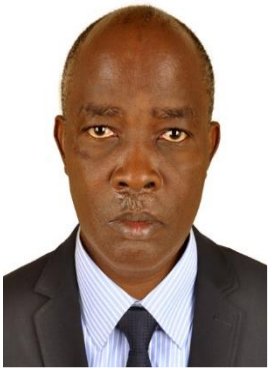

Dr. Bbosa Science

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Cells and tissues

Overview

The cell is the basic unit of life. A cell caries out a number of activities including protein synthesis, cell division and is where hereditary materials is. Specialized cells constitute tissues.

General objective

By the end of the topic, the learner should be able to describe the structure, function and organization of cells in an organization of cells in an organism.

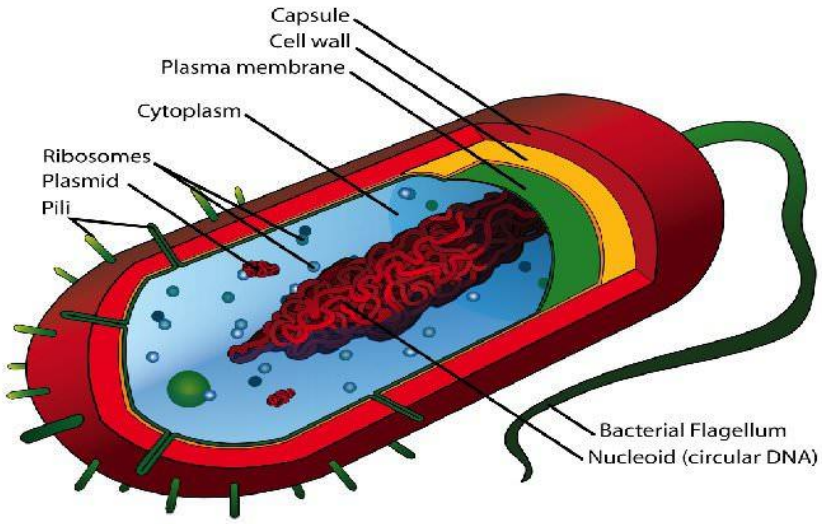
Specific objectives:
The student should be able to

a. Identify plant and animal cell structures visible under the light microscope.
b. Draw and label detailed animal and plant cells.
c. State the functions of cell structures as seen in an electron microscope
d. Distinguish the plant and animal cell as seen through an electron microscope
e. Explain the theory behind the structure of plasma membrane
f. Describe the fluid mosaic model of the plasma membrane.

1. There are two types of cells

a. Prokaryotic cells have DNA which is not enclosed in a nuclear membrane. They do not have true nuclei. They lack membrane bound organelles. Examples are bacteria and blue green algae,

A diagram of a bacterial cell



b. Eukaryotic cells contain membrane bound organelle including a true nucleus, mitochondria, chloroplast and others.

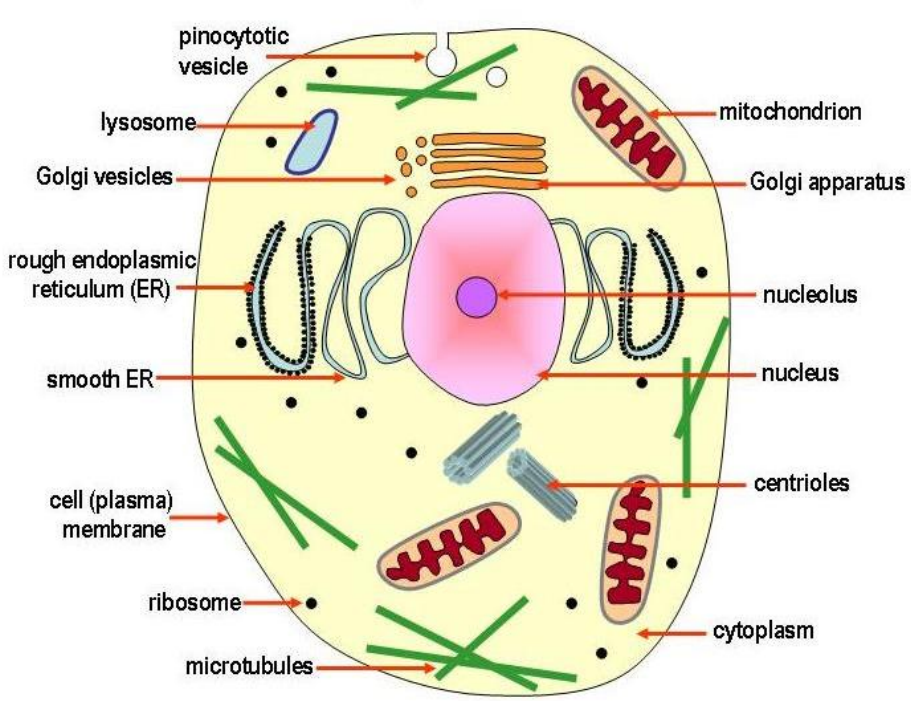
Advantages of membrane bound organelle

1. Many metabolic processes involve enzymes embedded in membranes, so the membrane bound organelles increase the surface area for activities like respiration and photosynthesis.
2. Maintain enzymes of a particular path way in one area for easy accessibility.
3. The metabolic pathway inside an organelle can be controlled by controlling substances that enter and leave the organelle.
4. Harmful reactants can be isolated

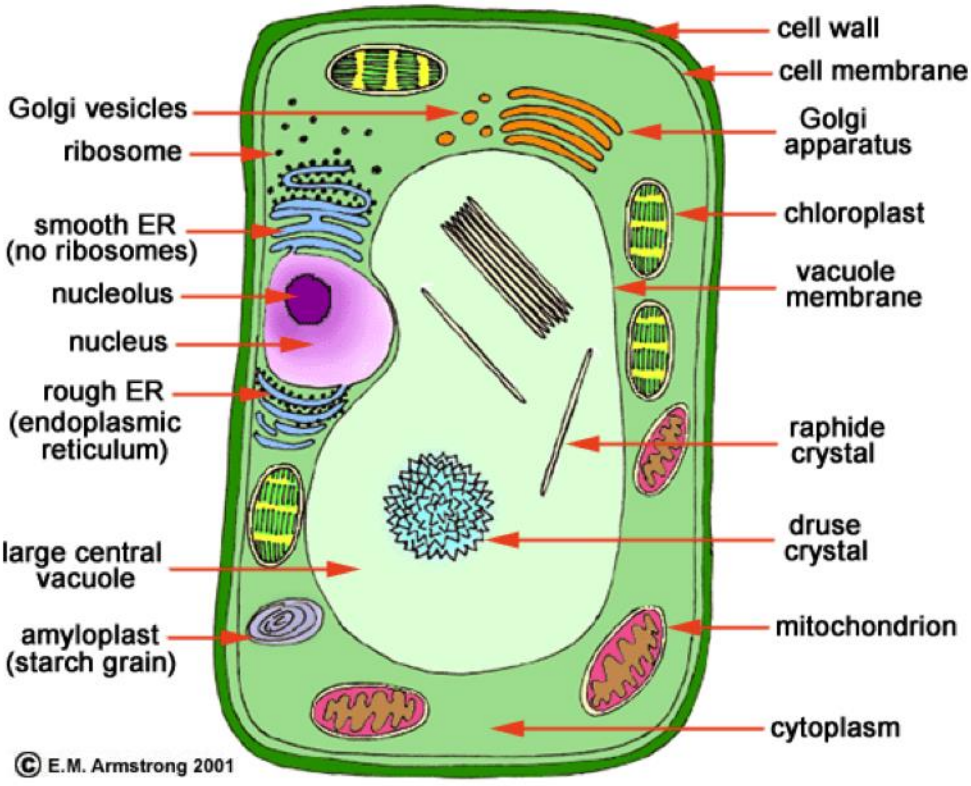
Differences between eukaryotic and prokaryotic cells

	Prokaryotic cell	**Eukaryotic cell**
1.	DNA not enclosed in membrane	DNA enclosed in a double membrane nucleus
2.	Has small ribosome (70s)	Has big ribosome (80s)
3	Lack mitochondria	Has mitochondria
4	Has no endoplasmic reticulum	Has endoplasmic reticulum
5	Small size	1000-1000 times the size of prokaryotes
6	Lack lysosomes and peroxisomes	contain lysosomes and peroxisomes
7	Lack Golgi apparatus	Has Golgi apparatus
8	Simple flagella	Complex flagella
9	Respiration occur in mesosome	Respiration occur in mitochondria
10	Lack chloroplasts	Plant cells have chloroplasts
11	Have ability to fix nitrogen	Lack ability to fix nitrogen

Fine structure of animal cell



Fine structure of plant cell



Differences between plant cell and animal cell

	Plant Cell	Animal cells
1	Has chloroplast	Lack chloroplast
2	Has cell wall	Lack cell walls
3	Has large central vacuole	Lack a vacuole or has small vacuoles
4	Has starch granule	Lack starch granule
5	Nucleus at the side	Nucleus centrally placed
6	Tonoplast present around vacuole	Tonoplast absent
7	Centrioles absent	Centrioles present
8	Cilia and flagella absent in higher plants	Cilia and flagella present
9	Few cells are capable of division	Almost all cells are capable of division

Parts of the cell

1. **Cytoplasm**

   All cells have a cytoplasmic matrix. It is an aqueous solution or colloidal suspension of mainly vital cellular materials. It is the site for protein synthesis and metabolic activities

   Functions of the cytoplasm
   1. Contain or keep organelles
   2. Contains nutrients for organelles
   3. Stores materials
   4. Maintain conductive atmosphere for cellular reaction

2. **Cell membrane**

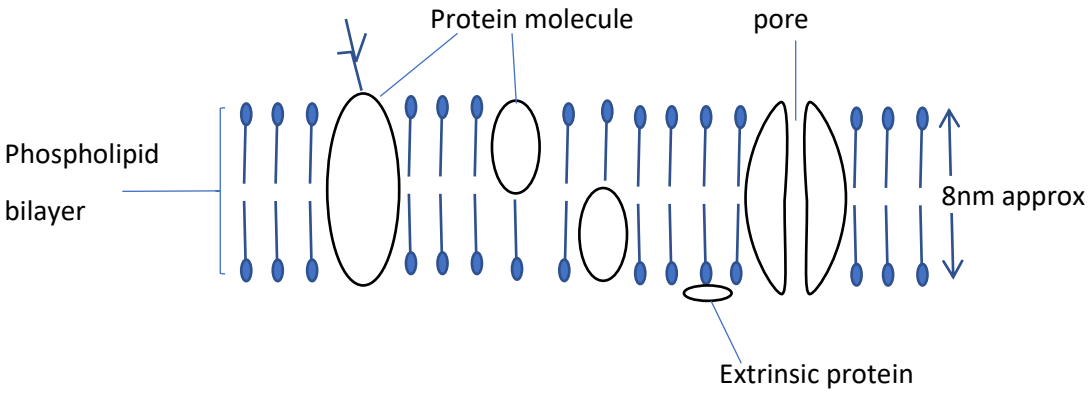
   It serves as a boundary between the cell and its environment. It may permanently exclude some items from the cell while permanently retaining others.

   Functions of the cell membranes
   1. It separates the contents of the cell from the external environment.
   2. Controls exchange of materials between the cells and external environment
   3. It separates compartment with specialized functions inside the cell
   4. Acts as receptor site for recognizing external stimulus such as hormones.
   5. Allows uptake of materials by phagocytosis and pinocytosis.
   6. Support enzymes of complex metabolic pathways in place for close proximity.

The fluid mosaic model of the cell

- The cell membrane is about 7nm thick
- It consists of a continuous phospholipid bilayer in which proteins are scattered in a mosaic manner.
- Proteins penetrate through the bilayer at a varying degree to form intrinsic and extrinsic proteins

- Intrinsic protein are those that penetrate through the bilayer while extrinsic proteins are those that float on top as islands in a sea.



Components of cell membrane and their function

1. Phospholipids: affect the fluidity and permeability of the membrane
2. Cholesterol: make the membrane less fluid at higher temperature.
3. Glucolipids: act as recognition sites e.g. human blood group system is as result of different glycolipids on the cell membrane of red blood cell.
4. Proteins:
   (i) provide structural support for the membrane,
   (ii) assist in active transport across the membrane
   (iii) act as recognition sites
   (iv) act as enzyme, energy transducers and electron carriers
5. Glycoproteins are recognition sites, e.g., for neurotransmitters and hormones.

The nucleus

This is the largest cell organelle enclosed by a double membrane perforated by nuclear pores. It contains chromatin which is the form of chromosomes during interphase. The nucleus also contains nucleolus that produces ribosomes

Function of nucleus

1. Contains DNA for inheritance controlling cell division and protein synthesis.
2. The nucleolus manufactures ribosome
3. Controls all activities of the cell

28. Growth in size of a single cell is limited by the

A. cytoplasm.

B. nucleus.

C. cell vacuole.

D. cell membrane.

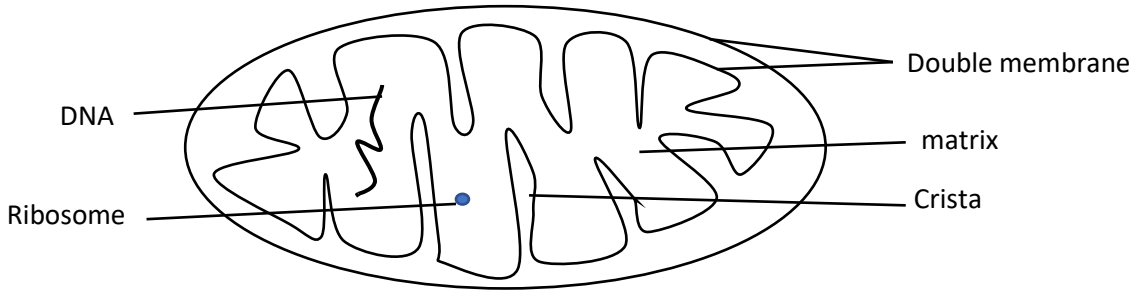
Nuscloli

Functions of nucleoli

The nucleolus is the site of synthesis of ribosomal RNA which is combined with proteins in the cytoplasm to make ribosomes.

Mitochondria

It a cell organelle surrounded by two membranes, the inner being folded to form **cristae**. The mitochondrion contains a matrix with a few ribosomes a circular DNA molecule and phosphate granules. Its main function is producing energy by aerobic respiration.



Adaptations of mitochondria to its function

1. The inner membrane is folded to form cristae that increase surface area for enzymatic activities.

2. Contains circular DNA to produce the necessary enzymes.
3. Has a large surface area for diffusion of gases.
4. Matrix contain necessary enzymes for Krebs cycle

Endoplasmic reticulum

This is a system of flattened membranes bound sacs called cisternae, forming tubes and sheet. Is continuous with the outer membrane of the nuclear envelope. Some of its parts is covered by ribosome and this is called **rough endoplasmic reticulum**. The part without ribosomes is called **smooth endoplasmic reticulum**.

Functions of endoplasmic reticulum

1. Ribosomes are site of protein synthesis
2. Smooth endoplasmic reticulum is a site of lipids and steroid synthesis.
3. The tubes are for intracellular transport

Golgi apparatus

Consists of stack flattened membrane-bound sacs, called cisternae, continuously being formed at one end of the stack and budded off as vesicles at the other.

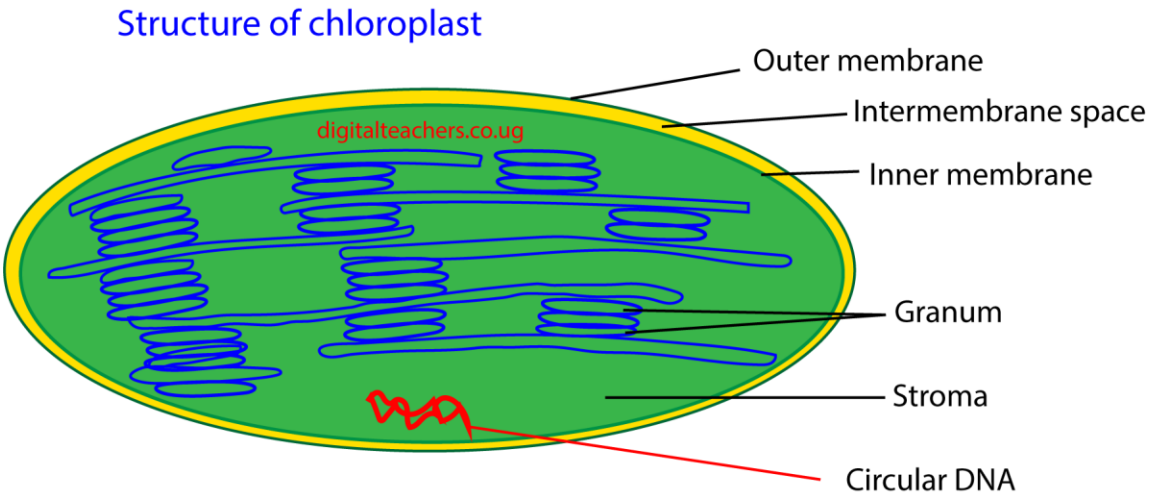
Functions of Golgi apparatus

1. Producing glycoproteins by adding carbohydrates to proteins
2. Producing secretory enzymes, e.g. digestive enzymes
3. Replenishing the cell wall
4. Produces materials for synthesis of plant cell wall.
5. Produces lysosomes concerned with breakdown of worn out structures in the cell.

Lysosome

Single small organelle that contain enzymes to destroy worn out parts of the cell and autolysis (digestion of the cell)

Chloroplasts



It is restricted to plant cell and used for photosynthesis. It is surrounded by an envelope of two membranes and contains a gel-like stroma through which runs a system of membranes that are stacked in places to form **grana**. The stroma contains ribosomes, circular DNS and lipid droplets.

Similarities between mitochondria and chloroplasts

1. Both have double membrane, circular DNA
2. Inner membrane is folded to increase the surface area
3. Contain ATPase enzyme for ATP synthesis
4. Both occur in plant
5. Both contain carrier proteins
6. Both contain circular DNA
7. Both contain ribosome,

Differences between mitochondria and chloroplasts

Chloroplast	Mitochondria
Structural difference	
1. Contain chlorophyll	Does not contain chlorophyll
2. Inner membrane form grana	Inner membrane folded to form cristae
3. May contain starch granules	Does not contain starch granules
Functional difference	
4. Use water	Produce water
5. Produce O_2	Produce CO_2
6. Use sunlight and store its energy in food made	Set energy free from food for work
7. Occur only in green plants	Occur in both plants and animals

Histology

Specific objective

The learner must be able to

- Explain how epithelia tissues are adapted to diversity of functions in the body
- Distinguish between different levels of organization
- State the advantages and disadvantages of being unicellular
- State the advantages of being multicellular

Definition

A tissue is a group of similar cells linked with associated intercellular substances to perform a particular function(s). In complex organism, different tissues combine to form organs and organs combine to form organ system. Organ system combine to form organism

Advantages of unicellular state	Advantages multicellular state
Can exist on its own	There is specialization
Do not need gaseous exchange surface	Indefinite growth

Types of animal tissues

Classification of tissues depending on their function lead to the following:

Animal tissues

a. Epithelial tissues
b. Connective tissue
c. Skeletal tissue
d. Nerve tissue
e. Reproductive tissue

Plant tissue

a. Meristematic tissue
b. Epidermal tissue
c. Parenchyma
d. Collenchyma
e. Sclerenchyma
f. Vascular
g. Cork

Animal tissues

1. Epithelium

These are tissues that cover the external and internal surfaces of animal body. They may be made up of one or more layers of cells resting on a basement membrane. The cells are connected together by substance called hyaluronic acid.

The epithelial tissues function to protect underlying structures from injury through abrasion or pressure and from infection. Stress is combated by the tissues becoming thickened and keratinized, and where cells are sloughed off due to contact friction the epithelium shows a very rapid rate of cell division so that lost cells are speedily replaced. The free surface of the epithelium often is highly differentiated and may be absorptive or secretory in function

Epithelial tissues are subdivided into two major categories

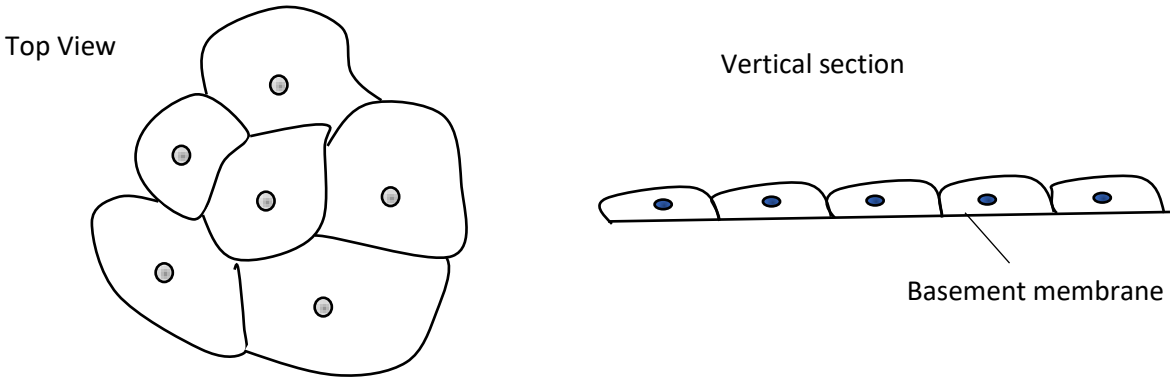
a. Simple epithelium
b. Compound epithelium

Simple epithelium

This type of epithelium is made up of only one layer of cells. Simple epithelium is divided into 5 types

(i) Squamous
(ii) Cuboidal
(iii) Columnar
(iv) Ciliated
(v) Pseudostratified

(a) Squamous epithelium consists of a sheet of flattened cells which fit closely together rather like crazy paving



Location of squamous epithelial tissue

- Skin outer layer
- Bowman's capsule in the kidney
- Alveoli of lungs
- Capillary walls

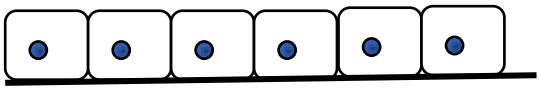
Squamous epithelium is thin and therefore allows easy diffusion of materials across it.

Function

- Protective
- Aloe easy diffusion

(b) Cuboidal

Heights of the cell is approximately equal to its width, when viewed in vartial section the cells appear square.



Location

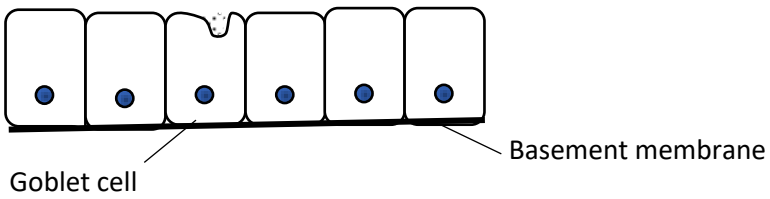
- Salivary duct
- Collecting duct of the kidney
- Thyroid gland

Functions

- Secretory
- Absorptive and its surface may be increased by microvilli to increase surface area.

(c) Columnar epithelium

It is made of elongated cells at right angles to the basement membrane.



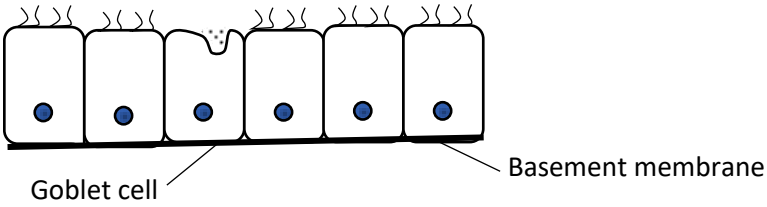
Location

Lining of the stomach and small intestines

Functions

- Secretory e.g. secretion of mucus in the stomach
- Absorptive e.g. absorption of digested food in the intestines.

(d) Ciliated epithelium



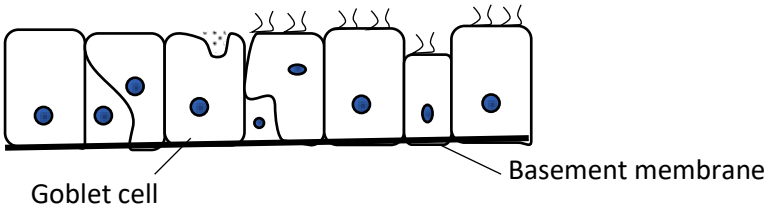
This is made of columnar shaped cells but having numerous cilia at their end. The cells are associated with mucus secreting goblet cells producing fluids in which cilia set up current.

Location

- Oviduct
- Trachea
- Bronchi

(e) Pseudo-stratified epithelium

This is made up of one layer of cells but some cells do not reach the free surface. It appears as if it is stratified.



Location

- Urinary tract
- Trachea
- Olfactory mucosa

Function

Secretory

Compound epithelium

made up of more than one layer of cells. There are two types of compound epithelium

a. Stratified epithelium

Made up of a number of layers of cells. The cells are made by mitotic division of the germinal layer which rests on the basement membrane

Occurrence: vagina, esophagus and skin

Function: protects the body against friction.

b. Transitional epithelium

This is made of 3-4 layers of cell. The cells are able to modify their shape when placed under different conditions.

Location: urinary bladder, ureter and pelvis

Glandular epithelium

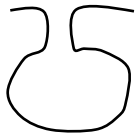
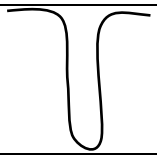
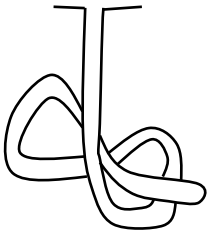
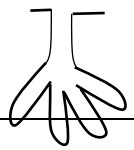
These are epithelium cells that are folded inwards forming invagination where cells lining the bottom of the invagination are secretory.

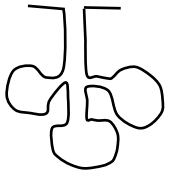
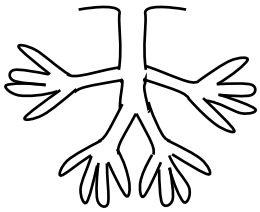
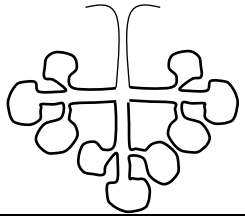
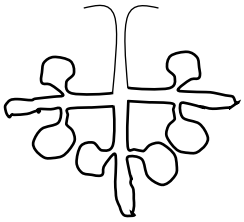
There are two types

(i) Exocrine glands: these are glands whose secretion are released through ducts
(ii) Endocrine glands: are glands without ducts and pass their secretion into blood streams.

Types of exocrine glands

There are different types of glands depending on the epithelial folding.

Types of gland	Structure	Examples
1. Simple saccular		Mucus glands in the skin of amphibian
2. Simple tubular		Crypts of Lieberkühn of the walls of mammalian small intestines Fundic region of the stomach
3. Coiled tubular		Sweat gland
4. Simple branched tubular		Brunner's gland in walls of mammalian small intestines

5. Simple branched saccular		Secretory sebaceous glands in mammalian skin
6. Compound tubular gland		Parts of the pancreas which secretes digestive enzyme and mammary glands
7. Compound saccular		Mammary gland
8. Compound tubular-saccular		

Connective tissue

These are the tissues that hold specialized tissues and organs in the right position and fill the spaces between them. They consist of jelly-like ground substances or matrix in which several types of cells are embedded.

Classification

(i) Loose connective tissue
(ii) Fibrous tissue (white and yellow)
(iii) Adipose tissue
(iv) Dentine tissue
(v) Skeletal tissue
(vi) Blood cell making tissue

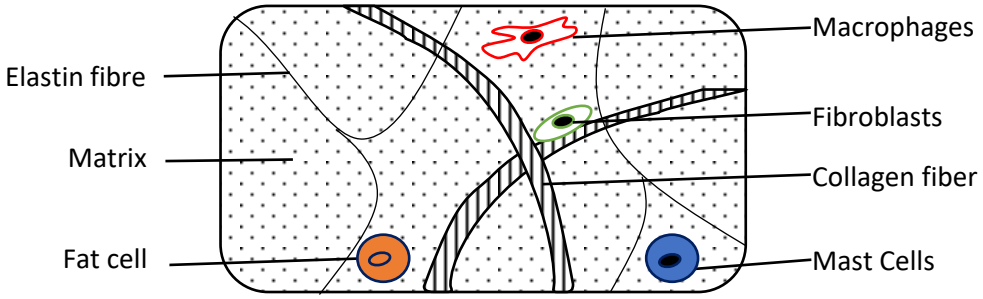
(i) Areolar

This is the fundamental type of connective tissue found allover the body beneath the skin and therefore connecting the skin and therefore connecting the skin to structures below it. It binds sheets of epithelium to mesenteric (capillary network around alimentary canal). It joins blood vessel and nerves whereby they enter or leave body organs. It also fills up space between adjacent tissue and therefore acts like packing tissue.

Functions

- packing tissue
- insulator due to accumulation of fat cells
- support other organs

Structure

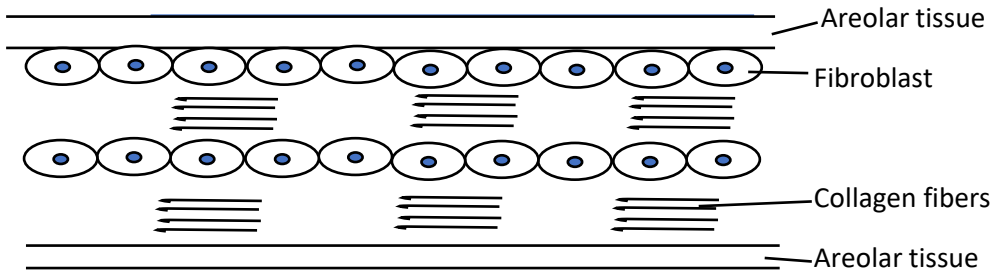


Functions of parts of connective tissue

- **Fat cells** store fats
- **Collagen and elastic fibers** provide mechanical support and flexibility.
- **Matrix** provide nutrients to the cell
- **Fibroblast** produce ground substance
- **Neutrophil, macrophages, mast cells** for defense

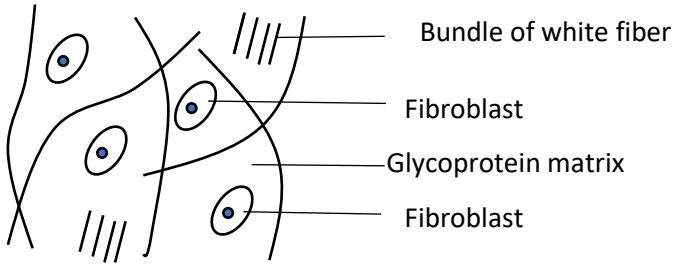
2. White fibrous tissue

This a tough tissue composed of organized bundle of collagen fiber closely packed together and running parallel to each other. Rows of fibroblast are scattered among the collagen and run alongside the bundles. Each bundle is bound to a neighboring tissue by areolar tissue. Fibrous tissue is abundant in tendons, ligament, sclera and cornea of the eye. These are areas where great strength and limited flexibility is required.



3. Yellow fibrous tissue

This contains a glycoprotein matrix containing only elastic fibers. The fibers are irregularly arranged and are branched. Fibroblasts are randomly distributed throughout the matrix. The elastic fiber provides the tissue with elasticity and flexibility. It also contains some few bundles of collagen which give it strength. It is found in ligaments, walls of arteries as components of lung and associated passage.



4. **Adipose tissue**

This tissue has no specific matrix but closely packed fat filled cells arrange in two lobules

The bone

Is a tissue that provided skeletal network in the body

Functions of bones

1. Provided shape that allow easy movement and recognition.
2. Protect delicate parts of the body; for, example rib cage protects the hear and the lung
3. Provide support
4. Provide a means of attachment of the muscle to allow movement
5. Store minerals like calcium and phosphorus
6. Produce blood cells like red blood cell

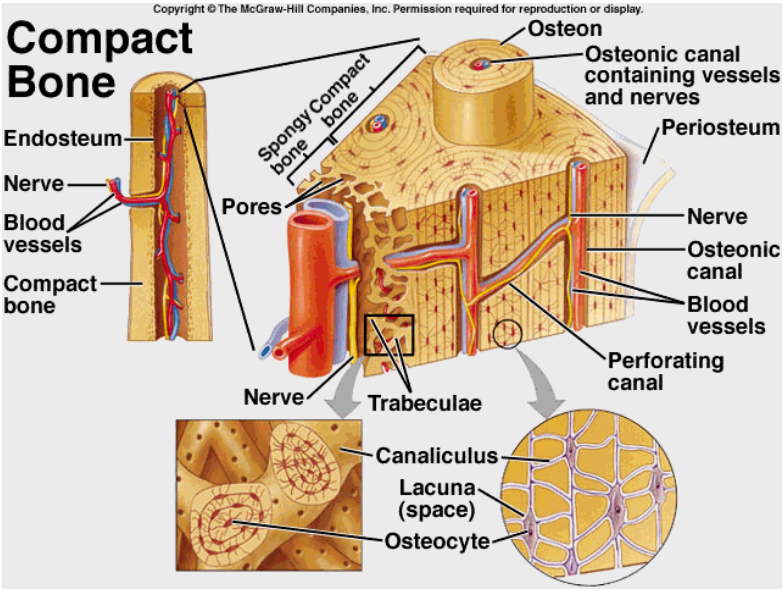
Structure

The bone is made of a matrix and cells.

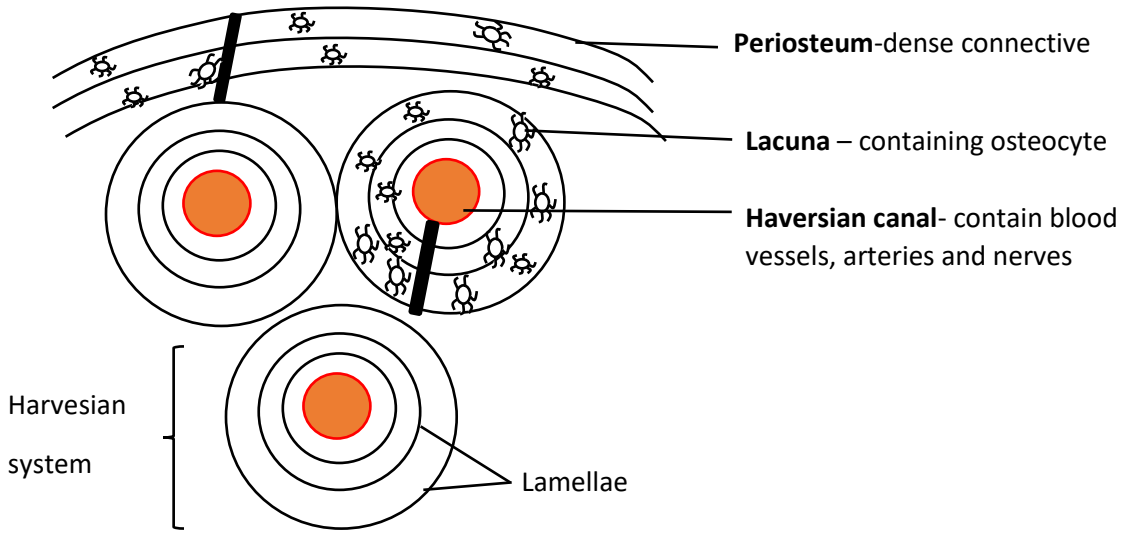
The matrix of compact bone is made of collagen fibers together with inorganic substances such as calcium, magnesium and phosphorous. These components are arranged in concentric circles called **lamellae**, around an **Haversian canal** containing an artery, a vein, lymph vessel and nerve fibers.

Bone cells are found in spaces in the lamellae known as **lacunae** and fine channels called **canaliculi** link lacunae.

The system of lamellae around one Haversian canal is called an **Haversian system**.



Drawing of cross section of a bone



Bone formation, also called **ossification**, process by which new bone is produced. Ossification begins about the third month of fetal life in humans and is completed by late adolescence. The process takes two general forms, one for compact bone, which makes up roughly 80 percent of the skeleton, and the other for cancellous bone, including parts of the skull, the shoulder blades, and the ends of the long bones.

Bone of the first type begins in the embryonic skeleton with a cartilage model, which is gradually replaced by bone. Specialized connective tissue cells called osteoblasts secrete a matrix material called osteoid, a gelatinous substance made up of collagen, a fibrous protein, and mucopolysaccharide, an organic glue.

Soon after the osteoid is laid down, inorganic salts are deposited in it to form the hardened material recognized as mineralized bone. The cartilage cells die out and are replaced by osteoblasts clustered in ossification centres. Bone formation proceeds outward from these centres.

This replacement of cartilage by bone is known as endochondral ossification. Most short bones have a single ossification centre near the middle of the bone; long bones of the arms and legs typically have three, one at the centre of the bone and one at each end. Ossification of long bones proceeds until only a thin strip of cartilage remains at either end; this cartilage, called the epiphyseal plate, persists until the bone reaches its full adult length and is then replaced with bone.

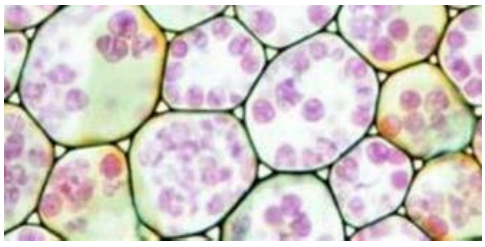
The flat bones of the skull are not pre-formed in cartilage like compact bone but begin as fibrous membranes consisting largely of collagen and blood vessels. Osteoblasts secrete the osteoid into this membrane to form a sponge like network of bony processes called trabeculae. The new bone formation radiates outward from ossification centres in the membrane. This process is called intermembranous ossification. There are several ossification centres in the skull. At birth, bone formation is incomplete, and soft spots can be felt between these centres. The lines where the new bone from adjacent centres meets form cranial sutures visible on the surface of the adult skull.

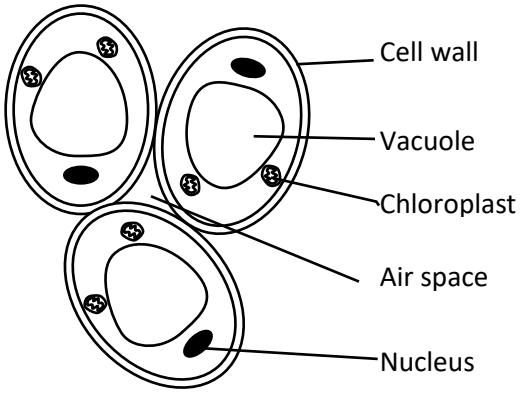
Both **endochondral** and **intermembranous** ossification produce immature bone, which undergoes a process of bone resorption and deposition called bone remodeling to produce mature bone.

Plant tissues

Simple plant tissues consist of only one type of cells. They are grouped according to the degree of thickening present in the cell wall

1. **Parenchyma**
   It is a simple permanent tissue of unspecialized usually spherical cells with thin cell walls. Parenchyma form the bulky of packing tissue within the plant.





Functions of parenchyma tissue

(i) Store water and food reserve

(ii) When tightly packed and turgid provide support for herbaceous plants
(iii)It is a ground tissue
(iv)Air spaces allow buoyancy in floating plants
(v) Air spaces allow gaseous exchange

Example

Which one of the following plant tissues performs both storage and supportive functions?

A. Parenchyma.

B. Sclerenchyma.

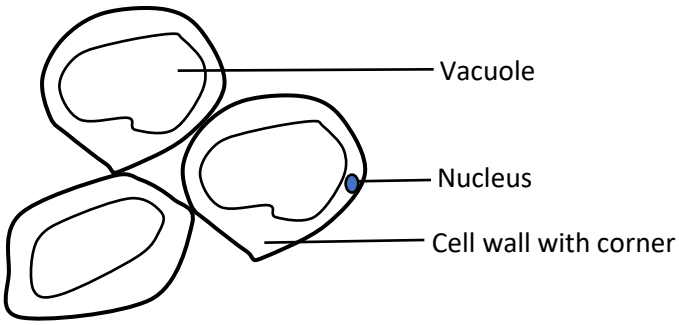
C. Collenchyma.

D. Phloem.

The answer is A

Parenchyma is the plant tissue that has both storage and supportive function. It store water and starch in most plants and also serves as the main supporting tissue in non-woody plants.

2. **Collenchyma**
Contains cells with additional cellulose deposited in the corners.



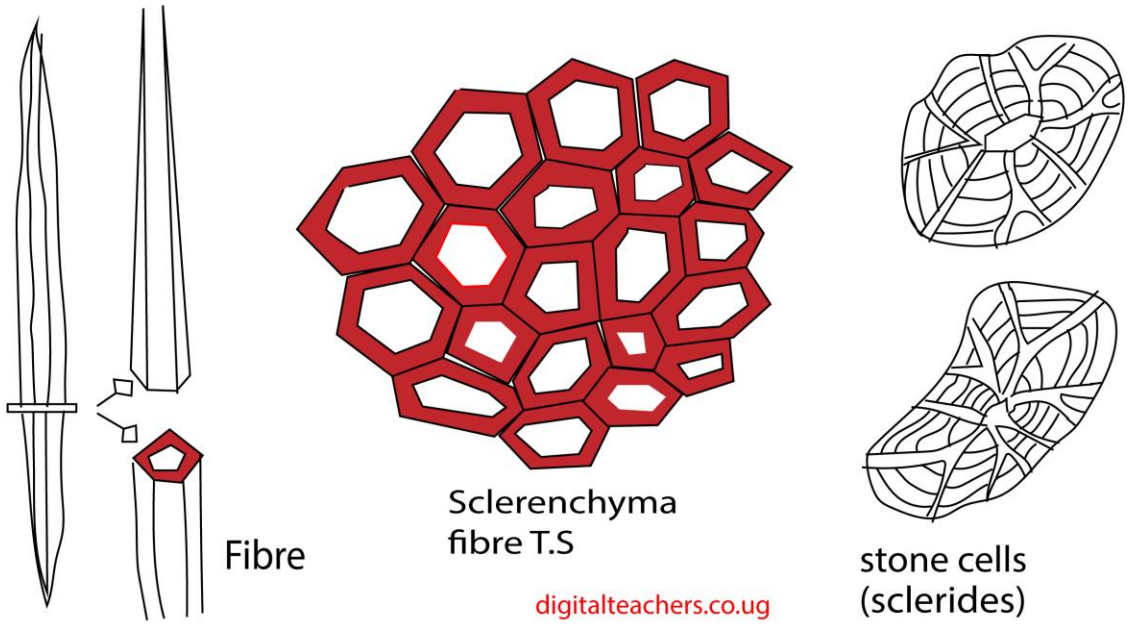
Function

(i) It provides mechanical strength to the petiole, leaves and stem of young dicot plants.
(ii) Collenchyma confers flexibility to various parts of the plant like petiole and stem, allowing for easy bending without breakage.
(iii)It allows for growth and elongation of plant organs.

(iv) Collenchyma present in leaves also prevents them from tearing.
(v) The living cells of collenchyma store food.
(vi) Collenchyma when containing chlorophyll performs the function of photosynthesis.

3. Sclerenchyma

Mature sclerenchyma cells are dead and cannot grow. They develop fully when the growth of surrounding tissue is complete. Sclerenchyma cells have large deposits of lignin in the cell wall and the cell content is lost in places, lignin is not deposited due to presence of plasmodesmata in primary cell wall, such regions are called pits. Some sclerenchyma cells are roughly spherical and are known as **sclereids**. These are usually found in small group in fruits and seeds, cortex, pith and phloem.



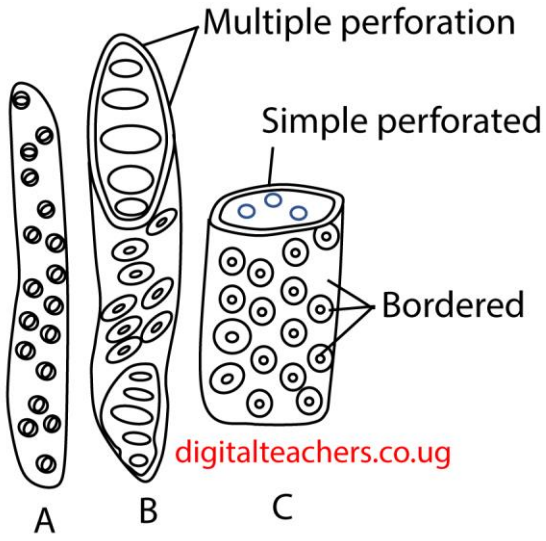
Sclerenchymatous fibre and stone cells

Function of sclerenchyma

(i) They provide mechanical support
(ii) They make up xylem and tracheid for water transport
(iii) In hypodermis of xerophytic plant, they prevent water lost
(iv) Sclerenchyma cells in the fruit walls help in its dehiscence and seed dispersal
(v) Sclerenchyma of seed coat protect the seed from desiccation

Xylem

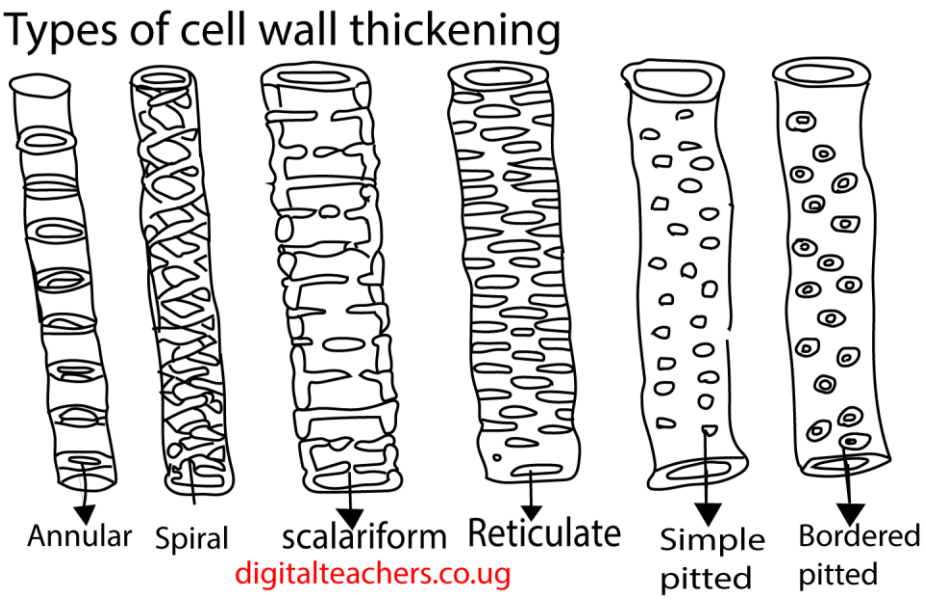
Consist of parenchyma cells and fibers together with vessels and tracheid.



Xylem (A- tracheid, B and C vessels)

Vessels are made of cylindrical dead cells, one on top of another with the cross wall broken down to form a long continuous tube from the roots to the leaves.

The type of vessel found depend on the degree and nature of cell thickening. In the **protoxylem** the lignin is deposited in rings or spirals to the cells is still capable of expansion. In metaxylem there is more extensive lignification arranged in patterns known as reticulate, scalariform or pitted.



Tracheid are spindle-shaped cell arranged in rows with ends of the cells overlapping. The cells have heavily lignified cell wall with no cell contents.

Functions of xylem

Transport water and mineral salts

They provide mechanical support.

Adaptations of the xylem

1. Cross walls are perforated or completely removed to form continuous tubes from roots to stems and leaves
2. Xylem vessels have no living contents to allow water to flow freely
3. Contain bordered pits to allow water cross to living cells
4. Lignified to prevent water loss
5. Lignified to prevent them from collapsing under negative pressure of transpiration pull.
6. Small tube to enable high capillarity
7. Xylem walls have high adhesive forces.

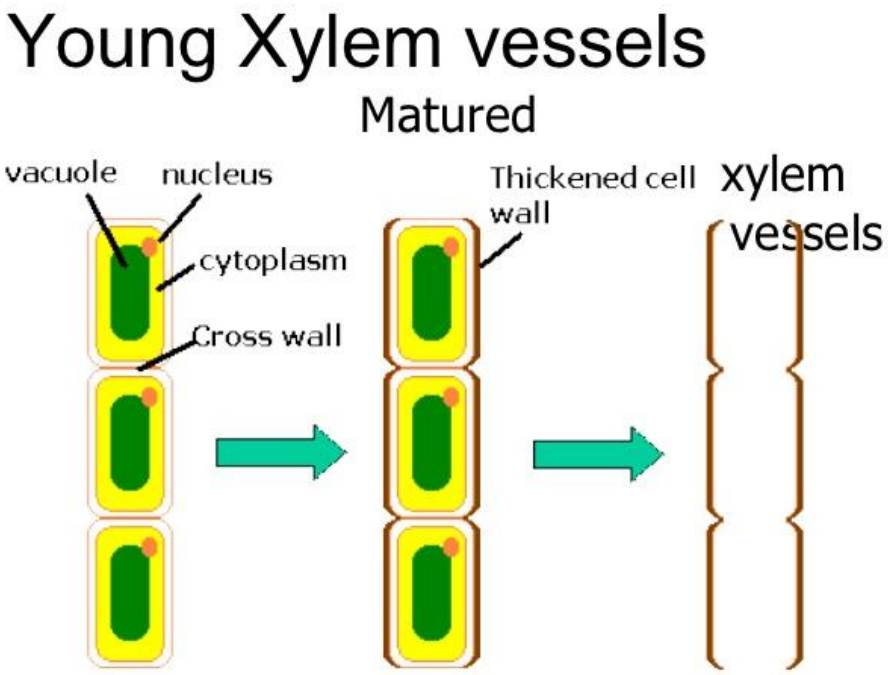
Adaptation to provide support

1. Walls are lignified

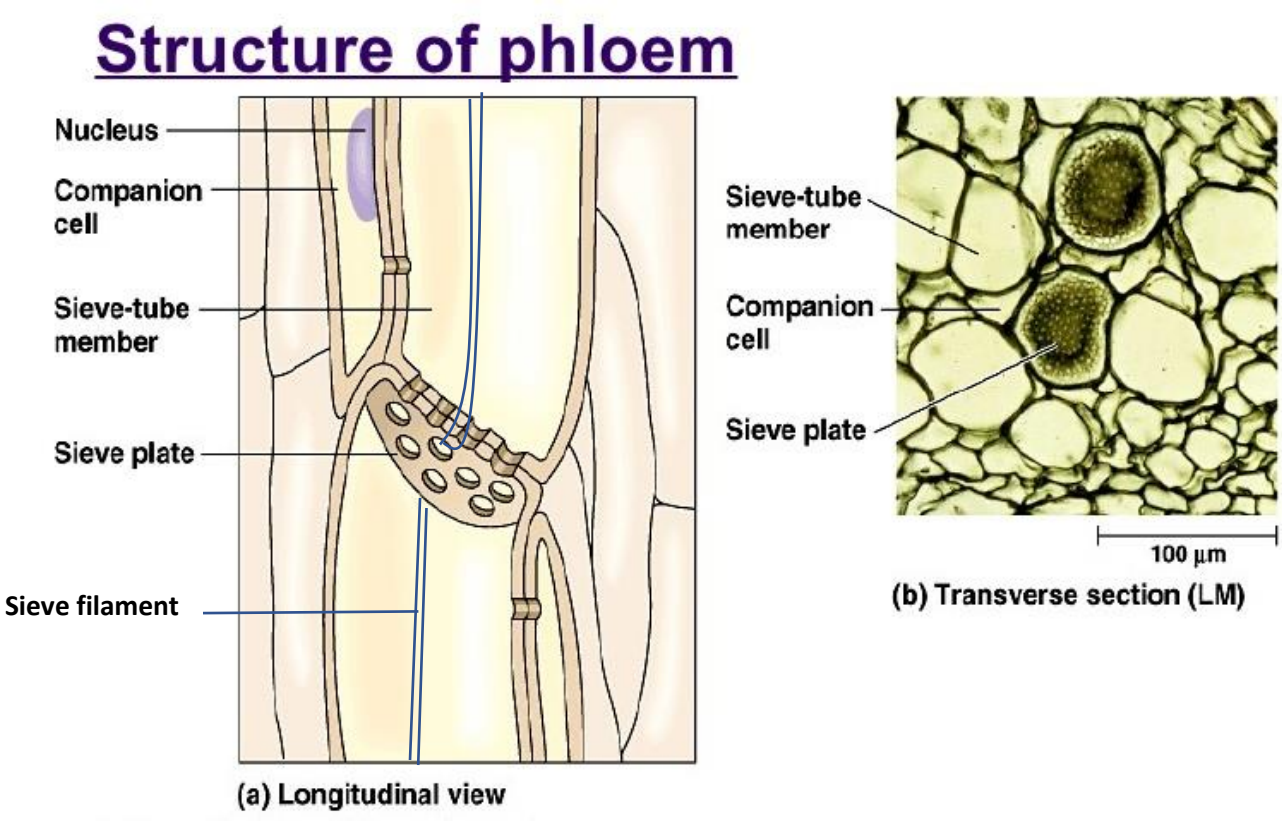
2. Vessels are circular for additional support.

Development of xylem

Cells destined to form xylem vessel elongate and develop thickened secondary wall. The walls are later lignified. The cell content die and cross section walls degenerate to form continuous open tube.



Phloem



The phloem consists of sieve tubes and companion cells.

Sieve tubes consist of columns of elongated, thin walled living cells called sieve tubes/elements. They have cross walls with many holes or pores called sieve plates. Each sieve tube has a companion cell.

Function

Transport of manufactured food (sucrose and amino acid) from leaves to other parts of the plant.

Adaptations

- Lack a nucleus and most cell organelles to leave room for transportation of food
- The sieve plates are perforated to allow rapid flow through
- Has filament for quick transport by streaming
- Intimate association with companion cells to obtain energy and materials

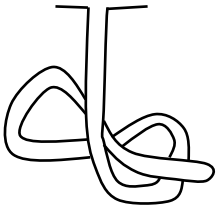
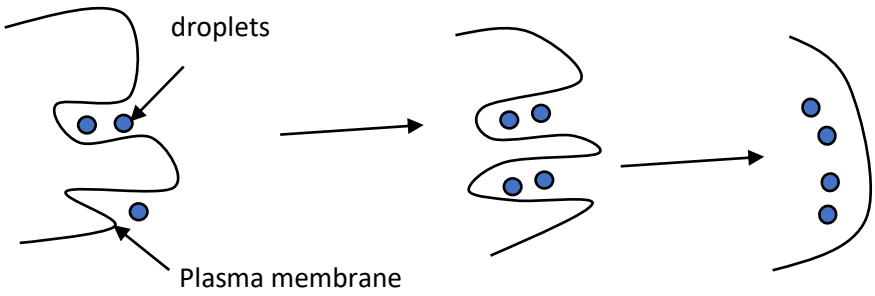
Differences between xylem and phloem

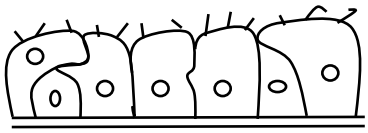
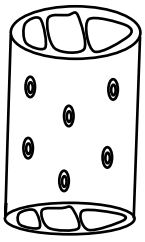
	Xylem	Phloem
1	Vessels are made of dead cells	Elements are made from living cells
2	Vessels have lignified cell walls	Phloem do not have lignified cell walls
3.	The end wall disappears completely	The end wall form sieve plates. They do not disappear completely
4.	Have pits	Have plasmodesmata
5.	Thick walls	Thin walls
6	Transport water and mineral salts	Transport food (sucrose and amino acids)

Development of phloem

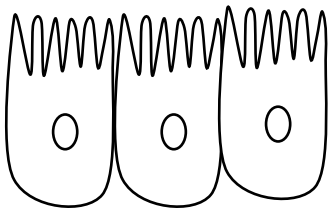
Cells destined to become sieve elements elongate, most cell organelles degenerate leaving cytoplasmic filament. The plasmodesmata of the end wall widen forming sieve pores.

Exercise

1.	2015/1/15	Which of the following epithelium tissues line blood capillaries? A. Cuboidal tissue B. Squamous tissue C. Columnar tissue D. Glandular tissue
2.	2014/1/4	The function of the nucleoli in a cell is to form A. The nuclear membrane B. Ribose C. The spindle during nuclear division D. Centrioles
3.	2013/1/4	The figure below shows a glandular tissue  In which part of the mammalian body is the tissue likely to be? A. Ileum B. Lungs C. Stomach D. Skin
4.	2013/1/12	Which one of the following consists of a pair of tissues specialized for support? A. Parenchyma and collenchyma B. Collenchyma and sclerenchyma C. Parenchyma and sieve tubes D. Xylem and phloem
5.		The type of feeding mechanism shown in figure below is 
		A. Pinocytosis B. Phagocytosis C. Filter feeding D. Predation

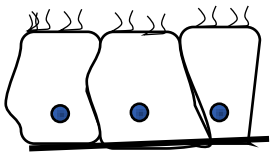
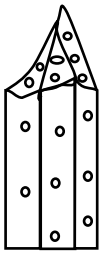
6.	2012/1/28	One disadvantage of multicellular state is the individual cells A. Are always small in size B. Lose independence C. Becomes less functional D. Become less specialized
7.	2012/1/36	The walls of collenchyma cells stained deep blue by methylene blue but not aniline hydrochloride. This shows that the wall A. Are not thickened B. Are thickened by lignin C. Contains living protoplasm D. Are thickened by material other than lignin
8.	2012/12	Squamous epithelium is made up of thin and delicate sheets of cell as an adaptation to A. Rapid cell division B. Facilitation of liquid movement C. Shortening diffusion distance D. Protecting the body from abrasion
9.	2010/1/4	The figure below represents a human tissue  The tissue would most likely be lining the A. Salivary gland B. Stomach C. Ileum D. Oviduct
10.	2010/1/7	1. The figure below represents a  A. Tracheid B. Xylem vessel element C. Sieve tube D. Phloem parenchyma cell

11.		Which of the following is not correct about cells of a tissue? A. Are of one type B. Have the same origin C. Have same particular function D. Are physically linked
12.	2008/1/2	The epithelial type lining the mammalian alveoli is A. Columnar B. Cuboid C. Stratified D. Squamous
13.	2008/1/16	A probable function of cell membrane is to A. Control entry and exist of materials form the cells B. Rapid conversion of sugar to starch C. Act as a template for in protein synthesis D. Enable substances diffuse against concentration gradient
14.	2007/1/1	Which of the following is a simple branched tubular gland? A. Brunner's gland B. Salivary gland C. Sweat gland D. Mammary gland
15.	2007/1/9	Which of the following is not correct about cells of a tissue? A. Have similar function B. Are of the same origin C. Are of one type D. Have physical linkage
16.	2007/1/24	A property of cells in a multicellular organism is that they A. Small B. Less functional C. Less specialized D. Dependent
17.	2007/1/25	Which one of the following tissues has the least power of regeneration? A. Blood tissue B. Epithelial tissue C. Bone tissue D. Nerve tissue
18.	2006/1/3	Which one of the following structures is found in both xylem and phloem in higher plants A. Sieve tracheid B. Parenchyma cells C. Companion cells D. Hollow vessels
19.	2006/1/11	Which of the following have a sole function of offering support to the

		plants? A. Sclerenchyma and vessel elements B. Vessel elements and tracheid C. Sclerenchyma and collenchyma D. Parenchyma and collenchyma
20.	2006/1/31	Which one of the parts of a mammal possesses an epithelial tissue as shown in the figure below?  A. Oviduct B. Ileum C. Respiratory tract D. Loop of Henle
21.	2005/1/4	The main distinguishing character of a eukaryotic cell is A. Membrane organelles B. Lack of a nucleus C. Presence of a nucleus D. Presence of DNA double strand
22.	2005/1/6	Which of the following organelle would most likely be abundant in the tail of a tadpole at a time of its reabsorption during metamorphosis? A. Centrioles B. Lysosomes C. Golgi apparatus D. Endoplasmic reticulum
23.	2004/1/11	In higher plants, the lateral roots originate from the A. Endodermis B. Epidermis C. Pericycle D. Cambium
24.	2003/1/3	A plant tissue which is tubular, open ended, with lignified and thickened walls is A. Tracheid B. Xylem vessel C. Parenchyma D. Sieve tube
25.	2003/1/21	Viruses cannot reproduce outside the body because A. Not all of them contain DNA B. They are too small to reproduce C. They are unable to synthesize their own DNA D. They are unable to absorb raw materials from the surroundings.

26.	2003/1/28	Rapid transport of materials within the cytoplasm of a cell is associated with the presence of A. Spindle fibers in the dividing cell B. An extensive endoplasmic reticulum C. Many plasma membrane pores D. Extensive Golgi apparatus
27.	2003/1/34	Which of the following types of epithelia lines the walls of the mammalian alveoli? A. Columnar epithelium B. Cuboidal epithelium C. Stratified epithelium D. Squamous epithelium
28.		Which of the following does **not always** form part of a bacterium cell? A. Cell wall B. Flagellum C. Cytoplasm D. Ribosome
29.	2002/1/10	Which one of the following cell organelles would be most active at sites where substances move against diffusion gradient? A. Ribosome B. Lysosome C. Mitochondria D. Golgi bodies
30.	2002/1/15	Which one of the following is not correct about viruses? They A. can only reproduce in living cells B. Are the smallest living organisms C. Are facultative parasites D. Do not have cellular structures
31.	2001/1/16	Which one of the following structures operate independently of nervous control? A. cilia of paramecium B. flagella of euglena C. stinging cells of coelenterates D. pigment cells of fishes
32.	2001/1/26	Which one of the following features would be prominent in mucus secreting cells? A. Large nucleus and dense matrix B. Numerous rough endoplasmic reticulum and Golgi body C. Numerous mitochondria and lysosome D. Dense matrix and smooth endoplasmic reticulum
33.	2001/1/40	Which one of the following types of epithelia experiences the highest wearing? A. Stratified B. Columnar C. Glandular D. Ciliated

34.	2000/1/21	In which one of the following is ciliated epithelium found? A. Kidney tubules B. Small intestines C. Lining of capillaries D. Lining of alveoli
35.	2000/1/35	Which of the following gland is compound saccular? A. mammary gland B. sebaceous gland C. sweat gland D. gastric gland
36.	2000/1/37	Which one of the following cell organelle is associates with the final stage of most cell secretion? A. Smooth endoplasmic reticulum B. Rough endoplasmic reticulum C. Ribosome D. Golgi Apparatus
37.	1999/1/1	Which of the following is a function of the Golgi body in the cell? A. Secreting substances out of the cells B. Synthesis of proteins C. Assembling of raw materials for secretion D. Synthesis of carbohydrates
38.	2000/1/2	Which of the following cell types are unlikely to be found in the mammalian intestines? A. Columnar B. Ciliated C. Stratified D. Squamous
39.	1998/1/24	Which one of the following glands has a compound tubular structure? A. Mucus gland in the skin of frog and other amphibians B. Salivary gland in the mouth of a mammal C. Brunner's gland in the walls of a mammalian small intestine D. pancreas
40.	1999/1/25	2. What role is associated with the endoplasmic reticulum? A. Site for protein synthesis B. Isolation and transport of the proteins synthesized C. Synthesis and transport of lipids and steroids D. Production of amino acids
41		Which of the following is the main function of the Golgi apparatus in a living cell? A. Destruction of worn out cell organelles B. Synthesis of cell wall components C. Synthesis of proteins D. Intracellular transport

42	1997/1/32	Which one of the following epithelial tissue is illustrated in figure below?  A. Columnar B. Squamous C. Cuboidal D. stratified
43	1997/1/39	Cells with uniformly thickened and lignified walls are likely to be A. Phloem B. Parenchyma C. Collenchyma D. Sclerenchyma
44.	2015/1/23	Which one of the following plant tissues perform both storage and support functions? A. parenchyma B. sclerenchyma C. collenchyma D. phloem
45.	2015/1/27	The figure below shows an epithelial tissue  The function of the tissue is to A. Increase surface area for absorption of material B. Provide smooth lining for movement of materials C. Act as a junction between different tissues D. Move materials along the surface
46		The figure below is a section of a structure from a plant tissue.  The tissue with such a structure is the A. Collenchyma B. Parenchyma C. Phloem D. Xylem

47.		Viruses resemble living organism because they possess A. A nucleus B. Genetic material C. A cell membrane D. Oxidative enzymes
49.	2012/1/7	A companion cell has a large nucleus because A. It supports the sieve tube element which has no nucleus B. It controls a large volume of cytoplasm C. Movement of material in the sieve tube is active process D. of its high metabolic rate
50.		Which one of the following tissues would be stained deepest red by a dye that stains nucleic acid? A. Sieve tube B. Tracheid C. Collenchyma D. cambium
51.	2015/21	Which one of the following plant tissues, have cell with walls least adapted to support? A. Sclerenchyma B. Collenchyma C. Tracheid D. Xylem vessels
52.	2014/1/28	Growth in size of a single cell is limited by the A. Cytoplasm B. Nucleus C. Cell wall D. Cell membrane
53.	2004/1/18	The tails pf the phospholipids lie in the center of the cell membrane due to their being A. Light B. Hydrophilic C. Polar D. Hydrophobic
54.	1998/1/10	A young herbaceous stem maintains an erect position mainly due to A. Lignified tissue in the stem B. Water pressure in xylem tissue C. High turgor pressure in the parenchyma cells D. Low osmotic pressure in the parenchyma cells
55.	2015/1/26	In sponges, the different types of cells are independent of each other in function because A. The different cell show division of labor B. Collar cells maintain the flow of water C. Sponges are made of collar flagellates D. The cell are not coordinated

56	2012/1/8	Which one of the following parts would show a distinct blue color if a cross section of a dicotyledonous plant was stained with iodine solution? A. Pericycle B. Poriferous layer C. Endodermis D. pith
57	1996/1/21	Chromophores are A. reproductive cells B. fat-containing cells C. carotenoid containing cells D. pigment-containing cells in certain vertebrates

Paper 1 Section B

1. (2013/1/44) (a) Name two areas in plants where each of the following tissue is found?
   (i) Sclerenchyma (1mark)

   ……
   ……
   ……

   (ii) Collenchyma (1marks)

   ……
   ……

   (b) Give three structural adaptation of the sclerenchyma tissue for its function (3marks)

   ……
   ……
   ……
   ……
   ……
   ……
   ……
   ……

   (c) Explain the importance of collenchyma tissue in leaves and young stems (02marks)

   ……
   ……
   ……
   ……

   (d) Outline three structural differences between the chlorenchyma and sclerenchyma tissue. (03marks)

   ……
   ……
   ……
   ……

2. (2012/1/43) (a) Describe the adaptations of each of the following tissues for their functions, giving one example of the site where each of them is found.
   (i) Stratified tissue (3marks)

   ……
   ……
   ……

(ii) Collagen tissue (3marks)

……
……
……

(b) Explain how the structure of proteins enable them to form body tissues and structures

(4marks)

……
……
……
……
……
……

3. (1996/1/part B No. 6)

(a)State **two** important difference which can be recognized under the light microscope between plant and animal cells

……
……
……

(b) (i) Name the membrane-bounded channels which form a network and almost fill the cytoplasm of most cells and are only recognizable under the electron microscope

……
……
……

(ii) What are the 'small granules' associated with the channels mentioned in (i) and what is their function?

……
……
……

C (i) Give one way by which you would recognize the "colloidal state" of protoplasm

……
……

(ii) Which constituent of the protoplasm are responsible for its colloidal state?

……

(c)Viewed under the electron microscope, the cell membrane has a three-layered structure. What is the chemical nature of each of these layers?

Paper 2

1. (2012/1/4) Describe how each of the following tissues are related to their functions
   (i) Parenchyma (03marks)
   (ii) Collenchyma (03marks)
   (iii) Sclerenchyma (06marks)

   (b) Explain the distribution pattern of mechanical tissue in a stem and root of a dicotyledonous plant. (08marks)

(2011/2/2) (a) Describe the structure of the plasma membrane according to fluid mosaic model (10marks)

(b) Explain how exocytosis and endocytosis occur across the plasma membrane.

(05marks)

(c) Explain the role of proteins within plasma membranes.
(05marks)

3. (2010/2/2) (a) Describe the structure of the vascular system in higher plants (7marks)

(b) How is the stem in (a) adapted to its function? (13marks)

4. (2010/2/4) (a) Explain how organisms have overcome the challenges of being multicellular. (12 marks)

5. (1999/2/2) (a) Describe the structure of cartilages and bones

(b) How is cartilage replaced by bone?

6. (a) Describe the fluid mosaic structure of the plasma membrane. (10marks)

   (b) How does the structure account for the movement of materials in and out of the cells.

7. (2007/2/3) Explain how the epithelial tissue is adapted for its function. (20marks)

Answers to the objective type questions

1	B	11	B	21	A	31	A	41	B
2	B	12	D	22	B	32	B	42	B
3	D	13	A	23		33	A	43	D
4	B	14	A	24	B	34	A	44	A
5	A	15	B	25	C	35	A	45	D
6	B	16	D	26	B	36	D	46	D
7	D	17	D	27	D	37	C	47	B
8	C	18	B	28	B	38	D	48	
9	D	19	C	29	C	39	D	49	D
10	B	20	A	30	C	40	B	50	B
52	B								

6. (a) Describe the structure of plant cell wall
(b) Compare the structures of plant cell wall and plasma membrane
(c) How is the plant cell wall suited for functioning?

2. (a) What is meant by the term **cell organelle**?
(b) Describe the fine structure of the following:
(i) Golgi complex
(ii) Nucleus
(iii) Mitochondrion
(c) How is structure related to functioning in each of the structures in (b) above

4. (a) Describe the functioning of Golgi apparatus in animal cells.
(b) Explain the role of lysosomes in animal cells.

a. Figure 1 shows an epithelial tissue

Fig. 1

The function of the tissue is to

A. increase surface area for absorption of materials.

B. provide smooth lining for movement of materials.

C. act as a junction between different tissues.

D. move materials along the surface.

The answer is D

The epithelium shown is a ciliated epithelium. The beating of the cilia creates a current of fluid which moves material along the surface lined by this kind of epithelium.

Recall

- To increase surface area for absorption of material, epithelial surfaces are often highly folded and sometimes the membrane of individual cells are finely folded into microvilli
- A smooth lining is provided by simple squamous epithelium
- Tissues that act as a junction between different tissue are not epithelia but connective tissue fibres.

Examples

a. Growth in size of a single cell is limited by the

A. cytoplasm.

B. nucleus.

C. cell vacuole.

D. cell membrane.

The answer is B

The nucleus directly dictates the size of a cell because it directs the formation of materials that sustain cell content. Since the genetic constitution of the nucleus is content, a cell grows only up to a size that the nucleus can sustain.

4. Figure 1 shows a glandular tissue.

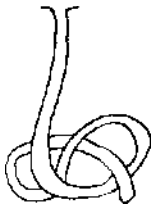


Fig 1

In which part of the mammalian body is the tissue likely to be?

A. Ileum.

B. Lungs.

C. Stomach.

D. Skin.

4. The answer is D

The figure shows a coiled tubular. this is typical of the sweat glands in the mammalian skin.

Note:

The ileum contains simple, tubular glands called crypt of Lieberkühn

The stomach contains simple, branched, tubular glands called gastric glands.

The lungs do not contain glandular epithelium. Their air sacs are lined with simple squamous epithelium, whose function is to allow exchange of gases between the blood and alveolar air

12. Which one of the following consists of tissues specialized for support?

A. Parenchyma and collenchyma.

B. Collenchyma and sclerenchyma.

C. Parenchyma and sieve tubes.

12. The answer is B.

Collenchyma and sclerenchyma are plant tissue specialized for support.

Note:

Parenchyma is a packing tissue, filling space in plant organs, between other tissues. It also functions as a storage tissue but may also be involved in support, especially when turgid, in non-woody plants.

Sieve tubes are then main functional components of phloem and responsible for transport as manufactured food within the plant.

Xylem is primarily responsible for transport of water mineral salts, but its lignified walls serve as extra support for the plant.

43. (a) Name two areas in plants where each of the following tissues is found

(i) Sclerenchyma

(ii) Collenchyma

(b) Give three structure adaption of the sclerenchyma tissue for its function.

(a) Explain the importance of collenchyma tissue in leaves and young stems

(b) Outline three structure difference between the collenchyma and sclerenchyma tissue

Solution

(a) (i) Sclerenchyma is found in:

- Vascular bundles.
- Hypodermis of monocotyledonous stems.

  Others

- Pericycle of dicotyledonous stems, in form of strands of secondary xylem and secondary phloem.
- Sclerenchymatous fibres on the surface of seeds, e.g. cotton
- Endocarp of nut.
- Gritty mass in the pulp skin of pears and guava fruits

(ii).Collenchyma is found in:

- In petiole and leaf lamina.
- Stems of herbaceous plants.

(b) Cells have highly lignified thick walls provide enough resistance to forces of the environment.

- Cells are dead and therefore place no extra metabolic demand on the plant.
- Sclerechyma fire are elongated and arranged in sheets or stands to increase their strength

  Others:

- Sclerenchyma fibre are interlocked to enhance their combined strength
- Sclerenchyma is the strengthen mechanical tissue of leave and young stems. It supplements the effects of turgid parenchyma in maintaining shape and form of leave and young stems.

Collenchyma	sclerenchyma
Consists of living cells Cell wall is thickened with cellulose Cell wall thickening is non -uniform	Consists of dead cells Cell wall is thickened with mainly lignin Cell wall thickening is uniform

others

Collenchyma	sclerenchyma
May contain chloroplasts Cell cavity is wide Has no pores	Does not contain chloroplasts Cell cavity is very narrow or even closed May be perforated with pore in the walls

8. Which one of the following parts would show a distinct blue colour if a cross section of a root of a dicotyledonous plant was stained with iodine solution?

A. Pericycle. B. Piliferous layer.

C. Endodermis. D. Pith.

The answer is C

In a dicotyledonous plant, endodermis cells have a high content of starch grains. As such, they show a distinct blue colour in a cross-section of root stained with iodine. It is for this reason that the endodermis is also sometime called the starch sheath.

28. One disadvantage of the multicellular state is that individual cells

A. are always small in size. B. lose independence.

C. become less functional. D. become less specialized.

28. The answer is B

I n Multicellular organisms, cells often become specialized to perform certain functions and therefore lose ability to perform other functions. As a result, cells become dependent on each other for the function(s) which they are not specialized to perform.

36. The walls of collenchyma cells are stained deep blue by methylene blue but not aniline hydro chloride. This shows that the walls

A. are not thickened.

B. are thickened by lignin.

C. contain living protoplasm.

D. are thickened by materials other than lignin.

The answer is D

Thickening of plant cell occurs by deposition of extra layers cellulose or deposition of lignin or suberin (cork). These materials are identified in microscopy by their ability to take up certain stains.

Lignin, for example, stains yellow with aniline hydrochloride but not stain with methylene blue

Cellulose does not stain with aniline hydrochloride but stains deep blue with methylene blue.