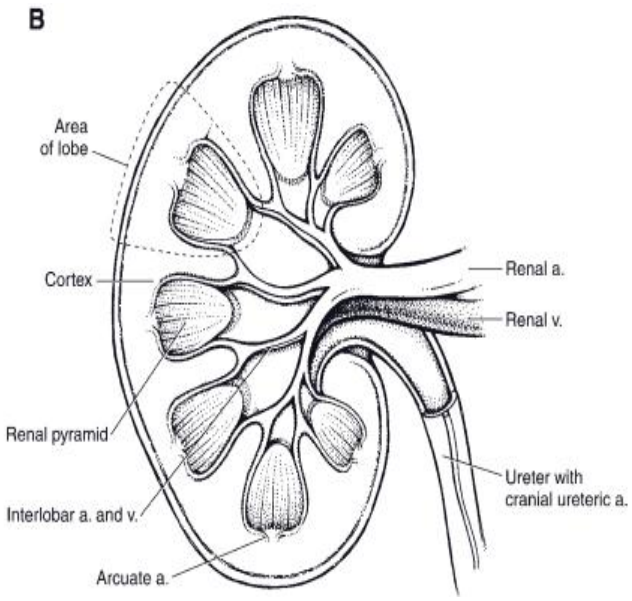
1. The urinary system
2. The genital / reproductive system

4. The urinary system

The urinary system consists of two kidneys, two ureters, the urinary bladder, and the urethra. The paired kidneys remove waste products from the blood, help regulate the composition of plasma, and perform certain hormonal functions. The system of tubules in each kidney coalesces into a single mucomuscular tube, the ureter, which extends caudad to empty into the urinary bladder, a distensible reservoir for the storage of urine. When full, the urinary bladder discharges the urine through the urethra to the outside of the body.

Kidneys

The kidneys are in the dorsal part of the abdominal cavity on each side of the aorta and caudal vena cava, just ventral to the first few lumbar vertebrae. In most domestic animals, the right kidney is slightly more cranial than the left, with the cranial pole of the right kidney lying snugly in a complementary fossa of the liver. The left kidney tends to be more pendulous, and in ruminants, the fore stomach may push the left kidney to the right as far as the median plane or beyond, particularly when the rumen is full.



The portion of the kidney immediately surrounding the renal pelvis is the renal ***medulla*****,** which appears striated because of the radially arranged ***collecting tubules*****.** In addition to collecting tubules, the medulla also contains some ***loops of Henle***(descending and ascending loops). The medulla is surmounted peripherally by the renal ***cortex*****,** in which reside the ***renal corpuscles*****,** the histological units of filtration.

Figure.

Ureter-is a muscular tube that conveys urine from the kidney to the urinary bladder. The smooth muscle of the ureter undergoesperistaltic waves of contraction that encourages the flow of urine to the urinary bladder. Each ureter originates at the renal pelvis (or the major calices of the bovine kidney) and emptiesinto the **urinary bladder** near its neck at the**trigone**

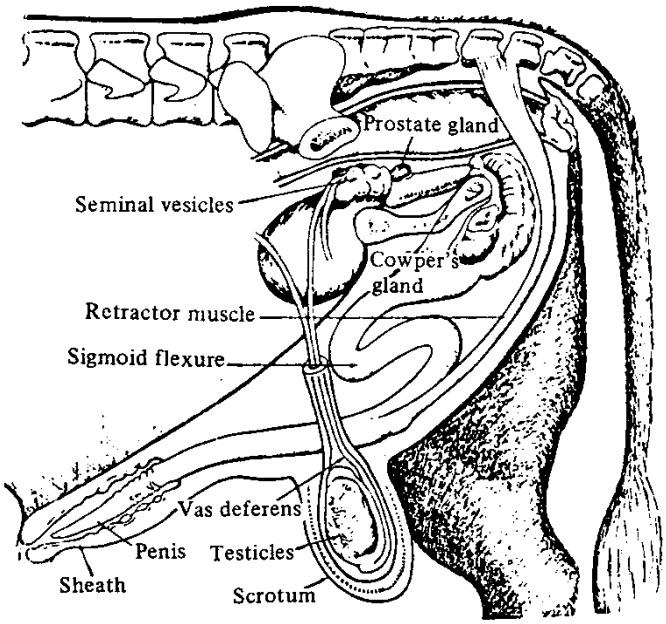
Urinary bladder- is a hollow muscular organ that varies in size and position with the amount of urine it contains. The empty, contracted bladder is a thick-walled, piriformorganon the floor of the pelvic cavity. As it fi llswithurine, its wall thins, and it enlarges craniad toward and then into the abdominal cavity.

Urethra- the **pelvic urethra** extends from the urinary bladder across the floor of the pelvic canal to the ischial arch. In female animals, it opens onto the floor of the vaginal vestibule. In the male animal, it receives the ducts deferens and ducts from the accessory sex glands, and then passes through the penis as the **penile urethra.** In both sexes, the pelvic urethra is surrounded by a true sphincter, the striated skeletal **m. urethralis,** over which the animal exercises voluntary control.

5. Reproductive system

i. Anatomy of the male reproductive system

Fig 6.1 Reproductive system of the bull



Embryologically the reproductive system is closely related to the urinary system. Often both are considered together under the title urogenital system. The urethra is used as a passage by both the urinary system of female and the male reproductive system.

The male reproductive system of farm mammals consists of two testes (or testicles) contained in the scrotum, accessory organs including ducts and glands, and the penis, which is sometimes referred to as the external genitalia. The testes produce spermatozoa (the male sex cells also called sperm) and testosterone (the male sex hormone). The scrotum provides the favorable environment of a lower temperature for the production of spermatozoa. The remaining structures assist the spermatozoa to reach their ultimate goal, the ovum of the female, in a condition conducive to fertilization of the ovum. These structures include the epididymis and vas deferens for each testicle, accessory sex glands, (seminal vesicles, prostate, and bulbo-urethral glands), and the urethra and the penis.

The testicles

The testicles vary somewhat from species to species as far as shape, size, and location is concerned, but the essential structure is the same. Each testicle consists of a mass of seminiferous tubules surrounded by a heavy fibrous capsule called the tunica albuginea, pass inward from the tunica albuginea to form a framework, or stroma, for support of the seminiferous tubules.

The penis – is the male organ of copulation, the penis, maybe divided into three general areas: the glans, or free extremity; the main portion, or body; and the two crura, or roots that attach to the ischial arch of the pelvis.

ii. Anatomy of the female reproductive system

Reproduction in the female is complex process that involves the entire animal body. The reproductive system itself includes the two ovaries, two Fallopian tubes and two fimbriae, the vagina, and the vulva. The ovum (or egg) is **ex**pelled from the ovary and received by the fimbria and carried to the Fallopian tube, where fertilization normally occurs during passage of the ovum from the ovary to the uterus. Within the uterus the fertilized ovum develops into an embryo and then into a fetus, and finally passes out of the uterus through the vagina and vulva as a newborn animal.

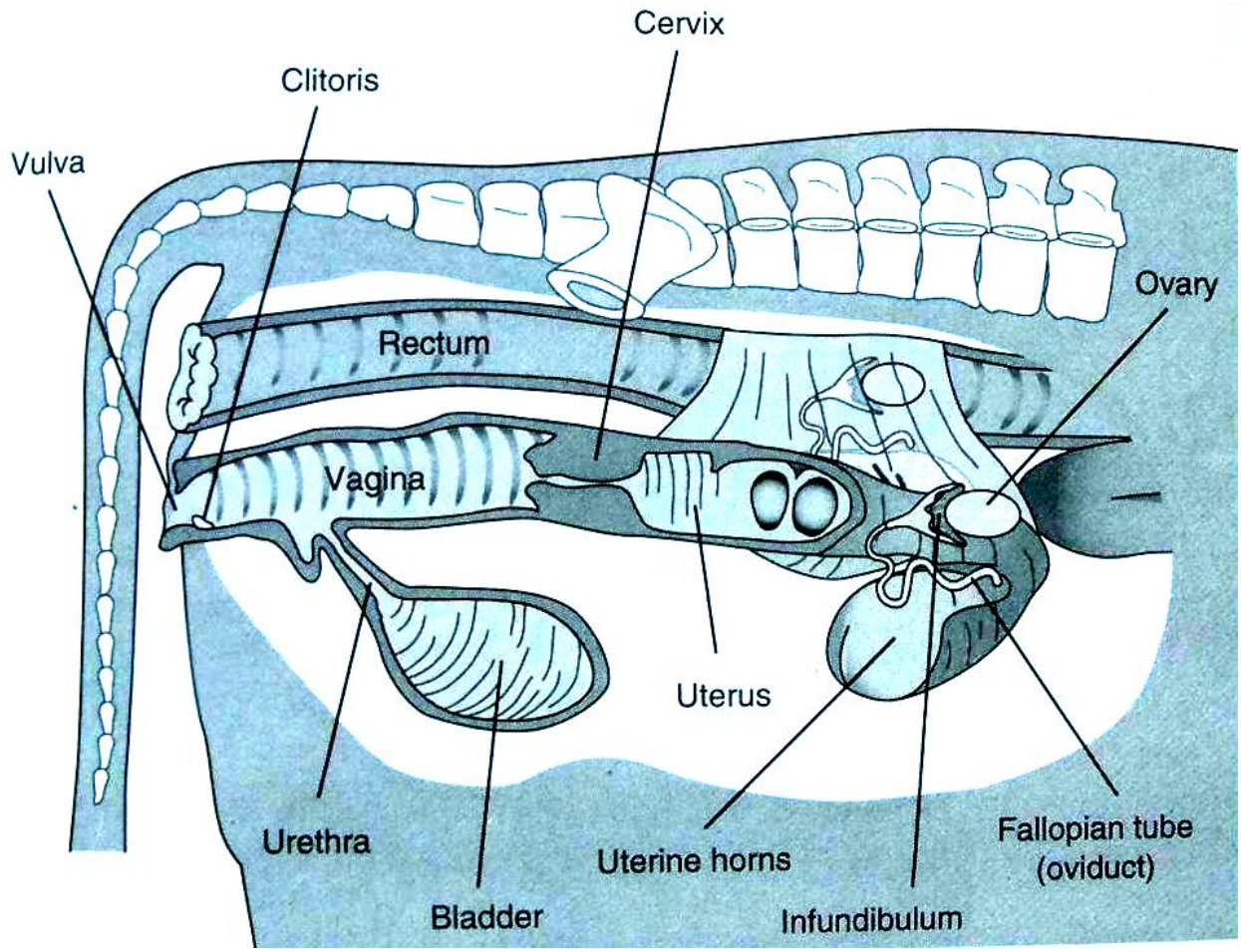


Fig 6.2 the reproductive system of female (side view)

The ovaries

The ovaries are the primary (or essential) organs of reproduction in the female, just as the testes are in the male. The ovaries may be considered to be both endocrine and cytogenic (cell producing) in nature, since they produce hormones which are absorbed directly into the blood stream and also produce ova which are expelled from the gland.

The fallopian tubes

The Fallopian tubes (also called oviducts or uterine tubes) are paired convoluted tubes which conduct the ova from each ovary to the respective horn of the uterus and also serve as the usual site for fertilization of ova by spermatozoa. The portion of the Fallopian tube adjacent to the ovary is expanded to form a funnel –like structure called the infundibulum, or fimbria. Some authorities consider the fimbria to include the entire expanded ovarian extremity of the Fallopian tube. Other authorities use the term fimbria when referring only to the fringe-like margin of the ovarian end of the Fallopian tube and call the funnel-shaped part the infundibulum. The fimbria appears to take an active part in ovulation at least to the extent of partially or completely enclosing the ovary and directing the ovum into the abdominal opening of the Fallopian tube.

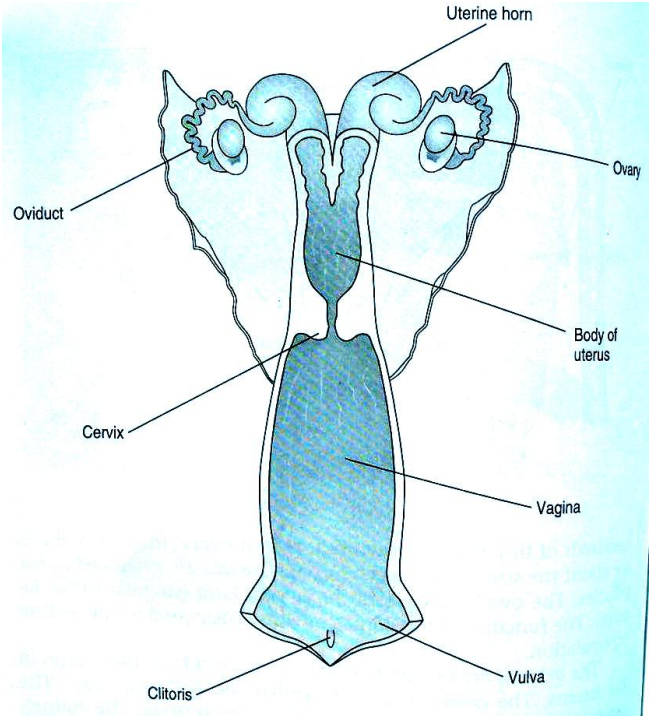


Fig 6.3 Female reproductive tracts of some domestic animals (top view)

The uterus

The uterus of domestic mammals consists of a body, a cervix (neck), and two horns, or cornua. The relative proportions of each varies considerably with the species, as does the shape and arrangement of the horns. The body of the uterus is largest in the mare, less extensive in the cow and sheep, and very small in the pig and dog. Superficially the body of the uterus of the cow appears relatively larger than it actually is because the caudal parts of the horns are bound together by the intercornual ligament. Like most other hollow internal organs, the uterine

wall consists of a lining mucous membrane, and an outer serous layer (peritoneum).

The vagina

The vagina is that portion of the birth canal that is located within the pelvis between the uteri cranially and the vulva caudally. The vagina also serves as a sheath for acceptance of the penis of the male during copulation, the act of breeding or service. The mucous membrane of the vagina is glandless, stratified squamous epithelium, except in the cow, where there are some mucous cells in the cranial part of the vagina next to the cervix, and the surface fails to cornify, probably because of low levels of circulating estrogens. The submucosa is loose and the muscular layers consists of an inner circular layer of smooth muscle and an outer longitudinal layer of smooth muscle. The serosa (peritoneum) is present only on the cranial part of the vagina. The caudal portion of the vagina is covered by pelvic fascia (connective tissue).

The vulva

The vulva is the external portion of the genitalia of the female that extends from the vagina to the exterior. The junction of the vagina and vulva is marked by the external urethral orifice and frequently also by a ridge which is the vestigial hymen. Occasionally the hymen may be complete enough to interfere with copulation. In domestic animals, the labia, or lips, of the vulva are simple rather than consisting of major and minor labia as in the human. The ventral commissure (lowest part) of the vulva conceals the clitoris, which has the same embryonic origin as the penis in the male.

Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are component uro-genital system? (4pts)
2. _____is a muscular tube that conveys urine from the kidney to the urinary bladder? (2pts)
3. What are the main reproductive system of male animal? (4pts)

Note: Satisfactory rating – 10 points Unsatisfactory - below 10 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

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Information sheet -7	Identifying the form and structure of the mammary gland

7.1. Anatomy and Architecture of Mammary Gland

I. Mammary Glands of Cows

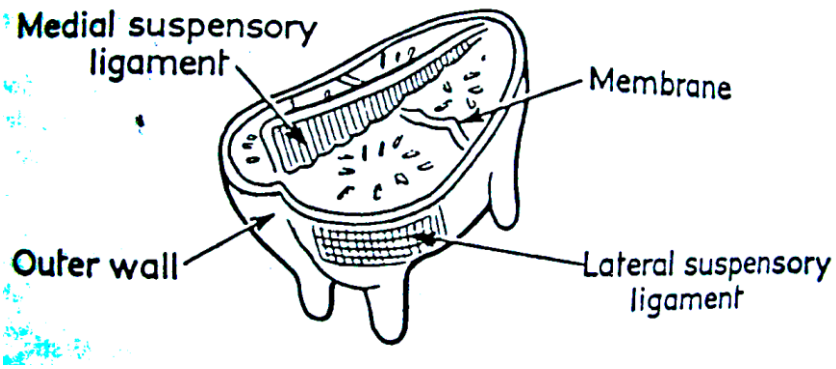
The mammary glands or udder of the cow is covered with fine hair except teat which is totally hairless. A desirable udder should be capacious, possess a relatively level floor, and be strongly attached, extending well forward with a rear attachment high and wide. The texture of the udder should be soft, pliable and elastic; well collapsed after milking. The teats should be uniform, of convenient length and size, cylindrical in shape, well-spaced and free from obstructions.

Exterior of the udder. The udder is a skin gland and is located entirely outside the abdominal cavity. Its only connection with the abdominal cavity is through the inguinal canal, a potential tube about four inches long, through which blood and lymph vessels and nerve fibres leave the abdominal cavity to enter the udder.

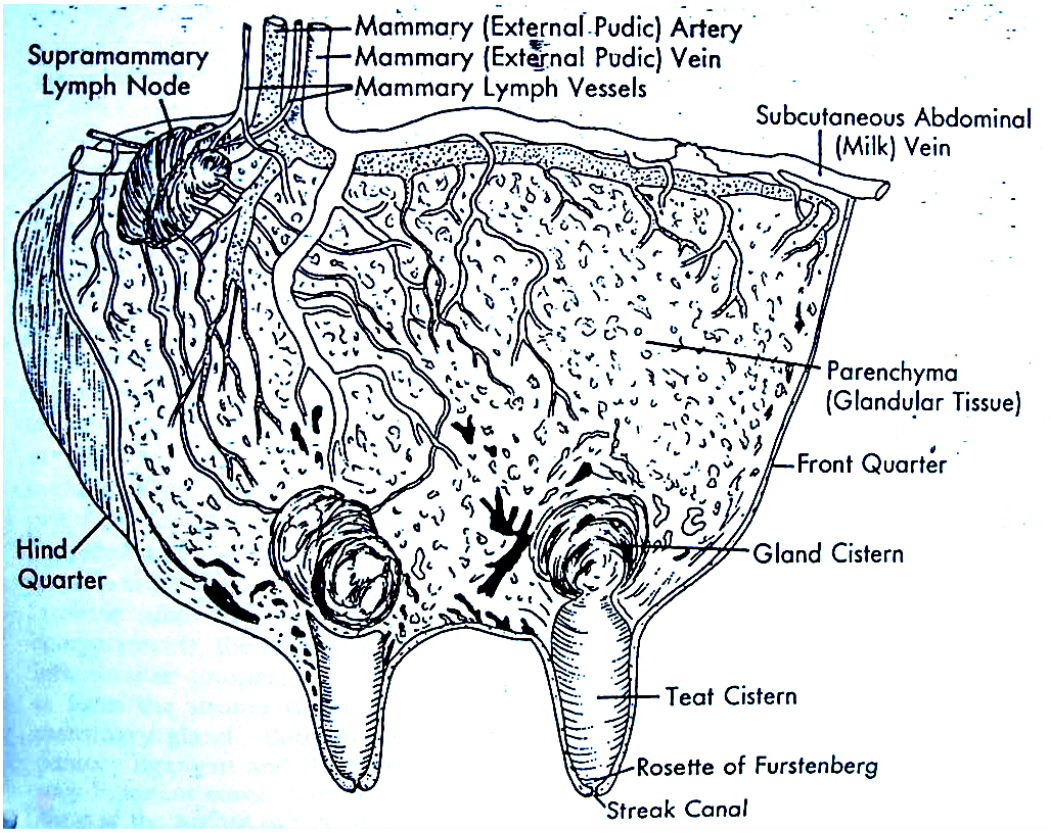
The right and left halves of the udder are indicated by the inter-mammary groove (Fig 7.2). The fore and rear quarters may be smoothly joined or may be demarcated by varying degree of grooving.

The rear quarters are usually larger than the front quarters and contain 1/4 to 1/2 more secretory tissue and thus the two front quarters normally produce about 40 per cent of the total milk yield and the two hind quarters about 60 per cent.

The mammary glands or udder of the cow consists of four quarters. The gross internal structure is shown in Fig 7.1.



↑*Fig 7.1 Cross section of udder, showing the four separate quarters*



↑*Fig 7.2 sagittal (dividing the full udder into right and left halves) section of udder of cow*

The udder usually increase about 1/3 in size between milkings, depending upon the quality of the udder and the amount of milk secreted.

Suspensory structures of the udder. The shape, size and placement of the udder is very important for best milk production. The udder should extend well forward in order to make maximum use of the available space and should have an easy carriage. The main structures that support the udder are the following.

1. Median suspensory ligament
2. Two lateral suspensory ligaments
3. Skin

The median suspensory ligament is elastic and the laterals are non-elastic. For this reason, filling of the udder causes the teats to protrude outward. In this way a maximum

amount of milk can be accommodated with a minimum lowering of the udder. The median suspensory ligament is primarily responsible for the udder “breaking down”. The skin covering the gland has little supporting action, but it protects the udder and minimizes swaying when the cow is walking.

Self-Check -7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. _____is covered with fine hair except teat which is totally hairless? (4pts)
2. List the main structures that support the udder? (6pts)

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

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Information sheet 8	Identifying and describing components of the immune system

The immune system

The cells of the immune system originate in the bone marrow, where many of them also mature. They then migrate to guard the peripheral tissues, circulating in the blood and in a specialized system of vessels called the lymphatic system.

1.1. The white blood cells of the immune system derive from precursors in the bone marrow

All the cellular elements of blood, including the red blood cells that transport oxygen, the platelets that trigger blood clotting in damaged tissues, and the white blood cells of the immune system, derive ultimately from the same **progenitor** or precursor cells—the **hematopoietic stem cells** in the bone marrow. As these stem cells can give rise to all of the different types of blood cells, they are often known as pluripotent hematopoietic stem cells. Initially, they give rise to stem cells of more limited potential, which are the immediate progenitors of red blood cells, platelets, and the two main categories of white blood cells.

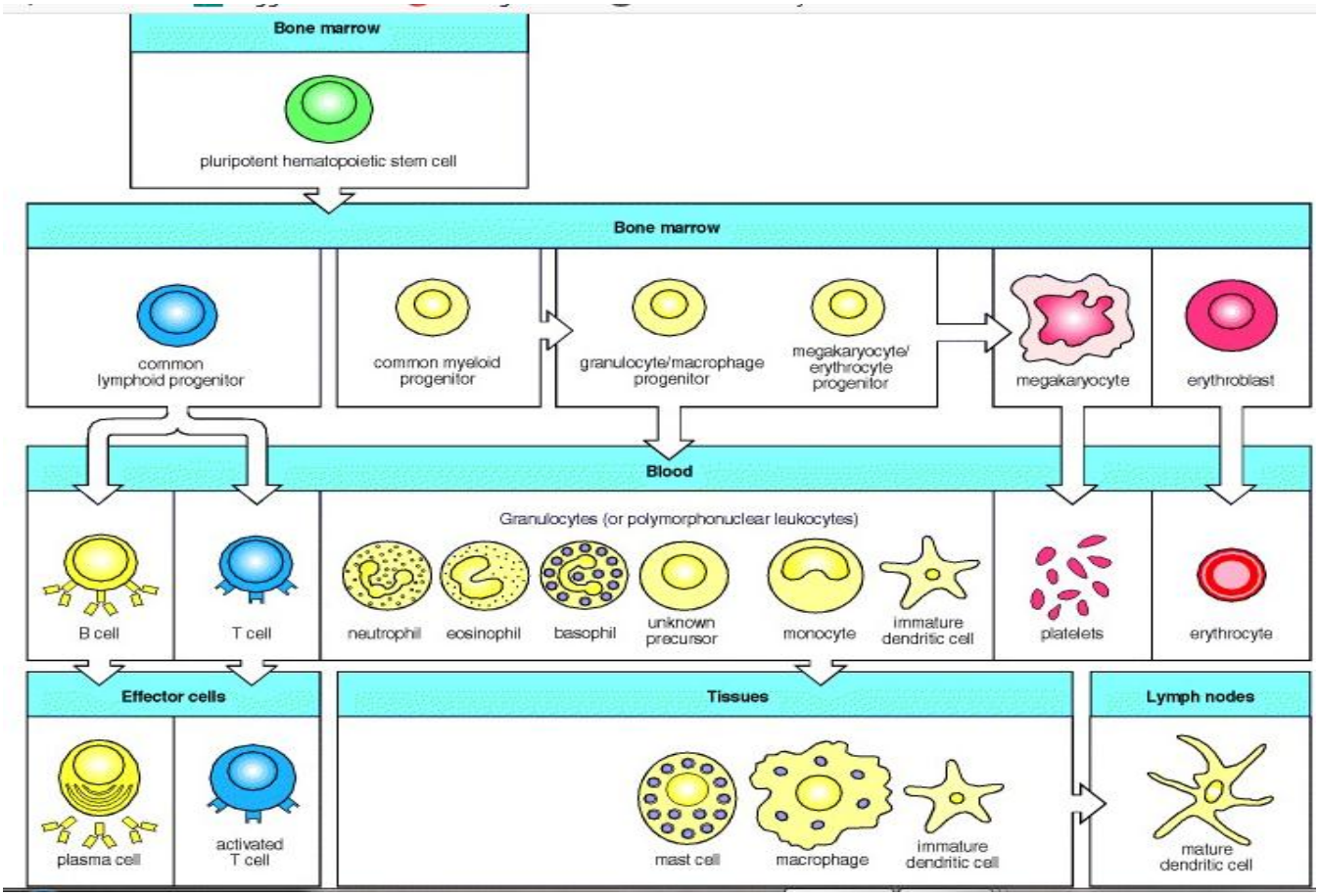


Fig.8.1 All the cellular elements of blood, including the lymphocytes of the adaptive immune system, arise from hematopoietic stem cells in the bone marrow

1.2. Lymphocytes mature in the bone marrow or the thymus

The lymphoid organs are organized tissues containing large numbers of lymphocytes in a framework of nonlymphoid cells. In these organs, the interactions lymphocytes make with nonlymphoid cells are important either to lymphocyte development, to the initiation of adaptive immune responses, or to the sustenance of lymphocytes. Lymphoid organs can be divided broadly into **central** or primary lymphoid organs, where lymphocytes are generated, and peripheral or **secondary lymphoid organs**, where adaptive immune responses are initiated and where lymphocytes are maintained.

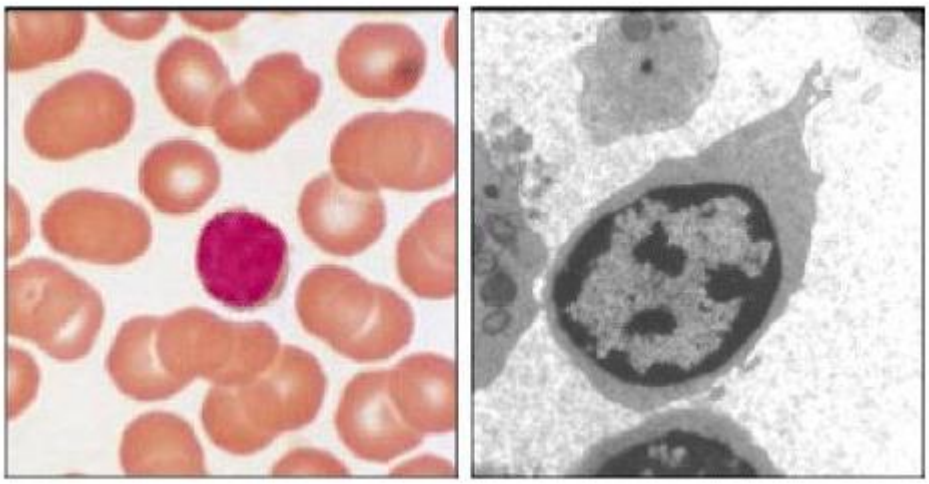


Figure 8.2 Lymphocytes are mostly small and inactive cells

1.3. The peripheral lymphoid organs are specialized to trap antigen, to allow the initiation of adaptive immune responses, and to provide signals that sustain recirculating lymphocytes

Pathogens can enter the body by many routes and set up an infection anywhere, but antigen and lymphocytes will eventually encounter each other in the peripheral lymphoid organs—the lymph nodes, the spleen, and the mucosal lymphoid tissues.

Lymphocytes are continually recirculating through these tissues, to which antigen is also carried from sites of infection, primarily within macrophages and dendritic cells. Within the lymphoid organs, specialized cells such as mature dendritic cells display the antigen to lymphocytes.

The lymph nodes are highly organized lymphoid structures located at the points of convergence of vessels of the lymphatic system, an extensive system of vessels that collects extracellular fluid from the tissues and returns it to the blood. This extracellular fluid is produced continuously by filtration from the blood, and is called lymph. The vessels are lymphatic vessels or lymphatics**.**

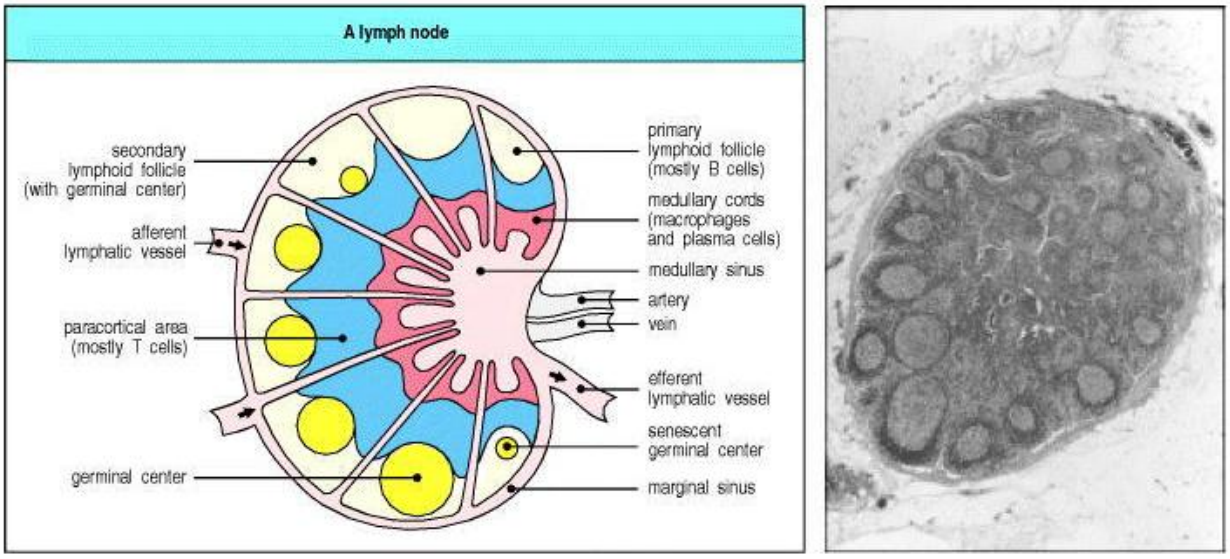


Figure 8.3 Organization of a lymph node

1.4. Lymphocytes circulate between blood and lymph

Small B and T lymphocytes that have matured in the bone marrow and thymus but have not yet encountered antigen are referred to as naive lymphocytes. These cells circulate continually from the blood into the peripheral lymphoid tissues, which they enter by squeezing between the cells of capillary walls.

Self-Check -8	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the main area the cells of the immune system originated? (4pts)
2. What are the organized tissues containing large numbers of lymphocytes in a framework of non-lymphoid cells? (4pts)
3. What are highly organized lymphoid structures located at the points of convergence of vessels of the lymphatic system? (4pts)

Note: **Satisfactory rating – 12 points** **Unsatisfactory - below 12 points**

You can ask you teacher for the copy of the correct answers.

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Information sheet -9	Identifying and recognized components of the nervous system

Nervous Systems of Animals

Animals are the only living things on Earth with complex nervous systems that first receive and interpret sensory signals from the environment and then send out messages to direct the animal's response. The complexity of an animal's nervous system depends on its lifestyle and body plan.

- Animals whose bodies don't have a defined head or tail have nerve nets, which are web like arrangements of nerve cells that extend throughout the body.
- Animals with a defined head possess a two-part nervous system:
    - **The central nervous system (CNS)** consists of the animal's brain and central neurons. It's housed in the head and may continue along the back.
    - **The peripheral nervous system (PNS)** consists of all the nerves that travel from the CNS to the rest of the animal's body.

In all animals with a backbone, including you, the CNS consists of a brain and a spinal cord. The brain contains centers that process information from the sense organs, centers that control emotions and intelligence, and centers that regulate the physiological balance of the body (homeostasis). The spinal cord controls the flow of information to and from the brain.

Both the brain and the spinal cord are highly protected. First of all, they sit within a liquid called cerebrospinal fluid that guards the CNS against shocks caused by movement and they're protected by the bones of the skull and vertebrae. CNS also supports the brain and spinal cord by supplying nutrients and helping to remove wastes.

The blood-brain barrier, which is created by the capillaries surrounding the brain, provides yet another layer of protection because the capillaries are highly selective about what they allow to enter the brain or cerebrospinal fluid. A final layer of protection is the meninges, two layers of connective tissue that surround the brain and spinal cord.

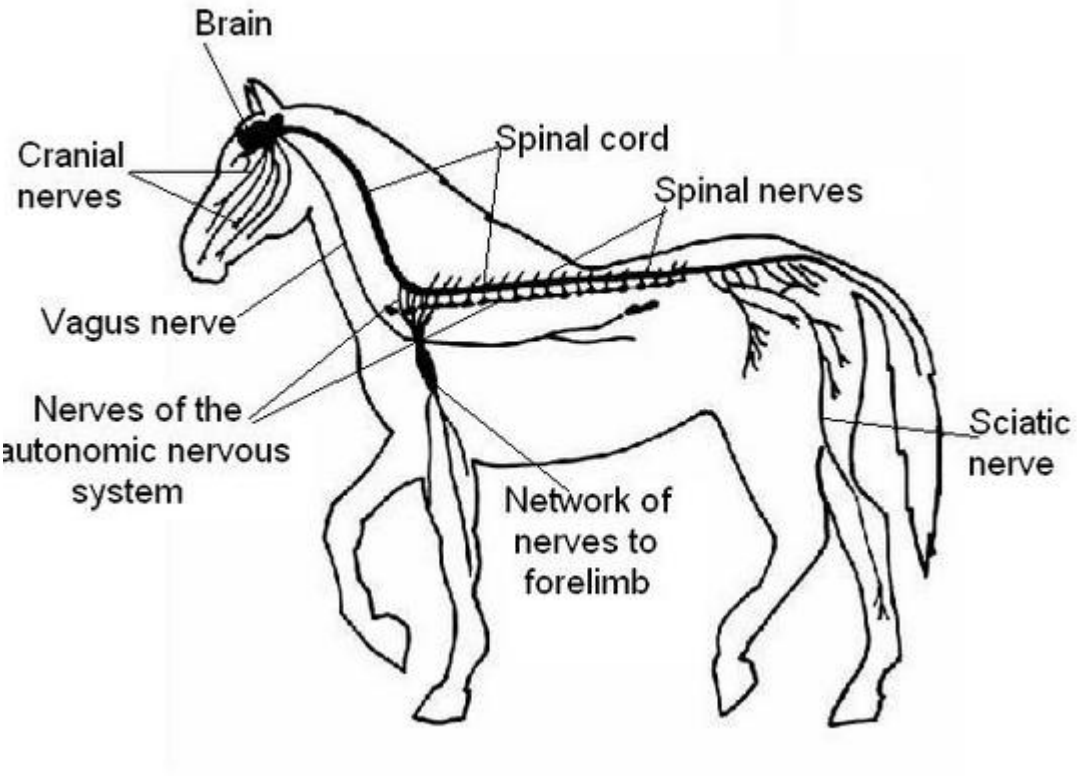


Fig. 8.1 Parts of nervous system

From the CNS, the nervous system branches off into the PNS, which is divided into two systems:

- **Somatic nervous system:** This part of the PNS carries signals to and from the skeletal muscles. It controls many of an animal's voluntary responses to signals in its environment.
- **Autonomic nervous system:** This part of the PNS controls the mostly involuntary internal processes in the body, such as heartbeat and digestion. It has two divisions that work opposite each other to maintain homeostasis:
    - The sympathetic nervous system automatically stimulates the body when action is required. This is the part of the nervous system responsible for the fight-or-flight response, which stimulates a surge of adrenaline to give the body quick energy so it can escape danger.

The sympathetic nervous system also quickens the heart rate to move blood through the blood vessels faster and releases sugar from the liver's glycogen stores into the blood so fuel is readily available to the cells.

- The parasympathetic nervous system stimulates more routine functions, such as the secretion of digestive enzymes or saliva. In contrast to the sympathetic nervous system, the parasympathetic nervous system slows down the heart rate after the fight-or-flight response is no longer needed.

Self-Check -9	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the central nervous system (CNS)? (4pts)
2. _____is part of the PNS carries signals to and from the skeletal muscles. (3pts)
3. _____is part of the PNS controls the mostly involuntary internal processes in the body. (3pts)
4. _____is consists of all the nerves that travel from the CNS to the rest of the animal's body. (2 pts)

Note: **Satisfactory rating – 12 points** **Unsatisfactory - below 12 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

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Dairy production

Level –III

Learning Guide-20

Unit of Competence: Identify and describing Anatomy, Physiology and Behavior of Dairy Animal

Module Title: Identifying and describing Anatomy, Physiology and Behavior of Dairy Animal

LG Code: **AGR DRP3 M05 LO3 LG20**

TTLM Code: **AGR DRP3 TTLM 1119v1**

LO 3: Identify the functions of the different body systems and structures

Instruction Sheet 1	Learning Guide 20

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Identifying and describing the functions of the integuments
- Understood Basic functions of the bone, joints and muscles.
- Identifying basic functions of the organs of digestive system and the accessory digestive organs for simple stomach and complex stomach animals
- Identifying basic functions of the respiratory system and the structures of the system
- Differentiating the function of the circulatory system and its different components.
- Describing the function of the urinary and reproductive systems;
- describing primary and accessory sex organs
- Recognizing mechanism of milk synthesis and secretion.
- Identifying the basic function of the immune system and
- Identifying organs and cells of the immune system
- Identifying the role and importance of the nervous system in animals.

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

The functions of the integuments are identified and described for different animal species

- Basic functions of the bone, joints and muscles are understood
- Basic functions of the organs of digestive system and the accessory digestive organs are identified for simple stomach and complex stomach animals
- Basic functions of the respiratory system and the structures of the system are identified
- The function of the circulatory system and its different components are differentiated
- The function of the urinary and reproductive systems; primary and accessory sex organs are described and mechanism of milk synthesis and secretion are recognized

- The basic function of the immune system and organs and cells of the system are identified
- The role and importance of the nervous system in animals are identified

Learning Instructions:

1. Read the specific objectives of this Learning Guide 20.
2. Follow the instructions described in number 1 to 7.
3. Read the information written in the “Information Sheet (**1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11)** in page **61, 63, 70, 76, 79, 84, 87, 90, 93, 95 and 99** respectively
4. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
5. Accomplish the **“Self-check** (**1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11)** in page **62, 69, 75, 78, 83, 86, 89, 92, 94, 98 and 101** respectively.
6. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 and 2” **in page -**
7. Do the “LAP test” in page __ (if you are ready). Request your teacher to evaluate your performance and outputs. Your teacher will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your teacher shall advice you on additional work.

Information sheet 1	Identifying and describing the functions of the integuments

The following points are the general functions of the integument in vertebrates. The functions are: 1. Protection 2. Temperature Control 3. Food Storage 4. Secretion 5. Excretion 6. Sensation 7. Respiration 8. Locomotion 9. Dermal Endoskeleton 10. Sexual Selection.

1. Protection:

The integument forms a covering of the body and is protective. It protects the body against entry of foreign bodies and against mechanical injuries. It protects the tissues against excessive loss of moisture, this is very important because both aquatic and terrestrial animals are dependent upon water in their bodies for various metabolic activities.

The integument forms protective derivatives, such as scales, bony plates, layer of fat, feathers and hair which reduce the effect of injurious contacts. In some animals the skin shows protective colouration which makes the animals resemble their environment, thus, making them almost invisible to their enemies. Poison glands of toads, slippery skin of aquatic animals and an armour of spines of some mammals are protective devices of the integument.

2. Temperature Control:

Heat is produced constantly by oxidation of food stuffs in tissues. This heat is distributed evenly by the circulating blood. The body heat is lost constantly with expired breath, with faces and urine, and from the surface of the skin. The integument regulates heat and maintains a constant temperature in endothermal animals.

3. Food Storage:

The skin stores fat in its layers as reserve food material which is used for nourishment in times of need. In whales and seals the fat of the skin forms a thick layer, called blubber which is not only reserve food but also maintains the body temperature.

4. Secretion:

The skin acts as an organ of secretion. Glands of the skin are secretory. In aquatic forms there are secretory mucous glands whose secretions keep the skin moist and slippery. In mammals sebaceous glands secrete oil which lubricates the skin and hairs.

5. Excretion:

The integument acts as an organ of excretion. Shedding of the corneal layer during ecdysis removes some waste substances. In mammals metabolic waste (salts, urea and water) is removed from the blood by means of sweat.

6. Sensation:

The skin is an important sense organ because it has various kinds of tactile cells and corpuscles which are sensory to touch, temperature changes, heat, cold, pressure and pain.

7. Dermal Endoskeleton:

The skin contributes to the endoskeleton. It forms the dermal bones of vertebrates and also forms parts of the teeth. Endoskeleton of head protects the brain and sense organs. In the body it protects the soft, tender viscera.

8. Sexual Selection:

The skin acts as an organ of sexual selection. It provides the feathers of birds which often have brilliant colours which are for sexual attraction. Some integumentary glands of mammals produce odours far attracting the opposite sex. Antlers of male deer distinguish it from female.

Besides the above functions, mammalian skin synthesises the vitamin D with the help of Sebum of sebaceous glands. Brood pouches beneath skin in some fishes and amphibians protect unhatched eggs. Nasal glands of tetrapods keep the nostrils free of dirt and water. Skin also has the power of absorption of oils, ointments, etc.

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the main functions of the integument in vertebrate? (4pts)
2. _____is produced constantly by oxidation of food stuffs in tissues? (4pts)

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

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Information sheet 2	Understanding basic functions of the bone, joints and muscles.

1.1. Functions of Bones

Bone is often stereotyped as simply a protective and supportive framework for the body. Though it does perform these functions, bone is actually a very dynamic organ that is constantly remodeling and changing shape to adapt to the daily forces placed upon it. Moreover, bone stores crucial nutrients, minerals, and lipids and produces blood cells that nourish the body and play a vital role in protecting the body against infection.

Bones have many functions, including the following:

- Support: Bones provide a framework for the attachment of muscles and other tissues.
- Protection: Bones such as the skull and rib cage protect internal organs from injury.
- Movement: Bones enable body movements by acting as levers and points of attachment for muscles.
- Mineral storage: Bones serve as a reservoir for calcium and phosphorus, essential minerals for various cellular activities throughout the body.
- Blood cell production: The production of blood cells, or hematopoiesis, occurs in the red marrow found within the cavities of certain bones.
- Energy storage: Lipids, such as fats, stored in adipose cells of the yellow marrow serve as an energy reservoir.

1.2. Function of joints

The point at which two or more bones meet is called a **joint**, or **articulation**. Joints are responsible for movement, such as the movement of limbs, and stability, such as the stability found in the bones of the skull.

Classification of Joints on the Basis of Structure

There are two ways to classify joints: on the basis of their structure or on the basis of their function. The structural classification divides joints into bony, fibrous, cartilaginous, and synovial joints depending on the material composing the joint and the presence or absence of a cavity in the joint.

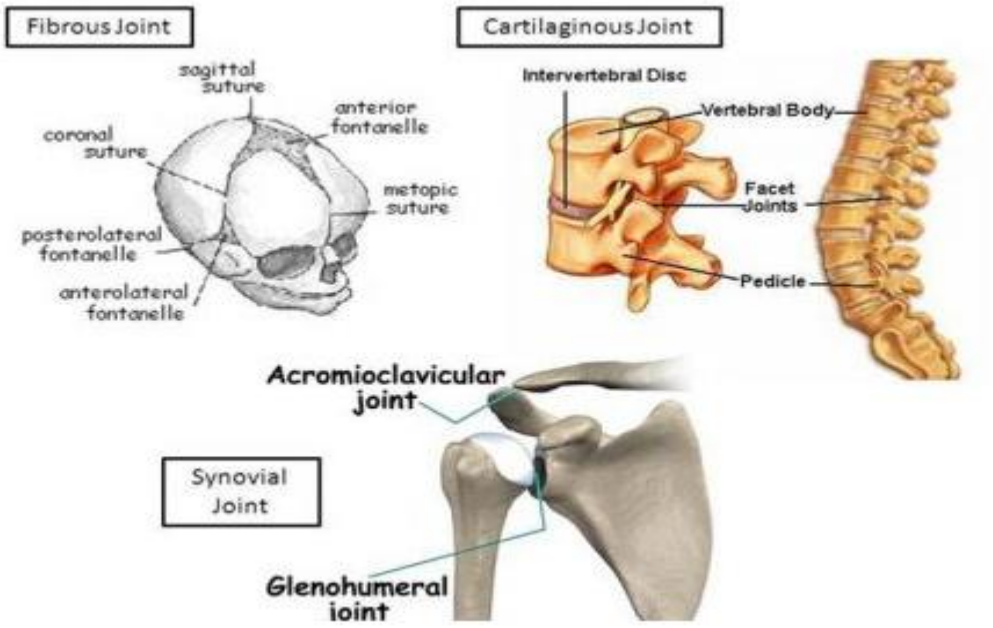


Fig 1.1 Classification of Joints

i. Fibrous Joints

The bones of **fibrous joints** are held together by fibrous connective tissue. There is no cavity, or space, present between the bones and so most fibrous joints do not move at all, or are only capable of minor movements. There are three types of fibrous joints: sutures, syndesmoses, and gomphoses. **Sutures** are found only in the skull and possess short fibers of connective tissue that hold the skull bones tightly in place.

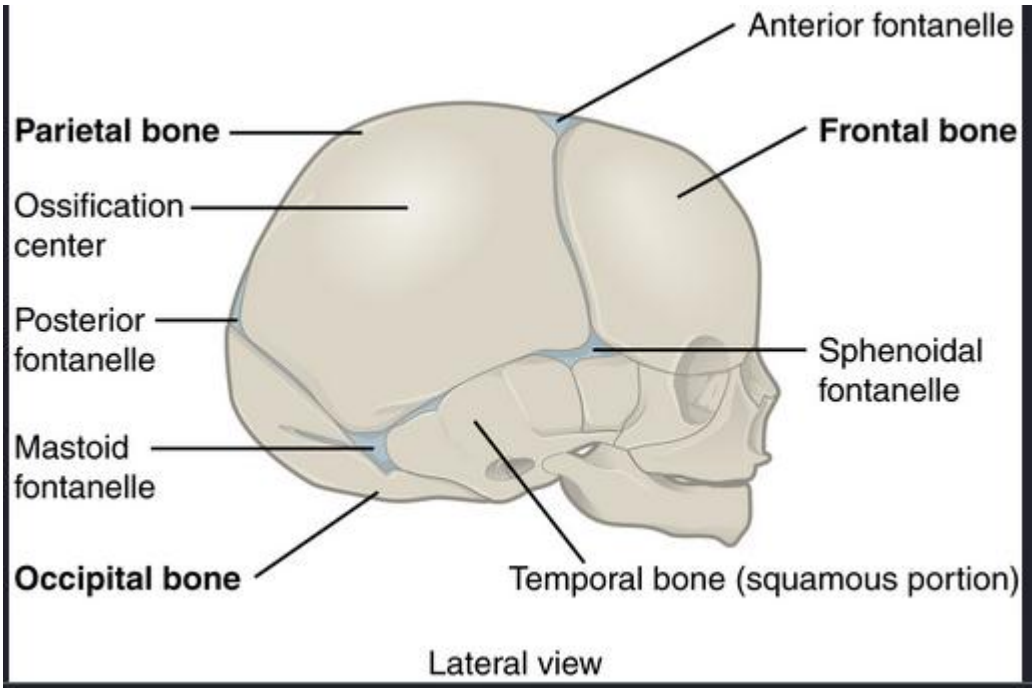


Fig. 1.2 Fibrous joints

ii. Cartilaginous Joints

Cartilaginous joints are joints in which the bones are connected by cartilage. There are two types of cartilaginous joints: synchondroses and symphyses. In a synchondrosis, the bones are joined by hyaline cartilage. Synchondroses are found in the epiphyseal plates of growing bones in children. In symphyses, hyaline cartilage covers the end of the bone but the connection between bones occurs through fibrocartilage. Symphyses are found at the joints between vertebrae. Either type of cartilaginous joint allows for very little movement.

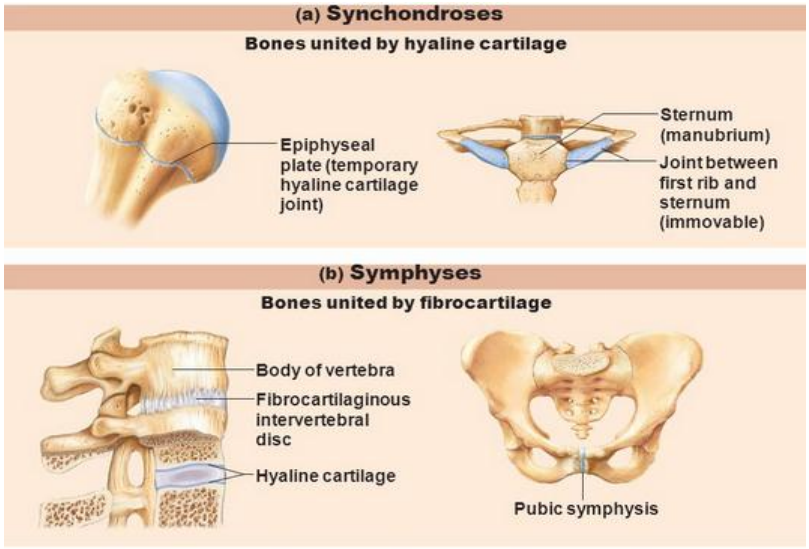


Fig. 1.3 Cartilage joints

iii. Synovial Joints

Synovial joints are the only joints that have a space between the adjoining bones (Figure 19.25). This space is referred to as the synovial (or joint) cavity and is filled with synovial fluid. Synovial fluid lubricates the joint, reducing friction between the bones and allowing for greater movement. The ends of the bones are covered with articular cartilage, a hyaline cartilage, and the entire joint is surrounded by an articular capsule composed of connective tissue that allows movement of the joint while resisting dislocation. Articular capsules may also possess ligaments that hold the bones together. Synovial joints are capable of the greatest movement of the three structural joint types; however, the more mobile a joint, the weaker the joint. Knees, elbows, and shoulders are examples of synovial joints.

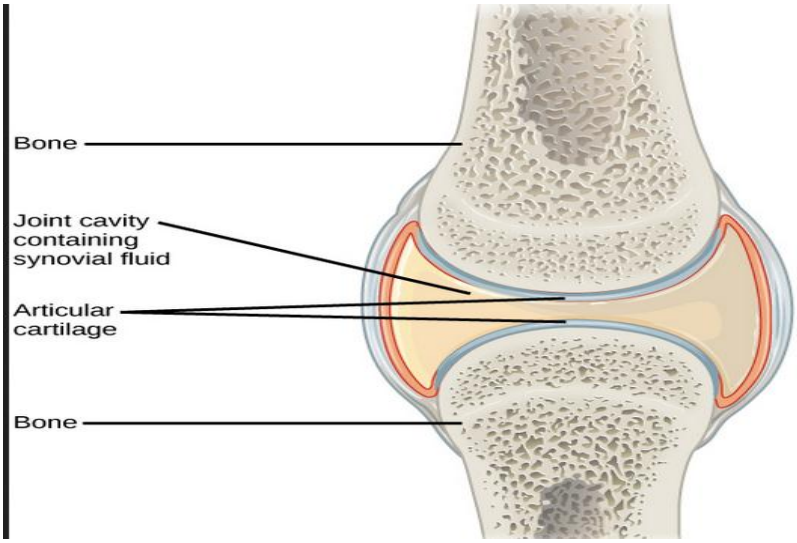


Fig. 1.4 Synovial joints are the only joints that have a space or "synovial cavity" in the joint.

1.3. Function of the muscle

The varied function of muscle is mostly based on the contraction and relaxiation of muscle fibers.

- ☞ Produces movement
- ☞ Restrains movement

- Produces heat in homoeothermic (warm blooded) animals (because skeletal muscle is in a state of tone and thus generates heat even when at rest).
- Muscles in the wall of stomach and intestine contract to mix and propel food along the gastro intestinal tract.
- smooth muscle layers in the wall of blood vessels control the distribution of blood w/c is propelled bythe contraction of the cardiac muscle of the heart.
- In the eye smooth muscle fibers adjust the diameter of the pupil and thickness of the lence for optimal vision.
- In the skin it causes the hair to stand up.skeletal muscles permit locomotion by contracting to change the relative position of bones duriong movement and by mantaining joint angles against the pull of gravity during support.
- The skeletal muscles of respiration move air into and out of the lungs byby contracting to change the volume of thoracic cavity.
- In addition heat production through shivering is the result of breif repetitive contractions of skeletal muscles throughout the body.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Bones have many functions. (4pts)
2. What are the structural classification of joints? (4pts)
3. What the function of muscle? (5pts)

Note: **Satisfactory rating – 13 points** **Unsatisfactory - below 13 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

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Information sheet 3	Identifying basic functions of the organs of digestive system and the accessory digestive organs for simple stomach and complex stomach animals

3.1. Identifying functions of digestive organs

Mouth- primarily used for holding, grinding and mixing of food with saliva but may also be used to manipulate the environment (through grasping of objects) and as defensive and offensive weapon.

Teeth- are the hardest bony structures which are arranged in two dental arcades, one associated with the mandible and the other with incisive and maxillary bones.

Teeth have the following functions

- Reduction in size of food by grinding
- Increase surface area for chemical and/or microbial degradation
- Cutting of foodstuffs to be presented to mouth
- Protective function
- Kill Prey
- Food gathering for carnivores

Tongue- is a muscular organ used to maneuver the food mass

- Seizes and brings food to mouth
- Brings food to molars
- Assists in swallowing
- The Papillae(Projections on tongue)are used for moving food, grooming and tasting food

Pharynx- is a common Pathway for air and food and is located caudal to oral and nasal cavities. It can be arbitrarily divided into three portions: the oral (oropharynx), nasal (nasopharynx) and laryngeal (laryngeopharynx). It prevents food from entering larynx and nasal cavity by reflexes and the mechanics of swallowing

Esophagus-The esophagus is a muscular tube that connects the mouth with the fore stomach. Food passes down the esophagus by contraction of the muscles in the walls

that push the food along in a series of waves called peristalsis. The ruminant esophagus is also capable of reversed peristalsis or antiperistalsis. This allows food to be easily regurgitated from the rumen and chewed. It is a Combination of Skeletal and Smooth Muscle. Whole esophagus, including cranioesophageal sphincter are closed when not transporting food or water. It usually lies on left side of trachea.

Stomach- The stomach can expand significantly to store all the food from a meal for both mechanical and chemical processing. The stomach contracts about three times per minute, churning the food and mixing it with gastric juice. This fluid, secreted by thousands of gastric glands in the lining of the stomach, consists of water, hydrochloric acid, an enzyme called pepsin, and mucin (the main component of mucus). Hydrochloric acid creates the acidic environment that pepsin needs to begin breaking down proteins. It also kills microorganisms that have been ingested in the food. Mucin coats the stomach, protecting it from the effects of the acid and pepsin. About four hours or less after a meal, food processed by the stomach, called chyme, begins passing a little at a time through the pyloric sphincter into the duodenum, the first portion of the small intestine.

Digestion in ruminant: Like other vertebrates, ruminant Artiodactyla (including cattle, deer, and their relatives) are unable to digest plant material directly, because they lack enzymes to break down cellulose in the cell walls. Digestion in ruminants occurs sequentially in a four-chambered stomach.

Plant material is initially taken into the Rumen, where it is processed mechanically and exposed to bacteria than can break down cellulose (foregut fermentation). The Reticulum allows the animal to regurgitate & reprocess particulate matter ("chew its cud"). More finely-divided food is then passed to the Omasum, for further mechanical processing. The mass is finally passed to the true stomach, the Abomassum, where the digestive enzyme lysozyme breaks down the bacteria so as to release nutrients. Use of plant material is thus indirect, with primary processing by the bacterial flora maintained in the stomach.

Small Intestine*:* - The small intestine has three regions: the duodenum, the jejunum and the ileum. Partially digested food passes from the duodenum along the small intestine by way of peristaltic muscle contractions that start at the part where the abomasum is joined to the duodenum.

a) **Duodenum**- The duodenum is a horseshoe-shaped section surrounding part of the pancreas and the pancreatic duct, as well as ducts from the liver and gall bladder that open into it.

b) **Jejunum**- The lining of the jejunum is specialized for the absorption of carbohydrates and proteins. Its inner surface is covered in finger-like projections called villi, which increase the surface area available to absorb nutrients from the gut contents. The villi in the jejunum are much longer than in the duodenum or ileum. The epithelial cells which line these villi possess even larger numbers of microvilli, known collectively as the brush border.

c) **Ileum**

The ileum's main function is absorption of vitamin B_{12}, bile salts and whatever nutrients that were not absorbed by the jejunum. At the point where the ileum joins the large intestine there is a valve, called the ileo-caecal valve, which prevents materials flowing back into the small intestine.

The large intestine- The large intestine is divided into the cecum, ascending colon, transverse colon, descending colon, sigmoid colon, and rectum. The cecum is a swollen sac located in the lower right-hand portion of the abdominal cavity; The large intestine absorbs water from material passing through it and then excretes the remaining material as feces from the rectum.

The rectum, at the exit of the rectum, called the anus. Food and waste material are moved along the length of the intestine by rhythmic contractions of intestinal muscles; these contractions are called peristaltic movements. The entire intestine is held in place in the abdominal cavity by membranes called mesenteries.

3.2. Differentiating accessory digestive organs

Accessory Digestive Organs include: Salivary Glands, Pancreas &Liver

Salivary Glands: - these are glands involved in secretion of saliva which has the following functions

- Lubrication of chewed food
- Moistening of the oral walls
- Contain Digestive enzymes such as Ptyalin (salivary amylase)

Three pairs of chief Glands: Parotid, Mandibular, Sublingual and Some less defined, scattered salivary tissue (Labial, lingual, buccal & palatine).

Pancreas: - is a compound gland located along duodenum having both Exocrine and Endocrine portions. The exocrine portion produces sodium bicarbonate and digestive enzymes which pass through the pancreatic ducts to empty into the duodenum close to the opening of the bile duct.

The endocrine portion consists of isolated cells scattered throughout the gland, called **Islets of Langerhans** which produce hormones (insulin and glucagon) that directly pass into the blood stream to regulate blood sugar level.

Liver: One of the liver's primary jobs is to store energy in the form of glycogen, which is made from a type of sugar called glucose. The liver removes glucose from the blood when blood glucose levels are high. Through a process called glycogenesis, the liver combines the glucose molecules in long chains to create glycogen, a carbohydrate that provides a stored form of energy. When the amount of glucose in the blood falls below the level required to meet the body's needs, the liver reverses this reaction, transforming glycogen into glucose.

Another crucial function of the liver is the production of bile, a yellowish-brown liquid containing salt necessary for the digestion of lipids, or fats. These salts are produced within the lobules. Bile leaves the liver through a network of ducts and is transported to the gallbladder, which concentrates the bile and releases it into the small intestine.

Vitamins are also stored in the liver. Drawing on the nutrient-rich blood in the hepatic portal vein, the liver collects and stores supplies of vitamins A, D, E, and K. The B vitamins are also stored here, including a two- to four-year supply of Vitamin B12.

The liver also functions as the body's chemical factory. Several important proteins found in the blood are produced in the liver. One of these proteins, albumin, helps retain calcium and other important substances in the bloodstream. Albumin also helps regulate the movement of water from the bloodstream into the body's tissues. The liver also produces globin, one of the two components that form hemoglobin—the oxygen-carrying substance in red blood cells. Certain globulins, a group of proteins that includes antibodies, are

produced in the liver, as are the proteins that make up the complement system, a part of the immune system that combines with antibodies to fight invading microorganisms.

Many other chemicals are produced by the liver. These include fibrinogen and prothrombin, which help wounds to heal by enabling blood to form clots, and cholesterol, a key component of cell membranes that transports fats in the bloodstream to body tissues.

In addition to manufacturing chemicals, the liver helps clear toxic substances, such as drugs and alcohol, from the bloodstream. It does this by absorbing the harmful substances, chemically altering them, and then excreting them in the bile.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Whit is part of digestive organ which is a muscular organ used to maneuver the food mass. (4pts)
2. _____is a common Pathway for air and food and is located caudal to oral and nasal cavities? (3pts)
3. _____ is a compound gland located along duodenum having both Exocrine and Endocrine portions. (3pts)

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

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Information sheet -4	Identifying basic functions of the respiratory system and the structures of the system

The respiratory system performs several functions. Most importantly, it delivers oxygen to the cardiovascular system for distribution to the body and it removes carbon dioxide. Gas transfer occurs in the alveoli of the lungs, where the air-blood barrier is a thin, permeable membrane.

Failure or major dysfunction of gas transfer due to disease processes that compromise this membrane or its air or blood supply have serious effects. In addition to gas exchange, the respiratory system performs numerous other functions, including maintaining acid-base balance, acting as a blood reservoir, filtering and probably destroying emboli, metabolizing some bioactive substances (eg, serotonin, prostaglandins, corticosteroids, and leukotrienes), and activating some substances (eg, angiotensin).

The respiratory system also protects its own delicate airways by warming and humidifying inhaled air and by filtering out particulate material. The upper airways also provide for the sense of smell (olfaction) and play a role in temperature regulation in panting animals.

Large, airborne particles are usually deposited on the mucous lining of the nasal passages, larynx, trachea, and bronchi, after which they are carried by the mucociliary “blanket” to the pharynx to be swallowed or expectorated. Small particles may be deposited as deep as the alveoli, where they are phagocytized by macrophages. Defense against invasion by microorganisms and other foreign particles is provided by anatomic structures and by both nonspecific and immunologic mechanisms (both cellular and humoral).

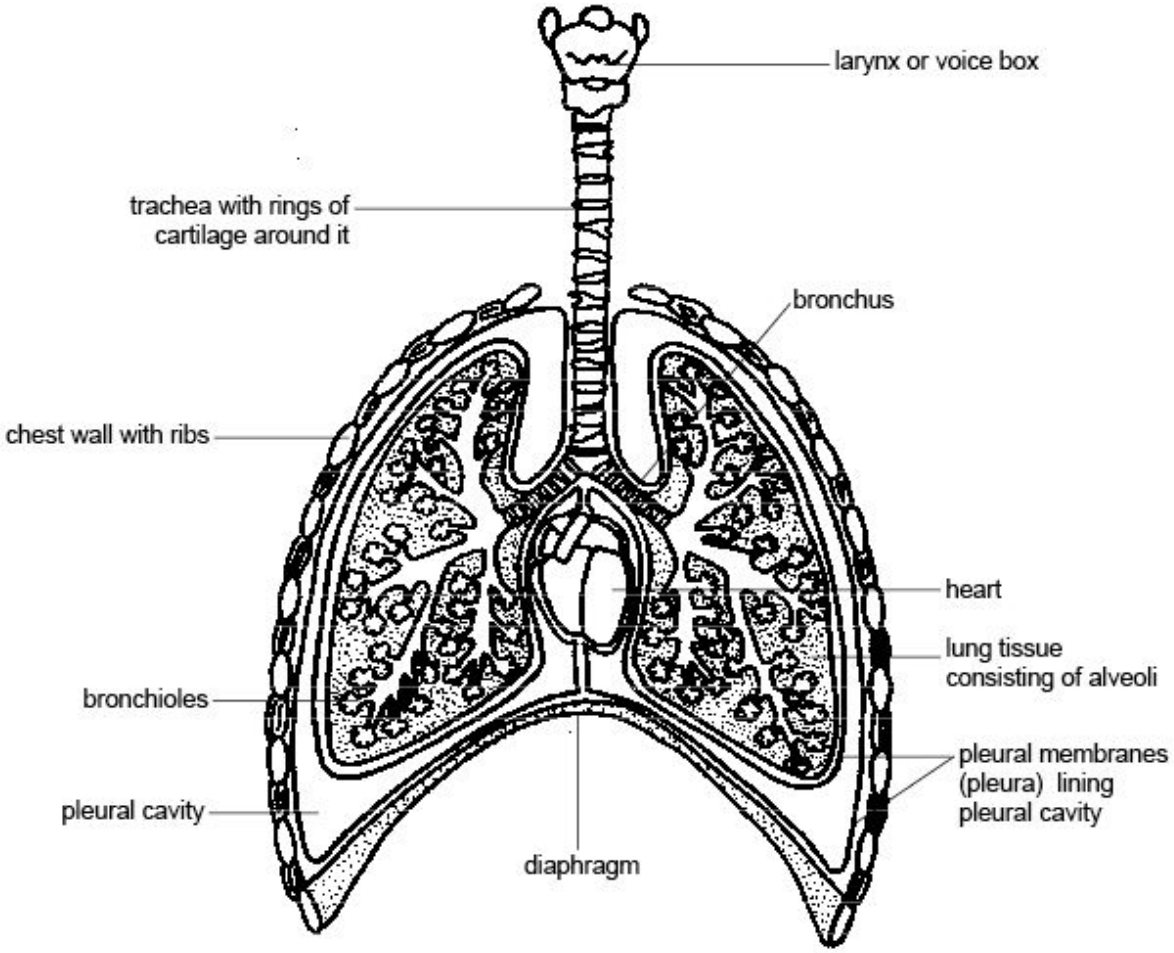


Fig. 4.1 diagram of respiratory system

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the most important functions of respirator function? (4pts)

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

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Information sheet-5	Differentiating the function of the circulatory system and its different components

Major Functions of the Cardiovascular System

The four major functions of the cardiovascular system are:

1. To transport nutrients, gases and waste products around the body

2. To protect the body from infection and blood loss

3. To help the body maintain a constant body temperature (‘thermoregulation’)

4. To help maintain fluid balance within the body

1. Transportation of nutrients, gases and waste products

The cardiovascular system acts as an internal road network, linking all parts of the body via a system of highways (arteries and veins), main roads (arterioles and venules) and streets, avenues and lanes (capillaries).

This network allows a non-stop courier system (the blood) to deliver and expel nutrients, gases, waste products and messages throughout the body.

Nutrients such as glucose from digested carbohydrate are delivered from the digestive tract to the muscles and organs that require them for energy.

Hormones (chemical messengers) from endocrine glands are transported by the cardiovascular system to their target organs, and waste products are transported to the lungs or urinary system to be expelled from the body.

The cardiovascular system works in conjunction with the respiratory system to deliver oxygen to the tissues of the body and remove carbon dioxide. In order to do this effectively the cardiovascular system is divided into two circuits, known as the pulmonary circuit and the systemic circuit.

The pulmonary circuit is made up of the heart, lungs, pulmonary veins and pulmonary arteries. This circuit pumps deoxygenated (blue) blood from the heart to the lungs where it becomes oxygenated (red) and returns to the heart.

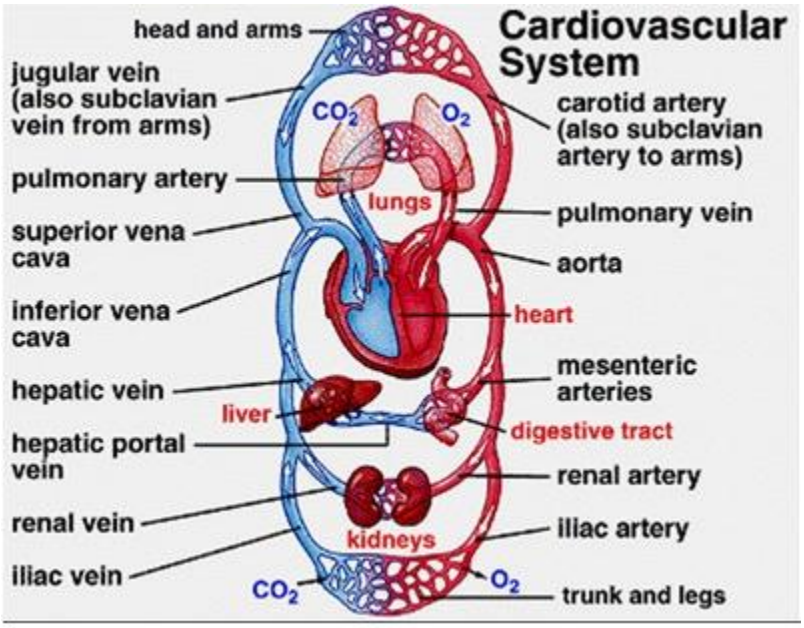


Fig. 5.1 Diagram of cardiovascular system

2. Protection from infection and blood loss

Blood contains three types of cells as listed below and shown in the adjacent image.

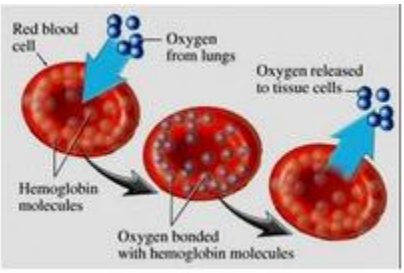
1. Red blood cells

2. White blood cells

3. Platelets

Red blood cells are responsible for transporting oxygen around the body to the tissues and organs that need it.

As oxygen enters the blood stream through the alveoli of the lungs it binds to a special protein in the red blood cells called haemoglobin. This can be seen in the adjacent image.



The job of **white blood cells** is to detect foreign bodies or infections and envelop and kill them, as seen in the below image.

When they detect and kill an infection they create antibodies for that particular infection which enables the immune system to act more quickly against foreign bodies or infections it has come into contact with previously.

Platelets are cells which are responsible for clotting the blood, they stick to foreign particles or objects such as the edges of a cut.

Platelets connect to fibrinogen (a protein which is released in the site of the cut) producing a clump that blocks the hole in the broken blood vessel. On an external wound this would become a scab.

If the body has a low level of platelets then clotting may not occur and bleeding can continue.

Excessive blood loss can be fatal – this is why people with a condition known as haemophilia (low levels or absence of platelets) need medication otherwise even minor cuts can become fatal as bleeding continues without a scab being formed.

Alternatively, if platelet levels are excessively high then clotting within blood vessels can occur, leading to a stroke and or heart attack. This is why people with a history of cardiac problems are often prescribed medication to keep their blood thin to minimise the risk of clotting within their blood vessels.

3. Maintenance of constant body temperature (thermoregulation

Regulation of body temperature, fluid pH, and water content of cells

4. Maintaining fluid balance within the body

The cardiovascular system works in conjunction with other body systems (nervous and endocrine) to balance the body's fluid levels. Fluid balance is essential in order to ensure sufficient and efficient movement of electrolytes, nutrients and gases through the body's cells.

When the fluid levels in the body do not balance a state of dehydration or hyperhydration can occur, both of which impede normal body function and if left unchecked can become dangerous or even fatal.

Dehydration is the excessive loss of body fluid, usually accompanied by an excessive loss of electrolytes

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the three types of Blood cells in dairy animal body? (4pts)
2. _____ Cells which are responsible for clotting the blood, they stick to foreign particles or objects such as the edges of a cut? (3pts)
3. _____ Cells responsible for transporting oxygen around the body to the tissues and organs that need it. (3 pts)

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information sheet-6	Describing the function of the urinary and reproductive systems

6.1 The kidneys and urinary system

The urinary system, also known as the renal system or urinary tract, consists of the kidneys, ureters, bladder, and the urethra. The purpose of the urinary system is to eliminate waste from the body, regulate blood volume and blood pressure, control levels of electrolytes and metabolites, and regulate blood pH. The urinary tract is the body's drainage system for the eventual removal of urine.

The kidneys have an extensive blood supply via the renal arteries which leave the kidneys via the renal vein. Each kidney consists of functional units called nephrons. Following filtration of blood and further processing, wastes (in the form of urine) exit the kidney via the ureters, tubes made of smooth muscle fibres that propel urine towards the urinary bladder, where it is stored and subsequently expelled from the body by urination (voiding). The female and male urinary system are very similar, differing only in the length of the urethra.

Urine is formed in the kidneys through a filtration of blood. The urine is then passed through the ureters to the bladder, where it is stored. During urination, the urine is passed from the bladder through the urethra to the outside of the body

a) Maintaining Water Balance

Animals lose water through their skin and lungs, in the faeces and urine. These losses must be made up by water in food and drink and from the water that is a by-product of chemical reactions. If the animal does not manage to compensate for water loss the dissolved substances in the blood may become so concentrated they become lethal. To prevent this happening various mechanisms come into play as soon as the concentration of the blood increases.

b) Excretion

Animals need to excrete because they take in substances that are excess to the body's requirements and many of the chemical reactions in the body produce waste products. If these substances were not removed they would poison cells or slow down metabolism. All animals therefore have some means of getting rid of these wastes.

The major waste products in mammals are carbon dioxide that is removed by the lungs, and urea that is produced when excess amino acids (from proteins) are broken down. Urea is filtered from the blood by the kidneys.

6.2 The major function of the reproductive system

It is to ensure survival of the species. Other systems in the body, such as the endocrine and urinary systems, work continuously to maintain homeostasis for survival of the individual. An individual may live a long, healthy, and happy life without producing offspring, but if the species is to continue, at least some individuals must produce offspring.

Within the context of producing offspring, the reproductive system has four functions:

- To produce egg and sperm cells
- To transport and sustain these cells
- To nurture the developing offspring
- To produce hormones

These functions are divided between the primary and secondary, or accessory, reproductive organs. The primary reproductive organs, or gonads, consist of the ovaries and testes. These organs are responsible for producing the egg and sperm cells gametes), and hormones. These hormones function in the maturation of the reproductive system, the development of sexual characteristics, and regulation of the normal physiology of the reproductive system. All other organs, ducts, and glands in the reproductive system are considered secondary, or accessory, reproductive organs. These structures transport and sustain the gametes and nurture the developing offspring.

Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the purpose of the urinary system? (4pts)
2. What are the major function of the reproductive system? (3pts)
3. What are the major waste products in mammals? (3 pts)

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

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Information sheet -7	Describing primary and accessory sex organs

The primary organ of reproduction in the male is **the testicles**, of which the bull has two, as is the case in most animals. Secondary sex organs and three accessory sex glands are part of reproductive male tracts. All reproductive organs work in concert for formation, maturation and transport of spermatozoa, which are eventually deposited in the female reproductive tract.

The reproductive system includes the primary organs necessary for reproduction - ovaries and the testes, but there are accessory organs as well. For the female, there is the uterus, oviduct, breasts, and vagina. The male has the penis and scrotum for accessory organs.

Female reproductive system

The ovary is the primary female reproductive organ and has two important functions: producing the female reproductive cell (the egg or ovum) and producing the hormones estrogen and progesterone.

The mammalian female reproductive tract produces the female gamete (*ovum,* pl. *ova*), delivers it to a site where it can be fertilized by the male gamete (spermatozoon), provides an environment for the development and growth of the embryo, and expels the fetus when it is capable of survival outside of the mother's body. The female organs of reproduction include two *ovaries,* two *uterine tubes* (also called *oviducts*), the *uterus,* the *vagina,* and the *vulva*

The eggs that start in a female were made when she was an embryo as primordial. From then, there will develop to become primary follicles. Secondary follicles build as the surrounding thecca tissue builds creating a granular layer.

The journey of the egg starts from the ovary where it is released from the building of fluid pressure in the antrum. The secondary follicle will travel from the ovary to the oviduct where it is grabbed by cilia and then is moved from the oviduct's various regions - isthmus and ampulla. If fertilization is to occur, it will occur in the oviduct. From there it will enter the uterus and attach to the uterine lining formed by the endometrium's stratum basale.

Male reproductive system

The male reproductive system starts with the sperm being produced at the seminiferous tubules of the testes. The seminiferous tubules are surrounded by supporting cells called Sertoli cells and Leydig cells. From the seminiferous tubules, sperm will travel to the epididymis to the vas deferens. At the vas deferens, accessory glands like the bublo-urethral glands and the seminal vessicles will contribute additional fluids and nutrients to help maintain the life of the sperm.

The penis has two main regions - the corpora spongiosum and the corpus cavernousum. These flank the urethra. Recall that the male urethra has three regions, the prostatic, membranous, and the spongy.

Self-Check -7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is primary organ of reproduction in the male animal? (4pts)
2. _____ is the primary female reproductive organ and has two important functions? (4pts)
3. What are the hormones produce in female reproductive cell

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

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Rating: _____

Name: _____ Date _____

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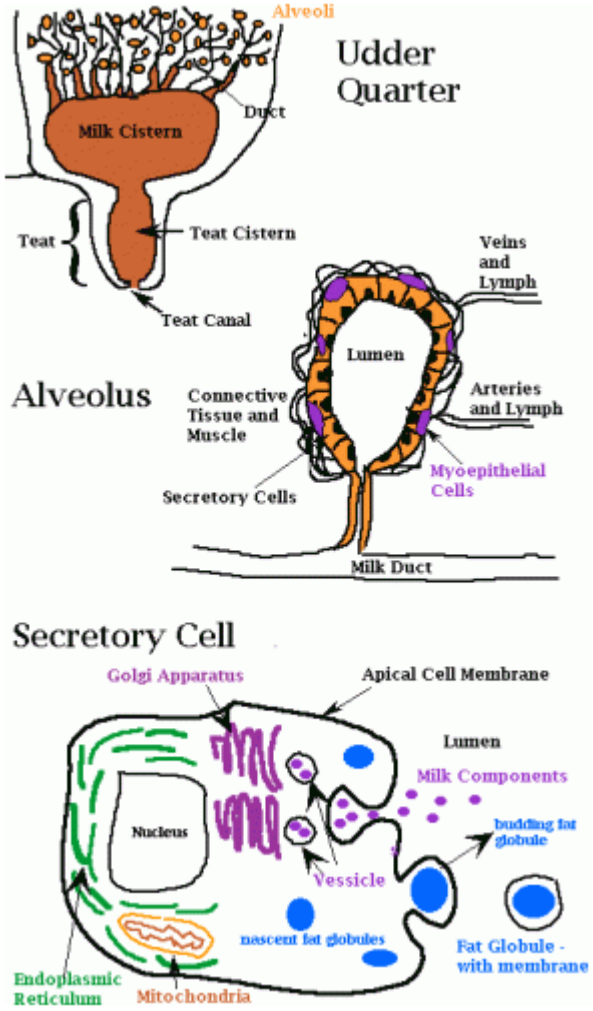
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Milk Biosynthesis

Milk is synthesized in the **mammary gland**. Within the mammary gland is the milk producing unit, the **alveolus**. It contains a single layer of epithelial secretory cells surrounding a central storage area called the lumen, which is connected to a duct system. The secretory cells are, in turn, surrounded by a layer of myoepithelial cells and blood capillaries.

The raw materials for milk production are transported via the bloodstream to the secretory cells. It takes 400-800 L of blood to deliver components for 1 L of milk.

Fig. 7.1 Milk synthesis and secretion



Milk secretion

The cow's udder is composed of glandular tissue containing milk-producing cells. The external layer of this tissue is muscular, thus giving cohesion to the body of the udder and protecting it against injury. The glandular tissue contains around two billion tiny bladders called *alveoli*. The milk-producing cells are located on the inner walls of the alveoli, which occur in groups of 8-120. Capillaries leading from the alveoli converge into progressively larger milk ducts which lead to a cavity above the teat. This cavity, known as the *cistern of the udder*, can hold up to 30 % of the total milk in the udder.

As the alveoli secrete milk their internal pressure rises. If the cow is not milked, secretion of milk stops when the pressure reaches a certain limit. Increase of pressure forces a

small quantity of milk out into the larger ducts and down into the cistern. Most of the milk in the udder, however, is contained in the alveoli and the fine capillaries in the alveolar area. These capillaries are so fine that milk cannot flow through them of its own accord. It must be pressed out of the alveoli and through the capillaries into the larger ducts. Muscle-like cells surrounding each alveolus perform this duty during milking

Self-Check -8	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Where is milk synthesized in cows? (4pts)
2. _____are so fine that milk cannot flow through them of its own accord (4pts)

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

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Information sheet- 9	Identifying the basic function of the immune system

Function of Immune system

Animals are under constant threat of invasion by a diverse range of microorganisms that seek to enter the body and exploit its resources for shelter and food. To ensure survival and prevent such exploitation, the body combats the most dangerous of these invaders with an equally complex set of defensive mechanisms that can be thought of as a series of barriers. These mechanisms include physical barriers to invasion such as a tough, thick skin or the ability to cough and sneeze. The second line of defense is a “hard wired” system of innate immunity that depends on a rapid, stereotyped response to stop and kill both bacterial and viral invaders. This is typified by the process of acute inflammation and by the classic sickness responses such as a fever. The third line of defense is the highly complex, adaptable, and incredibly effective adaptive immune system.

- **The innate immune**

Innate immune responses are highly effective against opportunistic organisms or those of low virulence, but by their very nature cannot do more than delay highly pathogenic microbial invaders. Longterm resistance and survival depends on adaptive immunity. The adaptive immune system is effective against a wide variety of pathogens. Its effectiveness improves each time it is activated in response to microbial invasion. Because the body accumulates immune memory cells as it ages, adaptive immunity provides an almost insurmountable barrier to most potential invaders. In its absence, the animal dies.

- **The adaptive immune**

Adaptive immunity is an **immunity** that occurs after exposure to an antigen either from a pathogen or a vaccination. There are two types of **adaptive** responses: the cell-mediated **immune** response, which is carried out by T cells, and the humoral **immune** response, which is controlled by activated B cells and antibodies

The adaptive immune system faces complex challenges. Many different microorganisms, including bacteria, viruses, protozoa, and helminths, may attempt invasion. The optimal immune responses to this diversity of invaders must also be very diverse. For example, invaders such as bacteria that live outside body cells are best attacked by an antibody-mediated (or humoral) immune response, whereas viruses living within cells are best destroyed by the killing of infected cells through cell-mediated mechanisms.

Self-Check -9	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. _____highly effective against opportunistic organisms or those of low virulence. (4pts)
2. _____an immunity that occurs after exposure to an antigen either from a pathogen or a vaccination? (4pts)

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

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Name: _____ Date _____

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Information sheet -10	Identifying organs and cells of the immune system

The immunity cells and tissues is constantly on the lookout for invaders, and once an enemy is spotted, a complex attack is mounted.

The immune system is spread throughout the body and involves many types of cells, organs, proteins, and tissues. Crucially, it can distinguish our tissue from foreign tissue — self from non-self. Dead and faulty cells are also recognized and cleared away by the immune system.

If the immune system encounters a pathogen, for instance, a bacterium, virus, or parasite, it mounts a so-called immune response. Later, we will explain how this works, but first, we will introduce some of the main characters in the immune system.

White blood cells are also called leukocytes. They circulate in the body in blood vessels and the lymphatic vessels that parallel the veins and arteries.

White blood cells are on constant patrol and looking for pathogens. When they find a target, they begin to multiply and send signals out to other cell types to do the same.

Our white blood cells are stored in different places in the body, which are referred to as lymphoid organs. These include the following:

- **Thymus** — a gland between the lungs and just below the neck. Produce lymphocytes, or T cells for short, among other things, are responsible for coordinating the innate and the adaptive immune system.
- **Spleen** — an organ that filters the blood. It sits in the upper left of the abdomen. As part of the immune defense, the functions of the spleen include the following:
    - It stores different defense cells that are released into the blood to get to the organs, if needed: macrophages, also called scavenger cells, can attack non-self-substances and pathogens directly. T lymphocytes inspect cell

surfaces, help in controlling defense and can also directly destroy cells that have been recognized as non-self or as pathogens. B lymphocytes produce antibodies, if needed.

- It is responsible for removing red blood cells (erythrocytes).
- Blood platelets (thrombocytes), which are responsible for blood clotting together, are stored and removed in the spleen.

- **Bone marrow** — found in the center of the bones, it also produces defense cells and red blood cells. Some of these defense cells, the so-called T lymphocytes (T stands for thymus), are differentiated in the thymus.
- **Lymph nodes** —small glands positioned throughout the body, linked by lymphatic vessels.

There are two main types of leukocyte:

1. Phagocytes

These cells surround and absorb pathogens and break them down, effectively eating them. There are several types, including:

- **Neutrophils** — these are the most common type of phagocyte and tend to attack bacteria.
- **Monocytes** — these are the largest type and have several roles.
- **Macrophages** — these patrol for pathogens and also remove dead and dying cells.
- **Mast cells** — they have many jobs, including helping to heal wounds and defend against pathogens.

2. Lymphocytes

Lymphocytes help the body to remember previous invaders and recognize them if they come back to attack again.

Lymphocytes begin their life in bone marrow. Some stay in the marrow and develop into B lymphocytes (B cells), others head to the thymus and become T lymphocytes (T cells). These two cell types have different roles:

- **B lymphocytes** — they produce antibodies and help alert the T lymphocytes.
- **T lymphocytes** — they destroy compromised cells in the body and help alert other leukocytes.

Self-Check -10	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. _____ is a gland between the lungs and just below the neck. (4pts)
2. What are the two main types of leukocyte? (6pts)

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

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Information sheet -11	Identifying the role and importance of the nervous system in animals

Functions of the Nervous System

The nervous system has three basic functions:

1. **Sensory neuron function** - to sense changes (known as stimuli) both outside and within the body. For example the eyes sense changes in light and the ear responds to sound waves. Inside the body, stretch receptors in the stomach indicate when it is full and chemical receptors in the blood vessels monitor the acidity of the blood.
2. **Integrative neuron function** - processing the information received from the sense organs. The impulses from these organs are analysed and stored as memory. The many different impulses from different sources are sorted, synchronised and co-ordinated and the appropriate response initiated. The power to integrate, remember and apply experience gives higher animals much of their superiority.
3. **Motor neuron function** - The third function is the response to the stimuli that causes muscles to contract or glands to secrete.

All nervous tissue is made up of nerve cells or **neurons.** These transmit high-speed signals called **nerve impulses**. Nerve impulses can be thought of as being similar to an electric current.

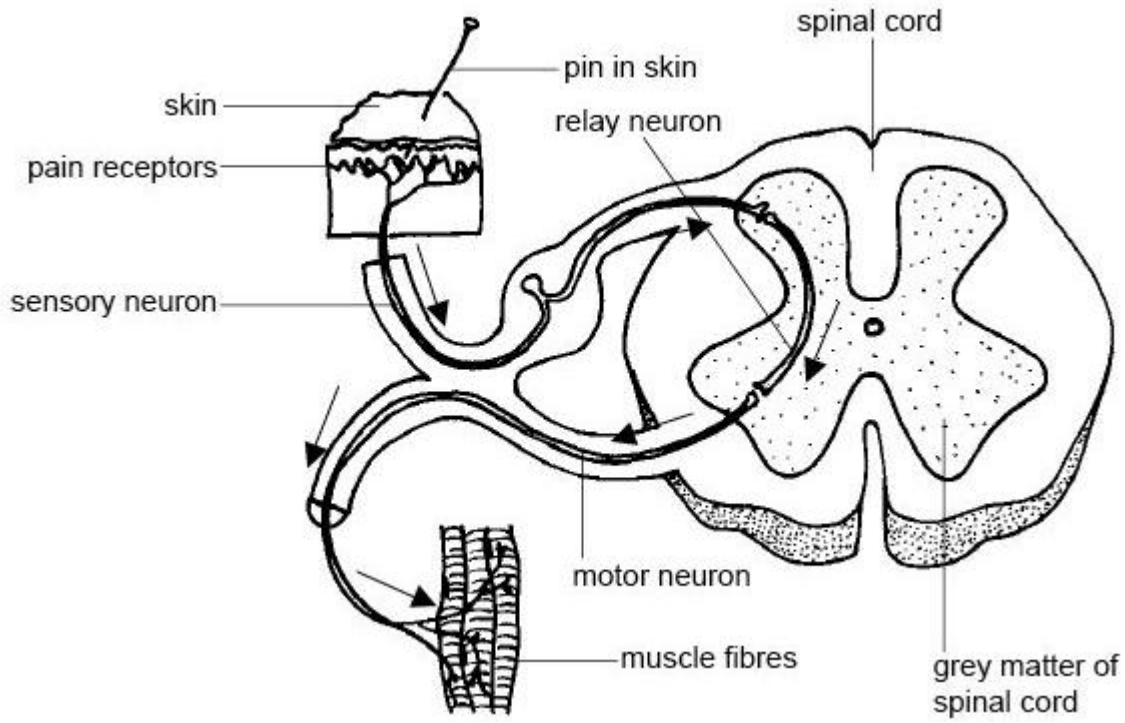


Diagram 14.2 - The relationship between sensory, relay and motor neurons

Self-Check -11	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the function of integrative neurons function? (4pts)
2. What is the function of motor neuron function? (4pts)
3. What is the function of sensory neuron function (4 pts)

Note: Satisfactory rating – 12 points Unsatisfactory - below 12 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

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Rating: _____

Name: _____ Date _____

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Reference

https://www.uoguelph.ca/foodscience/book-page/milk-biosynthesis

https://dairyprocessinghandbook.tetrapak.com/chapter/primary-production-milk

https://www.msdvetmanual.com/immune-system/the-biology-of-the-immune-system/overview-of-the-biology-of-the-immune-system

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Dairy production

Level –III

Learning Guide-21

Unit of Competence: Identify and describing Anatomy, Physiology and Behavior of Dairy Animal

Module Title: Identifying and describing Anatomy, Physiology and Behavior of Dairy Animal

LG Code: **AGR DRP3 M05 L04 LG21**

TTLM Code: **AGR DRP3 TTLM 1119v1**

LO4: Identify clinically important structure of animal body

Instruction Sheet 1	Learning Guide 21

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Identifying muscles involved on meat inspection and administration of drugs
- Identifying muscles involved in breathing and the different types of respiration
- Identifying the relative locations of organs used for external clinical diagnosis and application of treatment during ill health.
- Identifying the locations of blood vessels used in blood sample collection and drug administration.
- Identifying the clinical importance and locations of lymph nodes.
- Identifying appropriate sites for shoeing, hoof trimming and dehorning.
- Recognizing the location of sciatic nerve is identified and its importance during drug administration.
- Recognizing the location of the spermatic cord and its importance during castration.

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

The functions of the integuments are identified and described for different animal species

- Muscles involved on meat inspection and administration of drugs in different animal species are identified
- Muscles involved in breathing and the different types of respiration in farm animals are identified
- The relative locations of organs used for external clinical diagnosisand application of treatment during ill health are identified
- The locations of blood vessels used in blood sample collection and drug administration; for different animal species, are identified
- The clinical importance and locations of lymph nodes are identified
- Appropriate sites for shoeing, hoof trimming and dehorning are identified
- The location of sciatic nerve is identified and its importance during drug administration is recognized

- The location of the spermatic cord and its importance during castration are recognized

Learning Instructions:

1. Read the specific objectives of this Learning Guide 21.
2. Follow the instructions described in number 1 to 7.
3. Read the information written in the "**Information Sheet (1, 2, 3, 4, 5, 6, 7 and 8)** in page **(106, 109, 112, 116, 119, 122, 128 and 131)** respectively
4. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
5. Accomplish the **"Self-check (1, 2, 3, 4, 5, 6, 7 and 8)** in page **108, 111, 115, 118, 121, 127, 130 and 133 respectively**.
6. If you earned a satisfactory evaluation from the "Self-check" proceed to "Operation Sheet 1 and 2" **in -134 and 135.**
7. Do the "LAP test" in page 136 (if you are ready). Request your teacher to evaluate your performance and outputs. Your teacher will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your teacher shall advice you on additional work.

Information sheet -1	Identifying muscles involved on meat inspection and administration of drugs

1.1. Identifying the important muscles used for meat inspection

Sarcocysts can be found in skeletal muscle, cardiac muscles and central nervous system (CNS) in all species.

In cattle, sarcocysts are most common in cardiac muscle, the diaphragm and esophagus. In sheep also be found in the tongue.

The cylindrical, whitish cysts vary in size from a few micrometers to a few centimeters, and may or may not be visible to the naked eye.

They are found along the length of the muscle fiber and may resemble a grain of rice. Post-mortem lesions in symptomatic cattle may also include cachexia, hepatitis and myocarditis. Hemorrhages of the serosa of the viscera, myocardium and skeletal muscles have been reported in sheep infected with *S. tenella*. Sarcocysts have also been found in the muscles, lungs and other tissues. Therefore the following muscles should be inspected during post mortem for cysticercus parasites:

The tongue muscle

Massetter muscle

Biceps muscle

Triceps muscle

Diaphragm

Heart

1.2. Muscles used for drug adminstration

1. **Hamstring muscles**- pass caudal to the hip from tuber ischiadium to the proximal end of the tibia, fibula or the calcaneus of the tarsus. They include biceps femoris m., semi tendinous m. and semi memberaneous m. they are chief extensors of the hip.
2. **Gluteus muscle**- the middle gluteal muscle is another stronger extensor of the hip. It originates from thewing of iliumand inserts on the greater trochanter of the femur, a leverv projecting above the hip. The deep gluteal muscle extends from the spine of ischium laterad over the hip joint to insert on the greater trochanter.

3. **Trapezius muscle-** Trapezius muscle has 2 parts - Cervical and Thoracic part. it Originates from the median raphe of neck and supraspinous ligament between C3 and T9. Its insertion site is the Spine of scapula.

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. In which area sarcocyst is found? (4pts)
2. What types of muscles used for drug adminstration? (4pts)
3. List muscles used to inspect during post mortem for cysticercus parasites (4 pts)

Note: **Satisfactory rating – 12 points** **Unsatisfactory - below 12 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

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Information sheet -2	Identifying muscles involved in breathing and the different types of respiration

Upper airways muscles

- Nose–alae nasi flare the nostrils
- Pharynx–pharyngeal dilatormuscles (glenioglossus, tensor and levatorpalate) maintain pharyngeal tone during respiration, preventing collapse of the pharynx with the generation of negative intra-thoracic pressure that occurs during inspiration, and during sleep.
- Larynx–during inspiration, the crico-arytenoid muscle rotates the arytenoid cartilage, abducting the vocal cords to reduce resistance to airflow. During expiration, the thyro-arytenoid muscles cause adduction of the cords, increasing resistance to possibly prevent collapse of the lower airways.

Muscles of inspiration

- **Diaphragm**–the most important respiratory muscle, a membranous dome shaped muscle which separates the abdominal and chest cavities, with a surface area of 900cm2in adults and innervated by the phrenic nerve (C3--5). When it contracts at the start of inspiration, the diaphragm flattens down to increase intra-thoracic volume. This creates a negative intra-thoracic pressure relative to atmospheric pressure, favoring the movement of air from the mouth down into the lungs
- **External intercostal**–join adjacent ribs and contract at the start of inspiration to pull the ribs upward and outwards, augmenting the role of the diaphragm in increasing the intra thoracic volume.
- **Accessory muscles**
  - Scalenes–anterior, middle, posterior. Pull thefirst two ribs upwards.
  - Sternoclidomastoid–pulls the sternum upwards.
  - Pectoralis minor, vertebral extensors, serratus anterior

Muscles of expiration

During quiet breathing, expiration is passive, using the elastic recoil of the lungs and chest wall to move gas out of the mouth. IN active breathing, muscles used include:

- **Anterior abdominal wall muscles**: rectus abdomens, internal and external oblique and transverses abdomens. Contract on expiration and increase intra-abdominal pressure, pushing the diaphragm up and increasing intrathoracic pressure to favour air movement out of the lungs.
- **Internal intercostal muscles**–join adjacent ribs. Oppose the external intercostals by moving ribs downwards and inwards, enhancing the effects od the abdominal muscles.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is a muscle that creates a negative intra-thoracic pressure relative to atmospheric pressure, favoring the movement of air from the mouth down into the lungs? (4pts)
2. What are muscles used for inspiration air? (4pts)
3. What are muscles used for expirations air? (4pts)

Note: **Satisfactory rating – 12 points** **Unsatisfactory - below 12 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

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Information sheet -3	Identifying the relative locations of organs used for external clinical diagnosis and application of treatment during ill health.

Types of diagnosis

Based on the degree of certainty of the diagnosis and methods used to examine the animal diagnosis can be categorized as

I. Etiological diagnosis: - To determine the cause of disease.

II. Tentative diagnosis: - if the disease is not recognizable with certainty.

III. Symptomatic diagnosis- If a Particularly Prominent Clinical sign is present, but the site & cause are unknown, e.g. jaundice

IV. Complete (confirmatory diagnosis)- If sign, cause, site and nature of a disease are identified.

Physical examination methods for detection of clinical signs

A clinical examination is performed by senses of sight, touch, hearing and smell. The physical examination methods include:

A. Inspection

B. Palpation

C. Percussion and

D. Auscultation

A. Inspection (visual examination)

It is done with the aid of eyes to obtain a general impression. It is carried out some distance away from the animal and in close by.

B. Palpation

This is touching the part to be examined by the hand (*see fig. 1.7*) or probe to detect the presence of pain, various pathologies including variation in size, shape, consistency & to feel the temperature.

Terms Used To Define Palpation

A. Resilient - when a structure quickly resumes its normal shape after the application of pressure has ceased.

B. Doughy - when pressure causes pitting as in edema.

C. Firm - when resistance to pressure is similar to that of the normal liver

D. Hard - when the structure possesses bone like consistency.

E. Fluctuating - when a wave-like movement is produced in a structure by application of alternating pressure.

F. Emphysematous - When the swollen structure yields crepitating or crackling sound on pressure.

C. Percussion

It is done by means of striking a part of the body and listening to the sound generated, to obtain information about the conditions of the surrounding tissues (particularly the deeper lying organs) i.e. Is it a normal percussion sound or not? Percussion is used mainly for the examination of the thorax (lungs, heart).

- **Methods of Percussion**

1. **Hammer- Pleximeter Percussion** – This is a method of carrying out percussion in large animals using a Pleximeter & hammer.



Fig. 1.2 Pleximeter Percussion

2. **Finger – finger percussion**- this type of percussion is performed by using hands, the middle finger of one hand acting as a Pleximeter & the flexed middle finger of other hand as a hammer. It is mainly applied in small animals.

NB. The diagnostic value of percussion in large animals is rather limited because the internal organs are too large, and the over lying tissues (muscles, subcutaneous fat) are too thick to recognize the limits of the organs or abnormal areas, unless the clinician is highly experienced.

- **Modified Forms of Percussion**

1. **Ballottement –** in ballottement an interrupted firm push struck is applied to an appropriate part of the body with the object of evoking motion with the underlying organ & causing it to rebound on the fingertips. E.g. - pregnancy diagnosis in small animals and small ruminants.
2. **Fluid percussion:** Free fluid in a body cavity to be recognized by percussing the surface of the body on one side, and detecting the fluid wave produced by palpation of the opposite side.

Sounds Produced By Percussion

1. **Resonant**- it is characteristic of sound emitted by air containing organs, such as the lungs.
2. **Tympanic**- it is the sound produced by striking a hollow organ containing air under pressure, e.g. tympanic rumen or caecum.
3. **Dull**- it is the sound emitted by a solid organ like the liver or heart.

4. Auscultation

Auscultation is determining the physical condition of deep- lying organs, such as heart, lungs, and gastro intestinal tract, through the sense of hearing and with the aid of the **stethoscope**.



Fig. 1.3 Auscultation area

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are types of diagnosis during the animal diseased? (4pts)
2. What are the four physical examination methods for detection of clinical signs? (4 pts)
3. _____is touching the part to be examined by the hand or probe to detect the presence of pain. (2 pts.)

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information sheet -4	Identifying the locations of blood vessels used in blood sample collection and drug administration

4.1 Collection of blood from cattle

Jugular Vein

Using the halter, the head is elevated slightly, drawn to the side opposite the jugular vein to be sampled, and tied to a stationary surface. The vein is occluded by digital pressure n the jugular groove low in the neck. Insert 18 gauge needle into the distended jugular vein at approximately 45°. When positioned in the vein, collect blood. When the desired volume has been collected, the occluding pressure is removed.



Fig 1.4a blood sampling from jugular vein

Coccygeal vein:

Blood collection from the coccygeal (tail) vein is performed with the animal restrained in a crush. The tail is held in one hand such that the ventral surface is accessible. The ventral surface of the tail is cleaned with a swab to remove faecal material. A needle is then inserted perpendicular to the skin surface on the midline between (approximately) the third and fourth coccygeal vertebrae. When blood flows from the needle, the syringe is attached and the sample is collected.



Fig 1.5 blood sampling from tail vein

4.2 Collection of blood from sheep

Correctly position the animal for shearing. Shave the area approximately 4 inches wide by 8 inches long. Beginner can take the help of assistant. The assistant should turn the head of the animal at a 30–degree angle to the side by holding the animal under its jaw to allow for easy access to the vein. The animal's body may also need to be restrained. Locate the vein.



Fig 1.6b blood sampling from jugular vein

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are veins used to collect blood sample from dairy animal? (4pts)

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

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Information sheet -5	Identifying the clinical importance and locations of lymph nodes

Grossly enlarged lymph nodes may have been seen during observation of the patient before it is handled. Further observation and palpation is possible when the animal is restrained. The lymph nodes can be examined as a separate system or checked during the examination of the skin when the clinician's hands run over the whole body surface. Each paired node should be compared for size and consistency with the contralateral node.

Lymph node enlargement

This may occur for two main reasons.

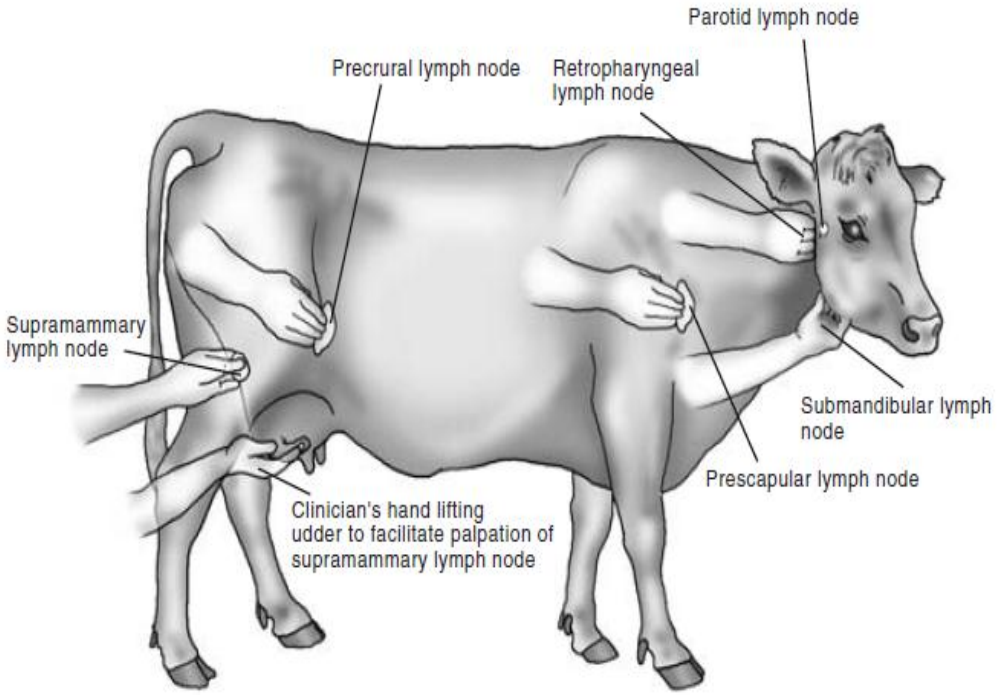
(1) Enlargement of one or more lymph nodes may occur in cases of infection of the lymphatic system. This can occur in a number of diseases including bovine tuberculosis, action bacillosis and a number of other bacterial infections. It can also occur in both forms of bovine leucosis – enzootic bovine leucosis (EBL) and sporadic bovine leucosis.

(2) Lymph node enlargement in response to local infection or inflammation in the region of the body drained by the lymph node involved. In these circumstances the lymph node is acting as a sentinel of local disease. The enlarged node may be warm and inflamed, and sensitive to the touch. On finding an enlarged lymph node the clinician should examine the area draining into the affected node for evidence of any pathological problem.

Location of the carcass lymph nodes

Many of the nodes are paired and should be compared for size and consistency. Lymph nodes are normally firmer than adjacent muscle and other soft tissues.

Fig. 1.7 Location of lymph nodes



Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What will be indicate during lymph node enlargement? (4pts)

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information sheet -6	Identifying appropriate sites for shoeing, hoof trimming and dehorning

A. Appropriate shoeing

Purpose of shoeing of animals.

1. To prevent excess wearing down of feet in working animals.
2. To prevent slipping of working animals on floor.
3. To prevent possible lameness and foot rot due to excessively worn out hoof and subsequent infected parts of hoofs.

Procedure:

Fig. 1.8 Appropriate site of shoeing



1. Cast the animal properly by Reuff's method and throw it on the soft ground. Tie at least three (two hind legs and one for leg) together.
2. Keep the feet resting on solid foot board?
3. Removal of old worn shoes. It is necessary to reduce the growth of the hoof wall occurred since last shoeing, before fitting new shoes.

(a) To remove a shoe knocks up the clenches with buffer and driving hammer.

(b) Raise each branch with the pincers, so that the nails are partly drawn out, taking care not to twist the shoe on the foot which may break the portion of the wall of the toe.

(c) Knock down the raised shoe with the closed pincers, draw out each nail and remove the shoe.

4. Clean the sole and clefts with the drawing knife. Remove any stumps of nails with the buffer and pincers.
5. Cut off loose chips of hoof from the lower and outside of the wall with the drawing knife. If the wall is overgrown it may be reduced by use of toeing knife or hoof trimmer.
6. In the last act of preparing the foot for shoeing makes use of rasp to bring the whole of the surface leveled.

7. Nailing the shoes:

(a) Place the shoe with one hand on the sole carefully to see that it is properly bedded to foot.

(b) Drive the nails in carefully one by one into the groove of the shoe through the toe wall directing outward. While doing so, if shoe tends to shift slightly, tap it back into position.

(c) As the nails point come through the horny wall of hoof, hammer it down (if it is short) or twist off with the claws of driving hammer but making it sufficient to form a clench.

(d) After the nails are driven, put the closed jaws of the pincers against the end of nail on the wall and drive the head of nail well into nail hole for proper fixing of shoe on the sole.

(e) Finally rub the edge of rasp round the juncture of shoes and hoof wall to prevent the edge of wall from splitting.

Precautions:

1. The bearing surfaces of shoe and foot should be leveled.
2. Proper angle of the hoof should be preserved and each side of the foot must be leveled when viewed from behind.
3. The outer circumference of the shoe should follow the hoof wall without being wide or close.
4. The shoe should be as light as possible, consistent and able to withstand wear for a month.
5. The minimum necessary number of nails should be used. The stumps nail left after point has been wrenched off is called “Clench” when beaten down to form a small hook.
6. The outer surface of the wall should be left untouched.
7. If nail length is not sufficient to clench up, if must be withdrawn and a fresh one is driven.
8. Nails be driven in right way otherwise it is likely to cause injury to sensitive laminae.
9. Both foot and shoe must fit each other and neither foot nor shoe is more important than the other.
10. The outer surface of the wall should never be rasped or cut except:

a. To make beds for clenches and clips.

b. In certain cases of brushing.

c. Very occasionally long toes may have to be ‘dumped’.

B. Appropriate hoof trimming

Step 1

Start with inside claw and trim to the appropriate length – 7.5cm for a small suckler cow or 8-8.5cm for larger breeds.

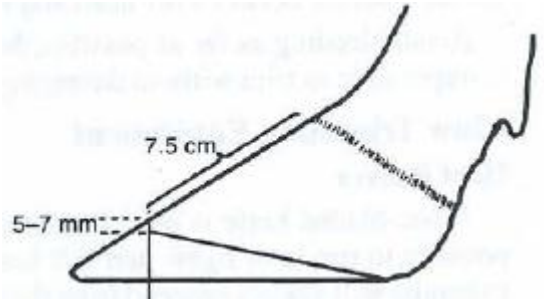


Fig. 1.9 Site of hoof trim

Once the toe is trimmed to the correct length, trim sole flat and spare the heel. Overtrimming the heel results in a shallower foot angle and increases the risk of digital dermatitis through increased contact with slurry.

Step 2

Move to the outside claw and trim the toe to match that of the inside claw – this image shows that this action is not required in this cow. Trim the sole flat to balance the heels for equal weight-bearing.

Again, the walls should not be trimmed in order to shape the foot as this removes the strongest weight-bearing areas.

Step 3

Modelling out. A small area is dished out from the sole on the inside claw – note that this should not extend into the bottom-third of the foot towards the toe.

A larger model is trimmed on the outside claw. Modelling aids slurry flow through the claw and reduces the risk of manure building up between the claws, and so reduces the risk of infectious causes of lameness.



Steps 4 & 5

The final two steps deal with problems on the foot.

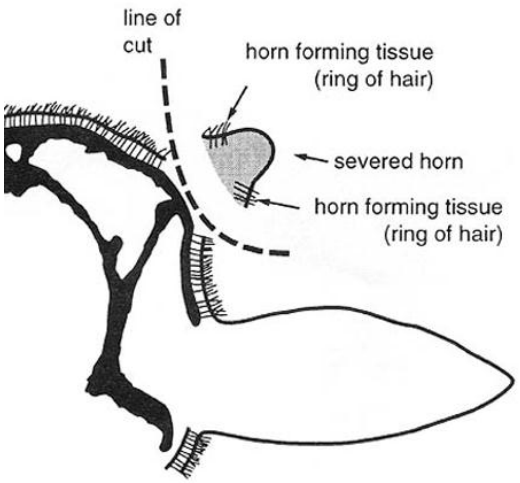
Step four involves resting the damaged claw by placing a block on the sound claw, usually the inside claw. In this example, this step was not required as there were no problems.

Step 5 involves removing loose or underrun horn from the back two-thirds of the outside claw and both heels. In this example, the cow had mild slurry heel and so the loose horn was removed without affecting heel height.



C. Dehorning

Dehorning is removal of the horns after they have formed from the horn bud. Physical methods of dehorning (gouge dehorning) include the use of embryotomy wire, guillotine shears, or dehorning knives, saws, spoons, cups, tubes, or high tension rubber bands. The Barnes-type scoop dehorner is commonly used for physical dehorning. When cattle have large horns they are sometimes "tipped", a procedure that removes the sharp end of the horn but leaves the base.



To ensure that there will be no regrowth of the horn after dehorning, the operator must remove the horn-forming tissue. This is done by removing a ring of skin at least 1 cm wide with the horn bud.

Fig. 1.10 Site of dehorning



Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the purpose of shoeing of animals? (4pts)
2. _____is removal of the horns after they have formed from the horn bud? (3pts)

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information sheet -7	identifying the location of sciatic nerve and recognizing its importance during drug administration

Location of sciatic nerve

The sciatic nerve is the major nerve arising from the lumbosacral plexus. Its fibers originate from the L4 to S3 spinal roots. The sciatic nerve leaves the pelvis through the greater sciatic foramen (sciatic notch) passing below the piriformis muscle and over the obturator internus muscle (Fig. 1.11a). In the buttock, it passes close to the posterior capsule of the hip joint. The sciatic nerve is composed of two distinct trunks, the medial or tibial division and the lateral or fibular division. The tibial division (medial part) innervates all the hamstring muscles with the exception of the short head of the biceps femoris which is innervated by the lateral division (fibular). The terminal branches (fibular and tibial) innervate all the muscles distal to the knee.

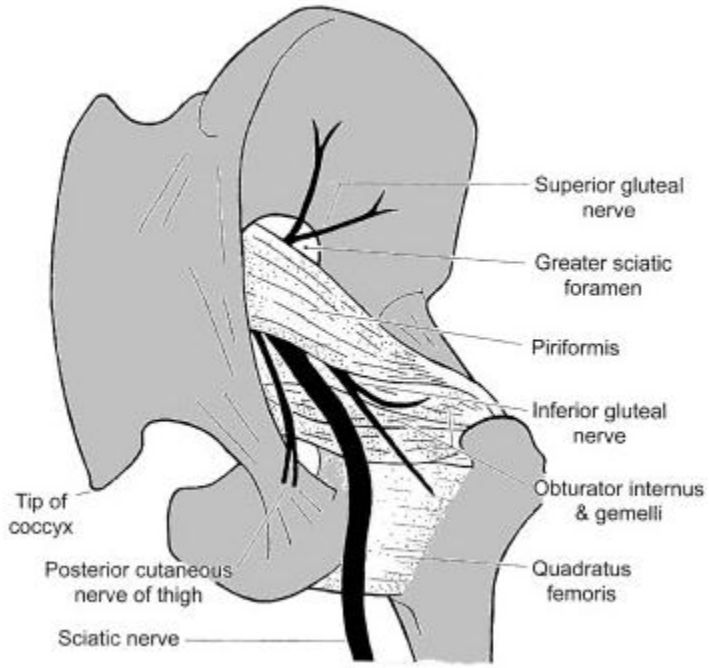


Fig. 1.11a. Area of sciatic nerve

The sciatic nerve is a large nerve which runs through the gluteal muscle. The sites were plotted and then the carcass dissected to show the position of the nerve. They found that

69% of injections were placed in a location that could cause damage to the sciatic nerve, and this was worse in thin cows



Fig. 1.11b. Area of sciatic nerve

Gluteal muscles – in the center of the muscular square bordered by the tuber coxae, tuber ischii, sacrum and base of tail. Do not inject caudal to the femur as this may damage the sciatic nerve (Fig. 1.11b.). For gluteal injections ensure safety when administering the injection by maintaining body position as close to the animal as possible; use a spare hand on the animal's body to detect sudden movements.

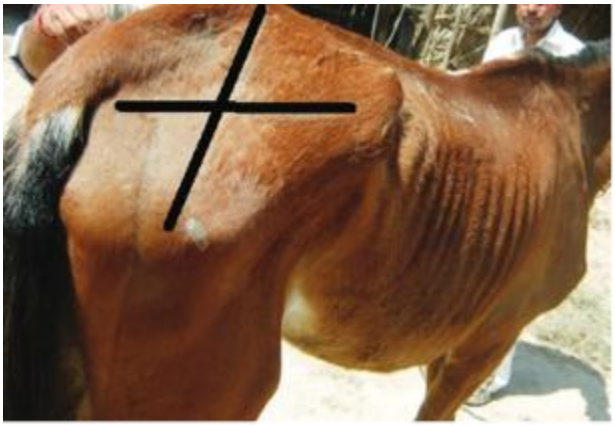


Fig.1.12 Area of gluteal muscle

Self-Check -7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. _____ is a large nerve which runs through the gluteal muscle (3pts)
2. _____is the center of the muscular square bordered by the tuber coxae, tuber ischii, sacrum and base of tail. (3pts)

Note: **Satisfactory rating – 6 points** **Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information sheet -8	Recognizing the location of the spermatic cord and its importance during castration

The **spermatic cord** is the **cord**-like structure in males formed by the vas deferens (ductus deferens) and surrounding tissue that runs from the deep inguinal ring down to each testicle. Its serosal covering, the tunica vaginalis, is an extension of the peritoneum that passes through the transversalis fascia.

- Traditionally farmers or animal raisers do not castrate animals and both males and females are allowed to mix together.
- The result is that poor males are allowed to mate with the females and the young stock produced are not very good.
- Uncastrated males also fight so it is better to castrate the animals which are not the best for breeding.

Methods of castration

With all methods of castration effective restraint (i.e. calf cradle) is essential for the welfare of the calf and the operator. Whether performing surgical or non-surgical castration it is important to disinfect equipment in an antiseptic solution, between animals, and have a separate bucket of antiseptic for washing hands.

- Surgical
- Elastrator rings
- Burdizzo (Bloodless castration pincers

Bloodless castration pincers

This is a method of bloodless castration for older calves. This technique is performed with the calf standing and the tail held over the animal's back. Push the testicle down in the scrotum and position the cord to one side. The burdizzo is then positioned approximately one-third of the way across the scrotum and applied over the cord about 2 inches above the testicle (Fig. 1.13). The burdizzo is left in place for approximately one minute. It is strongly suggested that the emasculator be applied twice on each cord. Repeat the procedure on the other side of the scrotum. Do not apply the burdizzo all the way across

the scrotum. The crushing of the blood and nerve supply is sufficient to make the testicle atrophy and become non-functional. Care must be exercised to be sure the cord is crushed and that no other damage is done. If the cord has been missed, repeat the procedure.



Fig. 1.12 Bloodless castration pincers

Self-Check -8	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

4. What is a method of bloodless castration for older calves (4pts)
5. _____is the **cord**-like structure in males formed by the vas deferens (ductus deferens) and surrounding tissue. (4pts)

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

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Operation sheet # 1	Perform shoeing of animal

Procedure

Step 1 cast the animal properly by Reuff's method and throw it on the soft ground.

Step 2 Keep the feet resting on solid foot board

Step 3 Removal of old worn shoes.

Step 4 Clean the sole and clefts with the drawing knife.

Step 5 Cut off loose chips of hoof from the lower and outside of the wall with the drawing knife.

Step 6 In the last act of preparing the foot for shoeing makes use of rasp to bring the whole of the surface leveled.

Step 7 nailing the shoes

Operation sheet # 2	Perform hoof trimming

Appropriate hoof trimming

Step 1 Start with inside claw and trim to the appropriate length – 7.5cm

Step 2 Move to the outside claw and trim the toe to match that of the inside claw

Step 3 Modelling out. A small area is dished out from the sole on the inside claw

Step 4 Step four involves resting the damaged claw by placing a block on the sound claw, usually the inside claw.

Step 5 involves removing loose or under run horn from the back two-thirds of the outside claw and both heels.

LAP Test-1	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 40min.

Depending upon the disease status of your animals, you may have to practice the following

Task 1: Perform shoeing of animal

Task 2: Perform hoof trimming

Reference

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Dairy production

Level –III

Learning Guide-22

Unit of Competence: Identify and describing Anatomy, Physiology and Behavior of Dairy Animal

Module Title: Identifying and describing Anatomy, Physiology and Behavior of Dairy Animal

LG Code: **AGR DRP3 M05 LO5 LG22**

TTLM Code: **AGR DRP3 TTLM 1119v1**

LO5: Identify behavior of dairy animals

Instruction Sheet 1	Learning Guide 22

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Observing, interpreting and recording behaviour of individual and groups of animals
- Comparing observed behaviour with known normal behavioural patterns.
- Identifying and implementing strategies to encourage natural behaviour.
- Recognizing and recording signs of stress in animals
- Implementing possible stress relieving systems.
- Taking appropriate measures on undesirable behaviourof animals.
- Participating in the determination and implementations of strategy to manage undesirable behaviour.

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

The functions of the integuments are identified and described for different animal species

- Behaviour of individual animals and groups of animals is observed, interpreted and recorded in accordance with institutional policies and procedures.
- Observed behaviour is compared with known normal behavioural patterns for a range of species.
- Strategies to encourage natural behaviour are identified and implemented.
- Signs of stress in animals are recognised, recorded and possible stress relieving systems implemented.
- Appropriate measures are taken on undesirable behaviour of animals according to the supervisor instruction.
- Participate in the determination and implementation of strategy to manage undesirable behaviour.

Learning Instructions:

1. Read the specific objectives of this Learning Guide 22.

2. Follow the instructions described in number 1 to 7.
3. Read the information written in the “Information Sheet (**1, 2,3, 4, 5, 6 and 7**) in page **141, 144, 147, 149, 152, 155 and 158** respectively
4. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
5. Accomplish the **“Self-check** (**1, 2, 3, 4, 5, 6 and 7**) in page **143, 146, 148, 151, 154, 157 and 159** respectively.
6. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 and 2” **in page -**
7. Do the “LAP test” in page (if you are ready). Request your teacher to evaluate your performance and outputs. Your teacher will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your teacher shall advice you on additional work.

Information sheet -1	Observing, interpreting and recording behaviour of individual and groups of animals

Under present day intensive dairy production systems the quantity and quality of animal's environment are reduced, resulting in the increased probability of development of abnormal behaviors as modern production systems provide minimum facilities only for the nutrition, reproduction and rest while the facilities for other important behavioral needs such as exploration, investigation, socialization, maternal care-giving, offspring's care-soliciting and play behavior are abysmally neglected.

Any behavior that does not fall in to the normal behavior repertoire of a species is termed as abnormal, while a stereotypy is a relatively invariant sequence of movements which has no obvious purpose or benefits such as prepuce sucking, scrotum sucking, tongue playing, bar biting and eye rolling are the examples of stereotypic abnormal behavior in dairy animals. It has been reported that 64 per cent of dairy animals comprising indigenous cows, crossbred cows and buffaloes kept under loose housing system at an organized dairy farm were suffering from one or other anomalous behavior.

The major abnormal behaviors observed in dairy cattle and the preventive and management measures to be taken are:

- Inter Sucking and Cross Sucking Behavior in Calves
- Inter Sucking or Self Sucking In Adult Cows
- Pica or Licking of Inanimate Objects
- Silent Heat Problems
- Milk Ejection Reflex Failure
- Neonatal Rejection
- Kicking Backwards
- Urine Drinking Problem
- Other Behavioural Problems

When describing antagonistic behaviours, use the following descriptors:

- **head butting**; which occurs with physical contact where one animal is butting, hitting, thrusting, striking or pushing the other animal with forehead, horns or horn base with a forceful movement; the receiver does not give up its present position
- **displacement;** which is physical contact where one animal is forcing the other animal to give up its position
- **chasing**; where one animal makes another animal move
- **fighting;** where two animals push their heads against each other while planting their feet on the ground with both exerting force against each other
- **chasing-up**; where one animal uses physical contact against a lying animal to make it rise

The behavior of cattle is determined both by instinct and experience, although the contribution of each is often disputed. One way to resolve this is to look at the behavior of animals isolated from the relevant environmental influences at birth. This is of dubious validity for some behaviours, e.g. vocalisation, which can be influenced when animals experience their mother's call *in utero*. Even so, there is no doubt that some behaviors, particularly those needed immediately after birth, are almost entirely innate (fully developed and complete at first appearance). Rearing calves in isolation produces socially maladjusted adult cows – less dominant, more nervous, and less interactive with other cows and having poor mothering ability

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the examples of stereotypic abnormal behavior in dairy animals? (4pts)
2. How the behavior of cattle is determined? (6pts)

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

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Information sheet -2	Comparing observed behaviour with known normal behavioural patterns

Known social behavior

Cattle are considered as gregarious animal, i.e. lives in a herd. Accordingly, they live in herds with other conspecifics and their behaviors are strongly dependent on other members of the herd. It is believed that a cow can recognize 50-70 other conspecifics.

The importance of social behavior in cattle or in other herd living animals becomes evident when the animal keepers aim to manage their herds. For example, when they plan to perform some medical treatment or transport them to another place, they should know the way animals communicate with each other and how to control them in order to reduce the probable risks of handling and improving their welfare.

Range cattle live in groups of cows and calves; males are often separated until breeding season. Dominance in cattle is based on age, sex, weight, presence of horns, and territoriality. Breed also seems to play a role heavier dairy cattle are dominant to lighter breeds, while lighter beef cattle are dominant to heavier breeds. When a heavier and older cow is introduced into a group, it is usually subordinate to existing members of the group. In large herds, triangular relationships between cows exist. In dairy cattle, hierarchies change constantly as cows are added or removed from the herd. Once a hierarchy is established, overt aggression is reduced.

Normal Cow Behavior

Cows differ widely in temperament. Some are always gentle; others are quite active, alert, and somewhat nervous under normal conditions and very excitable under stress. Most cows exhibit normal behavior patterns and respond to kindness and superior herd management. However, from time to time, a few animals in every herd develop behaviors which interfere with regular herd routine:

1. Stray voltage/current problems can accentuate differences in temperament. However, other management problems can have similar effects.

2. Concentrating animals (decreasing the surface area per animal), or introducing new animals into the herd, can increase aggressiveness in the herd.
3. Most cows kick because they are frightened, are in pain, or have been mistreated.
4. Tail-switching is sometimes used to express intense emotion. Restrained animals in a fearful situation tail-switch more than usual as they struggle against restraint.
5. Cows are often called creatures of habit. They notice and respond to any unusual change in their routine.

Behaviors of herd animals they:-

- Will follow the leader
- Will eventually group
- Frightened by intruders
- Anxious when isolated

- Isolated animals more dangerous
- Mothers will protect their young
  - Avoid separating cow-calf pairs

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Most cows exhibit normal behavior. What are they? (4pts)

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information sheet -3	Identifying and implementing strategies to encourage natural behaviour

Understanding animal behavior

In order to achieve the desired high levels of welfare, farmers, stockpersons and animal handlers should have at least a basic understanding of the behaviour of the animals they work with. Knowledge of animals' natural behaviour is essential in ensuring we create an environment, manage and care for individual animals and herds in a manner that enables them to express themselves naturally and to remain healthy with a high quality of life. This is a fundamental aspect of livestock production that we support and promote.

More specifically, gaining an understanding of animal behaviour allows us to more effectively identify and treat sick animals, respond to immediate challenges, select animals for breeding, design appropriate housing and to handle and herd without creating unnecessary stress

Behavior and health

Understanding and observing the feeding behaviour of cattle can provide an early indication of sickness, and there are techniques and indicators to further enable this as a management tool especially for groups of animals.

For example, electronic transponders implanted in ear tags allow monitoring at feeding time, and it has been shown that using such equipment to measure reduced time at the feed trough can be used as an early indicator of morbidity in beef cattle and is more effective than just visual appraisal.

However, the practical applications of detecting health challenges, such as parasite infestations, through behaviour may depend on the condition, the level of infection and their pathophysiological consequences.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is a fundamental aspect of livestock production that we support and promote? (4pts)

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

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Information sheet -4	Recognizing and recording signs of stress in animals

Recognition and assessment of stress and distress

The most potent sources of stress in captive environments for a given species on conditions that are likely to be stressful can be gleaned from descriptions of the behavior of the species in its natural habitat, but such information is no substitute for data based on experiments carefully conducted in the captive environment.

In assessing stress and distress in an animal, one should first determine whether the source is pain (acute or chronic) or other factors. That might be evident from the animal's recent history. If the animal is in pain, it might also be in distress. Or some unrelated, non-pain stressor could be producing distress or potentiating the pain. If it is determined that a stressor other than pain is contributing to the animal's distress. Distress caused by pain alone generally abates when the pain is relieved. But non-pain-induced distress should be addressed as a problem separate and distinct from pain and usually requires a non-pharmacologic (environmental) approach.

As indicated earlier, stress and distress are complex syndromes that are difficult to define and even harder to interpret and recognize. The recognition and assessment of stress and distress and the identification of events that induce them present many problems not often apparent to the untrained observer. The syndromes are among the physiologically most complex and psychologically compelling experiences that a human, and presumably an animal, can have.

Record potential Causes of Stress in Laboratory Animals

Husbandry Practices
• Inappropriate or variable temperature, humidity, ventilation, or illumination
• Inappropriate cage or enclosure size
• Noise
• Too infrequent change in bedding or removal of waste
• Stale food or dirty water
• Denial of positive social stimulation
• Maternal deprivation
• Social intimidation or abuse by companions

• Unprofessional behaviors or practices Experimental Design • Food and water deprivation • Inadequate caging • Poor or inappropriate technique • Failure to adapt or handle animals • Restraint • Social deprivation • Frequent changes in procedures or personnel
This is not meant to be all-inclusive and excludes situations in which pain-induced stress can arise (e.g., postsurgical recovery). It is assumed that animals are otherwise physically healthy.

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. _____ are complex syndromes that are difficult to define and even harder to interpret and recognize. (4pts)

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

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Pharmacologic control of stress and distress

The tranquilizers and sedatives used in animals today include drugs in four groups: phenothiazines, butyrophenones, benzodiazepines, and α2-Adrenergic agonists. Phenothiazines and butyrophenones have many common properties, especially general sympatholytic activity. They used to be considered "major" tranquilizers in human medicine; currently preferred terms are *antipsychotics* and *neuroleptics*. Benzodiazepines, once considered "minor" tranquilizers, are now thought of as antianxiety-sedative agents. α2-Adrenergic agonists have emerged as a very important group of drugs for tranquilizing and sedating animals.

Non-pharmacologic control of stress and distress

This section considers nonpharmacologic ways of preventing, minimizing, and alleviating non-pain-induced distress in laboratory animals through husbandry and management practices, socialization and handling, environmental enrichment, and experimental design. (The pharmacologic management of pain, a major stress that often leads to distress, and will not be discussed here, except to emphasize that the use of drugs to alleviate non-pain-induced distress is generally inappropriate.) As a general rule, nonpharmacologic approaches to the prevention or minimization of distress are more desirable than pharmacologic approaches.

Heat stress – factors

Heat stress in dairy cattle is actually the result of four variables; they are:

- Air dry bulb temperature
- Air relative humidity
- Air speed
- Radiation

How a cow cools herself

There are four basic pathways to remove metabolic heat produced within or heat transferred to a cow's body. Non-evaporative means include: 1) conduction, 2) convection, and 3) radiation.

When a high thermal gradient exists, heat is readily transferred from the cow to the surrounding environment. However, as summer temperatures rise to 70ºF and above, the gradient becomes too small to effectively cool cows solely by non-evaporative means. During these conditions, evaporative cooling, the fourth pathway, is most effective at keeping cows comfortable.

- Fans first (forced air convective cooling
- Ambient air conditions effect cooling
- sprinkling and fan cooling

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are stress controlling medicine**?** (4pts)
2. What measure will be taken to keeping cows comfortable from heat/hot environment.

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

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Information sheet -6	Taking appropriate measures on undesirable behaviour of animals

Regular observations

To detect health problems in animals, it is necessary to observe them frequently, several times per day. This can be combined with observations for heat detection

When observing the animal, check the following:

- Behaviour: does it react normally to its environment and in the group or is it acting strangely?
- Attitude: does it carry its head, ears, body and tail as usual? Does it walk normally?
- Condition: is the animal in good condition and is it well-muscled, neither too thin nor too fat?
- Does it eat, drink and ruminate properly?
- Does it urinate and defecate normally?
- If a cow is milked, is the milk normal and is there any sudden drop in production?
- Any other abnormal signs?

General examination

Be very careful with abnormal animals and pay attention to hygiene while examining the following aspects:

- Breathing frequency
- Pulse or heartbeat.
- Chewing the cud (rumination).
- Body temperature.
- Coat, skin, hooves and horns

Recommended Best Practice

- Dairy cattle should be kept in stable social groupings as much as practicable and the introduction of new animals into the herd should not occur more frequently than is necessary, because of the social stress involved as the introduced and resident dairy cattle re-establish a hierarchy.
- When mixing groups of unfamiliar animals, or introducing new animals to a stable social group, or when releasing cattle from long periods spent in an off-paddock facility, animals should be observed until settled and monitored for signs of

continuing aggression. Dairy cattle should be provided with sufficient area and with a non-slip surface, so that newcomers can move into free space if displaced or physically pushed or butted by the other animals.

- Under usual conditions cattle should be able to lie and rest comfortably on a dry, clean and well-bedded/soft surface for 10-12 hours a day to meet their behavioural needs.

Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are observed/checked while you examine abnormal animal? (4pts)
2. List the observing animal to check abnormality? (6pts)

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

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Information sheet -7	Participating in the determination and implementations of strategy to manage undesirable behaviour

Strategies to manage undesirable animal behaviours, including:

- Consulting behavior specialists.
- Food or food-related enrichment.
- Providing equipment to encourage appropriate exercise.
- Providing equipment and toys for skill development and time occupiers.
- providing species-appropriate housing and bedding

- Genetic selection for reduced aggression is feasible.
- Fighting and bullying post-mixing were moderately heritable, and skin lesion counts 24hrs after mixing could be used as a proxy trait.
- A genetic merit index using lesions to the anterior, central and rear regions recorded at 24h post-mixing as separate traits should allow selection against animals that participate in reciprocal fighting.
- Because of the low genetic correlations, selection for reduced aggression is likely to have only a small negative impact on the ease of handling at weighing.
- Selective breeding for reduced post-mixing lesion scores should have a long-term ameliorative effect on aggression and its related injuries even after dominance relationships have been established (i.e. pigs will be generally less aggressive).

Self-Check -7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

6. What are strategies to manage undesirable animal behaviours? (4pts)

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

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