

Structural Organisation in Animals

Introduction



Life activities are done by cells, tissues, organs and organ systems in animals. Tissues are a group of similar cells which perform a particular function. One or more types of tissues are combined to form organs. Cells, tissues, organ and organ systems exhibit division of labour in the animal body. These tissues are grouped into four-epithelial tissue, connective tissue, muscular tissue and nervous tissue.

The learner is aware of tissues like blood, muscle etc

Values and attitudes

After completing the chapter the learner

- ❖ *Appraises the role of cells and tissues in the formation of organisms which makes structural and functional diversity in the living world.*
- ❖ *Develops an ecofriendly behaviour by acquiring knowledge about the structural and functional uniqueness*



Concepts/ Ideas	Process/Activity with assessment	Learning outcome
<p>Animal Tissues</p> <p>➤ Epithelial tissue</p> <ul style="list-style-type: none"> • Simple epithelium • Compound epithelium <p>➤ Connective tissue</p> <ul style="list-style-type: none"> • Loose connective tissue <ul style="list-style-type: none"> • Dense connective tissue • Specialized connective tissue <p>➤ Muscle tissue</p> <ul style="list-style-type: none"> • Skeletal muscle • Smooth muscle • Cardiac muscle <p>➤ Neural tissue</p> <ul style="list-style-type: none"> - Observing - Identifying - Classifying - Differentiating - Inferring - Communicating 	<p>☞ General discussion using slide presentation, permanent slides and chart.</p> <p>■ Preparation of temporary stained slide preparation of cheek cell, blood smear (Practical evaluation)</p> <p>■ Observation of permanent slide of three types of muscular tissue.</p> <p>■ Preparation of model of the neuron</p> <p>■ Preparation of sketches with labelling and notes.</p>	<ul style="list-style-type: none"> • Identifies, differentiates, sketches, labels, and explains the different types of tissues • Explains and sketches the structure of muscles. • Constructs the model of neuron.
<p>Organ and Organ System</p> <p>➤ Earthworm</p> <ul style="list-style-type: none"> • Morphology • Anatomy • Economic importance <ul style="list-style-type: none"> - Observing - Identifying - Sketching - Differentiating - Communicating 	<p>☞ General discussion using slide show and field visit</p> <p>■ Preparation of vermicompost as an extended activity</p> <p>■ Listing of consolidation points in activity log noting the importance of earthworm in nature.</p>	<ul style="list-style-type: none"> • Recognises, explains, sketches and labels the major parts of earthworm • Differentiates the functions of various systems • Appraises the importance of earthworm's role in nature

Concepts/ Ideas	Process/Activity with assessment	Learning outcome
<p>➤ Cockroach</p> <ul style="list-style-type: none"> • Morphology • Anatomy <ul style="list-style-type: none"> • Digestive system • Circulatory system • Respiratory system • Excretory system • Nervous system • Reproductive system <ul style="list-style-type: none"> - Observing - Identifying - Sketching - Differentiating - Communicating 	<ul style="list-style-type: none"> ☞ General discussion using slide show ■ Demonstration of anatomical parts using virtual lab ■ Listing the consolidation points on morphology and anatomy of cockroach ■ Prepares the labelled diagram of mouthparts and digestive system of cockroach. 	<ul style="list-style-type: none"> • Recognizes, explains, sketches and labels the major parts of cockroach • Differentiates the functions of various systems of cockroach. • Identifies the role of cockroach in nature
<p>➤ Frog</p> <ul style="list-style-type: none"> • Morphology • Anatomy <ul style="list-style-type: none"> - Digestive system - Respiratory system - Circulatory system - Excretory system - Nervous system - Reproductive system • Economic importance <ul style="list-style-type: none"> - Observing - Identifying - Communicating - Differentiating 	<ul style="list-style-type: none"> ☞ Group discussion using slide presentation ☞ Demonstration of anatomy using virtual lab ■ Prepares notes and foodchain in activity log ■ Construction of food chain including frog 	<ul style="list-style-type: none"> • Recognizes, explains, sketches and labels the major parts of frog. • Appraises the importance of frog's role in nature.



Through the Chapter....

The mentor introduces the chapter showing the permanent slides of blood smear.

There are number of cells embedded in the matrix.

The preparation contains similar cells-Tissues.

Animal Tissues

CONCEPT: Epithelial tissues

- Simple epithelium
- Compound epithelium

Activity suggested: General discussion and Labwork

The mentor demonstrates cheek epithelium preparation and asks the learner to prepare their own. Through general discussion using slides the mentor explains the types of epithelial tissues.

Points to be discussed

- What are the different types of epithelial tissues?
- Name two types of glandular epithelium
- Based on the mode of secretion, how are glands classified?
- What is compound epithelium?
- Why are certain epithelium called ciliated?
- What are cell junctions?
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Preparation of temporary mount of human cheek epithelium

- ▲ *Collect epithelial tissue from the inner part of cheek by a gentle scrap using a nail or tooth pick.*
- ▲ *Spread the tissue for uniformly and stain using Methylene blue.*
- ▲ *Observe stained slide under microscope.*

Consolidation

- Epithelial tissues-simple and compound
- Simple epithelium-squamous, cuboidal, columnar
- Ciliated epithelium and its structure, location and function.
- Glandular-exocrine, endocrine
- Cell junctions-tight, adhering and gap junctions.
-

Notes in the activity log with consolidation and diagram showing different tissues.

Assigned activity

Make a chart showing the different types of epithelial tissues with diagrams.

CONCEPT : Connective tissue

- Loose connective tissue
- Dense connective tissue
- Specialised connective tissue

Activity suggested : General discussion

The mentor initiates a general discussion using slide show. The learners are asked to list the types of connective tissue.

Points to be discussed

- Categorise the types of connective tissue
- Based on the arrangement of fibres mention the types of connective tissues.

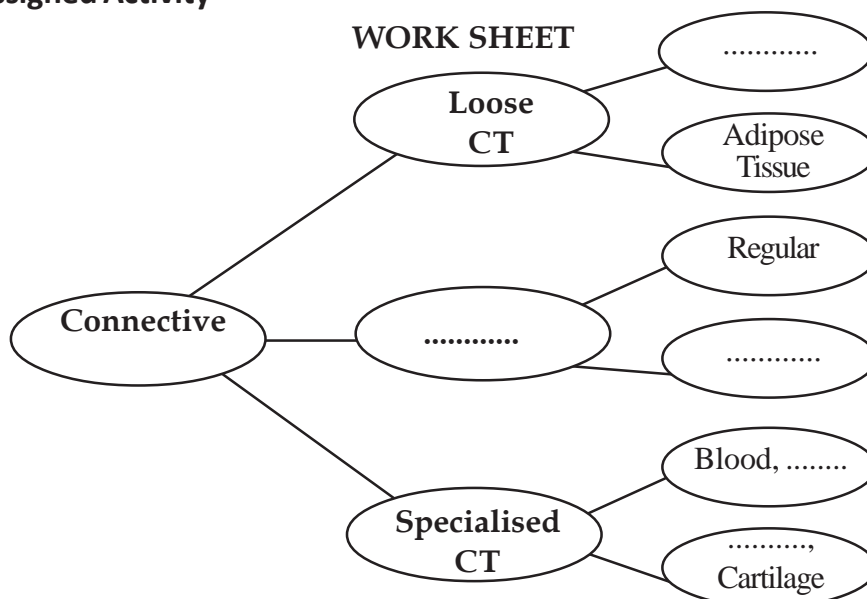
Consolidation

- Connective tissues - Loose CT, Dense C T and Specialised C T
- The Loose C T - eg-Areolar C T and Adipose CT
- Dense C T may be Dense regular or Dense irregular
- Specialise C T - cartilage, bone and blood

Notes on different types of connective tissues are consolidated in the activity log.

The following worksheet is to completed and can be used for peer assessment

Assigned Activity

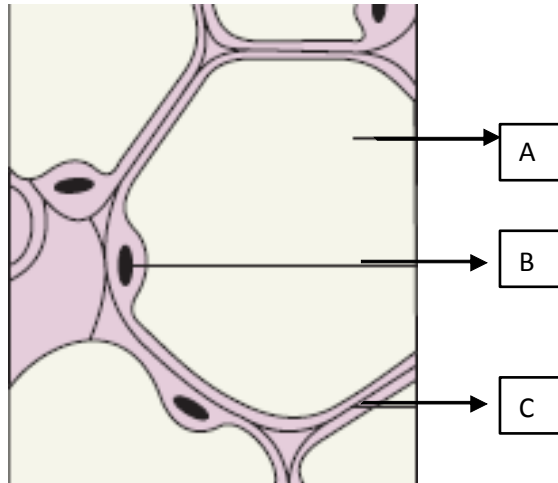




Make a chart showing the diagram of dense regular and dense irregular CT

- Label the following diagrams :

CONCEPT : Muscular Tissue



- Striated Muscles
- Non -striated
- Cardiac

Activity suggested : Group discussion

The mentor describes muscles through a group discussion using slide show.

Points to be discussed

- Classify muscles based on structure, function and location.

Consolidation



- Muscles are striated, non striated and cardiac.

Labelled sketches and notes on different types of muscles in the activity log are assessed as portfolio.

Assigned Activity

- Make a chart showing the details of three types of muscles .

CONCEPT : Neural Tissue

- Neuron
- Neuroglia

Activity suggested : General discussion

A general discussion is initiated using slides. The learners are asked to construct a model of the neuron using low cost materials.

Points to be discussed

- Explain the structure of a neuron.
- What are neuroglia?
-

Consolidation

- A neuron has a cellbody, axon and dendrites.
- Neuroglia is the connective tissue that connect neurons.
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Assigned Activity

- Construct a model of a neuron.

Notes on the structure of Neuron given in the activity log and a prepared model of neuron is assessed.

CONCEPT : Earth worm

- Morphology and anatomy.
- Economic importance.

Activity suggested : General discussion, Field study

A general discussion is conducted after visiting a vermicompost unit.

Points to be discussed

- What is the peculiarity of the first segment in earthworm?
- Identify the characteristics of the fused segments from 14-16 in earthworm.
- What are the morphological and anatomical peculiarities of



earthworm?

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Consolidation

- Peristomium is the first segment in earthworm which has a dorsal lobe called prostomium and a ventral mouth.
- Clitellum is formed by the fusion of 14-16 segments.
- The digestive system contains different parts like gizzard, typhlosole, intestinal caeca etc.
- Nephridia are of 3 types-integumentary, septal and pharyngeal nephridia.
- Circulatory system consists of the blood, heart and blood vessels.
- Earthworm is monoecious. Fertilisation is internal.
- Earthworm increases soil fertility.
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CONCEPT : Cockroach

- Morphology and anatomy
- Economic importance

Activity suggested: Videopresentation and general discussion

The mentor describes the morphology and anatomy using slide and video presentation raising a general discussion.

Points to be discussed

- Name the material present in the exoskeleton of cockroach.
- What is the food habit of cockroach?
- What is the peculiarity of the circulatory, respiratory, excretory and nervous systems in cockroach?
- How is the vision in cockroach different?
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Periplaneta americana

It is lighter in colour

It is about 38 mm long

Wings are present in both the sexes and extend beyond the posterior end of the body

Blatta orientalis

It is darker in colour

It is about 25 mmlong

Wings are rudimentary in the female and do not extend the hind end of the body in the male.

Consolidation

- Chitinous exoskeleton enables the arthropod to become the most successful animals on earth.
- Cockroaches are omnivorous in diet.
- Blood flows through open spaces called lacuna or sinuses and so circulation is open type.
- Air enters the tissues through trachea via ten pairs of openings in the lateral side of the body wall called spiracles or stigmata.
- 100-150 fine yellowish blind tubules that drain waste materials into intestine and expelled out.
- In cockroach the nervous system is formed by a brain and a double ventral ganglionated nervecord.
- Cockroach has mosaic vision with high sensitivity and less resolution.
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CONCEPT : Frog

- Morphology and anatomy.
- Economic importance.

Activity suggested: Video presentation and general discussion.

The mentor describes the various systems of frog through a general discussion using slide and video presentation .

Points to be discussed

- How do you distinguish a male frog from a female one ?
- What are the digestive secretions in frogs ?
- What are the different organ systems and their functions in frog?
- What is the structure of the reproductive system in frog?
- How is frog important in nature?
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Consolidation

- Male frog has vocal sacs and nuptial pads.
- Liver produces bile that emulsifies fat and pancreas produce enzymes that digest carbohydrates and proteins like higher animals.
- In water they respire by the skin (also during hibernation) but on land they respire using lungs and buccal cavity.



- In frog there is special venous connection between liver and intestine and kidney.
 - Endocrine glands in frog - thyroid, parathyroid, thymus, pineal, pituitary, pancreatic islets, adrenals and gonads.
 - The ear helps in hearing and balancing (ear is represented as tympanum)
 - In male frogs, the testes opens into kidney through Bidder's canal and form a common urinogenital duct that opens into cloaca. In females the ovum from ovary is transported by oviduct and urine is carried by ureters separately into cloaca.
 - Frog is an important link in the food web.
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- Activity log with consolidation and completed chart showing various systems.

■ **Process Assessment**

- Preparation of temporary mount of human cheek epithelium (PE)
- Preparation of blood smear (PE)
- Observation of permanent slides of observation of permanent slides of types of muscles (PE)
- Construction of model of neuron
- Demonstration of anatomical parts of cockroach using virtual lab
- Making of chart showing structure the epithelial tissues, muscle tissues and neuron

■ **Portfolio Assessment**

- Cheek epithelium (PE)
- Temporary mount of cheek epithelium and diagram (PE)
- Blood smear and diagram of blood cells (PE)
- Diagrams of skeletal, cardiac and smooth muscles (PE)
- Diagrams of TS of born and cartilage.
- Model of neuron.
- Labeled diagrams anatomical parts of cockroach.
- Charts of epithelial tissue, muscle tissue and neuron.

■ **Unit Assessment**

- Unit test
- Oral test
- Preparation of question and answers



Questions

1. Name the first segment in earthworm
a) Prostomium b) Peristomium c) Clitellum d) Metamere
2. Clitellum is formed by fusion of segments
a) 22-26 b) 26-35 c) 14-16 d) 5-9
3. Name the organ in earthworm homologous to human kidney.
a) Nephridium b) Flame cells c) Malpighian tubules
d) Green glands
4. Earthworm is considered as 'friend of farmers'. Give reason.
5. Rearrange the following terms to denote the alimentary canal of cockroach.
gizzard-oesopagus-mouth-rectum-anus-ileum- mesenteron-colon-crop
6. Malpighian tubules open into mesenteron. But they are not related to digestion. Give reason.
7. Though the nervous system is not well developed in cockroach, the sense organs are an exception .How do you respond to it?
8. Like higher animals in frog liver and pancreas acts in a similar way. How do you substantiate this statement?
9. In which of the following animals both hepatic and renal portal system are present
a) Man b) Frog c) Rabbit d) all the above
10. In frog the digestive, reproductive and excretory systems open into a common chamber. Name the structure.



SCORING KEY

Q. No	Value Points	Split score	Total score
1	Peristomium	½	½
2	14-16	½	1
3	(a)	½	½
4	They make the soil porous and increase aeration and increase soil fertility and root penetration.	1	1
5	Mouth-esophagus-crop-gizzard-mesenteron-ileum-colon-rectum - anus	3	3
6	Malpighian tubules are excretory in function but they open into mesenteron .	1	1
7	The sense organs of cockroach are a pair of compound eyes, antennae, maxillary palps, chemosensory receptors in legs etc. The compound eyes are highly sensitive with thousands of units called ommatidia.	½	1
8	In frogs the liver produces bile which helps in fat digestion. The pancreas produce pancreatic juice that helps in protein and fat digestion like higher animals.	1 1	2
9	Frog	1	1
10	Cloaca	½	½

Origin and main role of major tissues.

Name	Origin	Main functions
1 Epithelial tissues	Ectoderm, Endoderm and Mesoderm	Protection, secretion, absorption, excretion, reproduction
2 Connective tissue	Mesoderm	Attachment, support, protection, storage and transport
3 Muscular tissue	Mesoderm	Movement and locomotion
4 Nervous tissue	Ectoderm	Control and coordination of nerve impulse

Types of glands

Glands are classified in the following ways

1. **Based on the site of secretion, glands are classified as**

- a) **Exocrine glands** - They send their secretions by way of ducts to the site of action.
- b) **Endocrine glands** - They lack ducts. They discharge their secretions into the blood to be carried out to the site of action.

Cartilage

Cartilage is of three types

- a) **Hyaline cartilage** - It has a clear, homogenous, translucent, bluish-green matrix. It is called glass like cartilage since fibres are less. It is found in sternal ribs, tracheal and bronchial ribs, laryngeal wall etc.
- b) **Fibrous cartilage** - It contains prominent fibres in the matrix. They are of two types
 - i) **White fibrous cartilage** - It has little matrix and abundant white collagen fibres. They are found in intervertebral discs.
 - ii) **Yellow fibrous cartilage** - It has abundant network of yellow fibres in addition to white fibres. It is found in nasal septum, eustachean tube, epiglottis etc.
 - iii) **Calcified cartilage** - It has calcium salts deposited in the matrix. It is very hard and inelastic. It is found in the suprascapula of frog and vertebrae of shark etc.

Bone marrow

It's a soft, fatty tissue in bone. Its of two types

- a) **Red bone marrow** - It is red in colour due to the presence of numerous erythrocytes. It is an active tissue and produces blood corpuscles. It consists of reticular tissue and has only a few fat. It occurs in the spongy parts of the bones.
- b) **Yellow bone marrow** - It is yellow due to predominance of adipocytes. It is a passive tissue, which at the time of emergency, changes into red marrow to produce blood corpuscles. It consists of largely fat cells and a few reticular cells. It occurs in the shafts of the bones.



Regarding the texture, bone is of two types

- i) **Compact bone** - It has lamella arranged in Haversian systems without gaps in between shaft of the bones is formed of a hollow cylinder of compact bone. Its cavity contains yellow bone marrow. It stores fat and produces blood corpuscles in emergency.
- ii) **Spongy bone** - It has lamellae called trabeculae that form interlacing network with small spaces between them. These spaces contain red bone marrow. It is highly vascular and produces erythrocytes and granular leucocytes. Vertebrae, ribs, skull bones and expanded ends of long bones are formed of spongy bone enclosed by a layer of compact bone. The spongy bone provide considerable strength with a minimum of weight.

Bone formation

The skeleton is formed entirely of cartilage in an early embryo. Bone formation occurs later.

The process of bone formation is called ossification. It produces four types of bones with regard to their source.

- i) **Replacing bone** - Ossification occurs on cartilage. eg. Femur, humerus.
- ii) **Investing or membranous or dermal bone** - Ossification is formed in the dermis of skin as thin plates, which sinks to get attached over the original cartilaginous endoskeleton which gets covered. eg. parietals, frontals, nasals etc.
- iii) **Seasamoid bone** - Ossification is formed in tendons. eg. Patella
- iv) **Visceral bones** - Ossification is formed in the soft organs. eg. os-cordis in the heart of ruminants, os penis in the penis of rodents, os clitoris in the clitoris of many carnivores, os palpebrae in the eyelids of crocodiles etc.

Earthworm must keep its skin moist by secreting mucus to remain alive. It leaves its burrows during heavy rain, and if, sun comes out again and is left on a pavement, its skin dries up and it dies. In such a situation, earthworm is unable to secrete mucus fast enough to make up for that lost by evaporation.