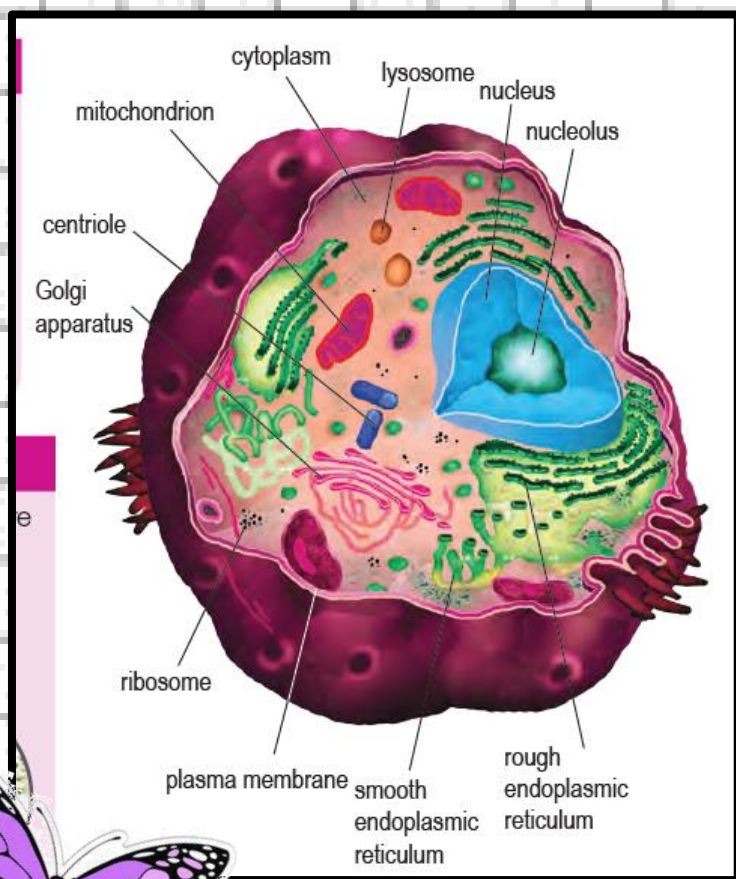


CHAPTER 2.1

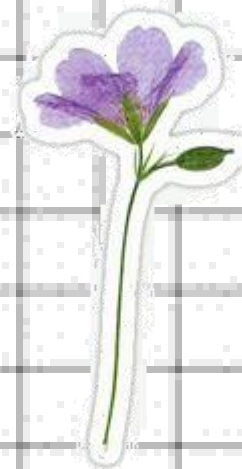
CELL STRUCTURE and function



COMPONENTS OF ANIMAL AND PLANT CELLS AND THEIR FUNCTIONS



ANIMAL CELLS



MITOCHONDRION



- It is rod-shaped or spherical
- It consists of two layers of membranes, which are the smooth outer membrane and folded inner membrane
- Contains enzymes that play a role in cellular respiration



function

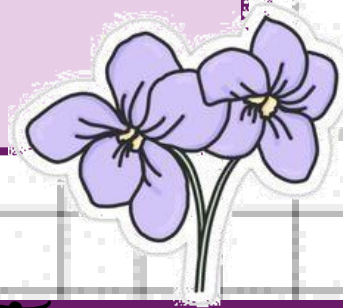
- A site that generates energy through the glucose oxidation process during cellular respiration
- Energy released in the form of ATP molecules (adenosine triphosphate) to be used by the cells



CENTRIOLE

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- Small cylindrical components that exist in pairs in animal cells
- Made up of complex arrangement of microtubules
- Does not exist in plant cells



function

- Forms spindle fibre during cell division in animal cells

GOLGI APPARATUS

- Consists of a stack of parallel flattened sacs that are coated by a single cell membrane
- New membrane is added at one end of the Golgi apparatus and vesicles bud off from the other end.



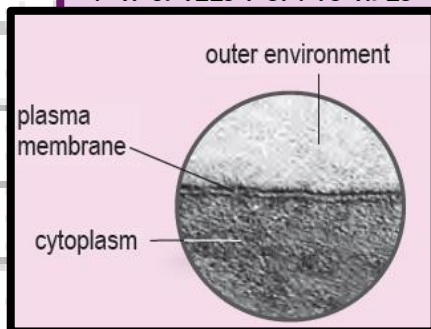
function

- Processes, modifies, packs and transports chemicals such as protein, carbohydrate and glycoprotein (combination of carbohydrate and protein)

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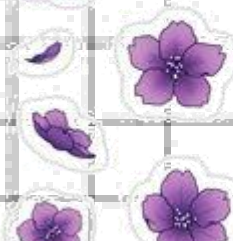
PLASMA MEMBRANE

- Outer membrane that surrounds the entire content of cell
- Made of proteins and phospholipids
- Thin and elastic film
- Partially permeable



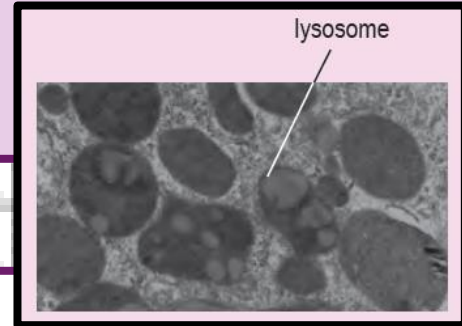
- Separates content of cell from the external environment
- Controls movement of substances into and out of the cell
- Allows exchange of nutrients, respiratory gases and waste materials between cells and their surroundings

function



LYSOSOME

- SMALL SPHERICAL SAC ENCLOSED IN A SINGLE MEMBRANE
- CONTAINS HYDROLYTIC ENZYMES



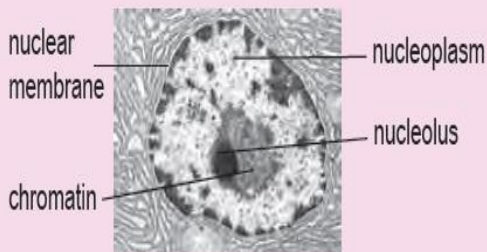
function

- HYDROLYSES COMPLEX ORGANIC MOLECULES SUCH AS PROTEIN, NUCLEIC ACID AND LIPID
- BREAKS DOWN BACTERIA AND COMPONENTS OF DAMAGED CELLS

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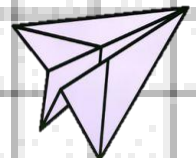
NUCLEUS

- LARGEST COMPONENT IN THE CELL
- SPHERICAL, COMPRESSED AND ENCLOSED IN A NUCLEAR MEMBRANE WITH MANY PORES
- THE NUCLEUS CONTAINS CHROMOSOMES, NUCLEOLUS AND NUCLEOPLASM.



- CONTROLS ALL CELL ACTIVITIES
- HAS CHROMOSOMES THAT CONTAIN DEOXYRIBONUCLEIC ACID (DNA). DNA DETERMINES THE CELL CHARACTERISTICS AND METABOLIC FUNCTION

function



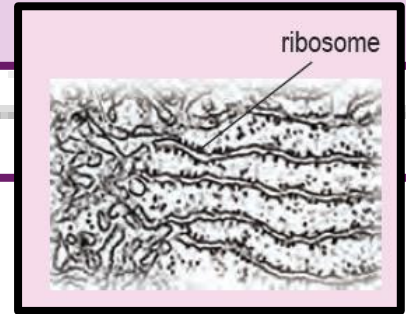
RIBOSOME

- Small, compact and spherical granules
- Consists of protein and ribonucleic acid (RNA)
- Ribosomes are present on the surface of the rough endoplasmic reticulum or exist freely in the cytoplasm.

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function

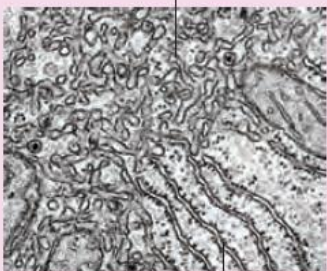
- Site for protein synthesis



ENDOPLASMIC RETICULUM

- Consists of a system of interconnected folded flattened sacs
- Endoplasmic reticulum membrane is continuous with the nuclear membrane.
- There are two types of endoplasmic reticulum:
 - Rough endoplasmic reticulum has ribosomes attached to the surface
 - Smooth endoplasmic reticulum does not have ribosomes

smooth endoplasmic reticulum

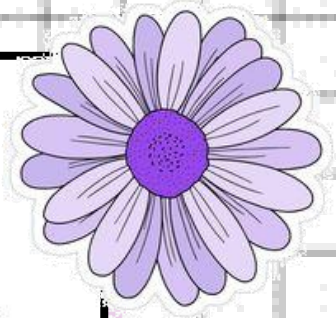
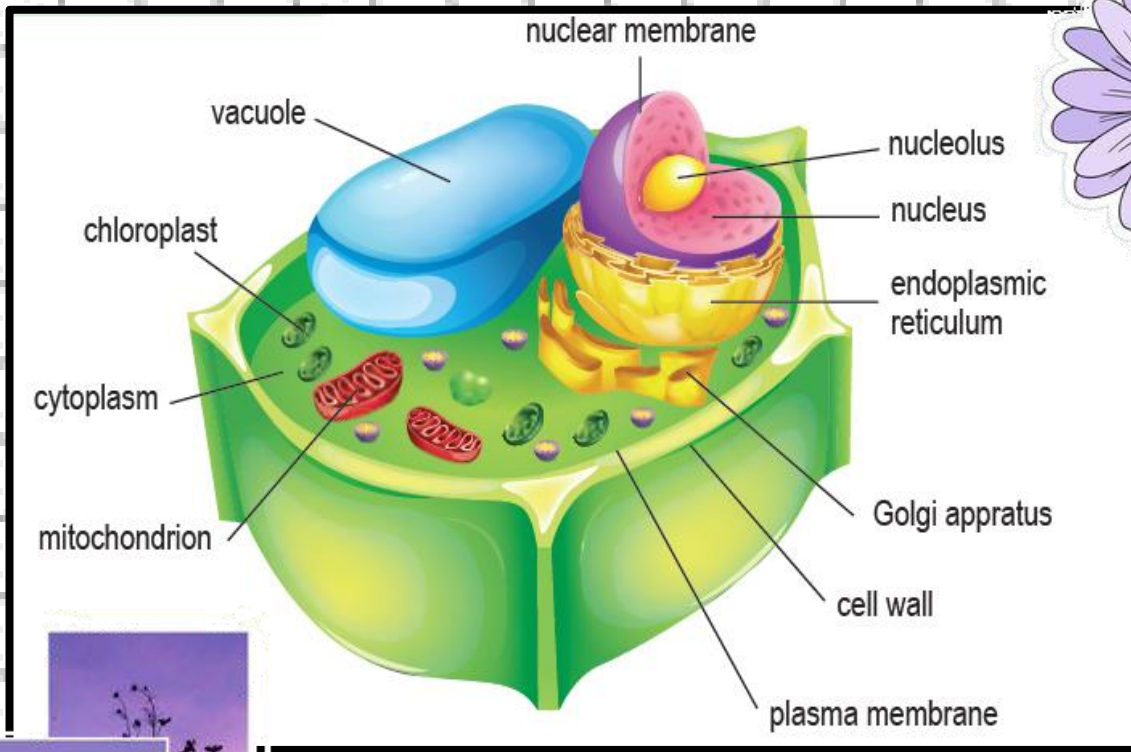


rough endoplasmic reticulum

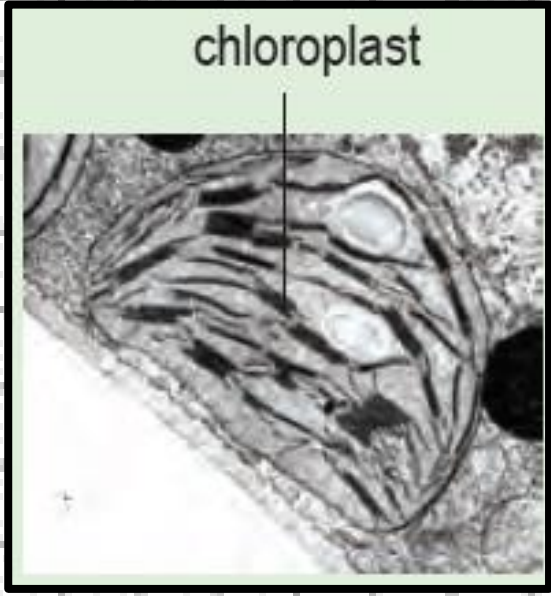
- The transport system within the cell
- Provides a wide surface for enzyme attachment and biochemical reactions
- The rough endoplasmic reticulum transports proteins synthesised by ribosomes.
- The smooth endoplasmic reticulum synthesises and transports glycerol and lipids, and carries out the detoxification of drugs and metabolic by-products.

function





PLANT CELL



CHLOROPLAST

- OVAL SHAPED
- CONSISTS OF TWO LAYERS OF MEMBRANE
- CONTAINS CHLOROPHYLL PIGMENTS IN THE GRANA THAT GIVE PLANTS A GREEN COLOUR

function

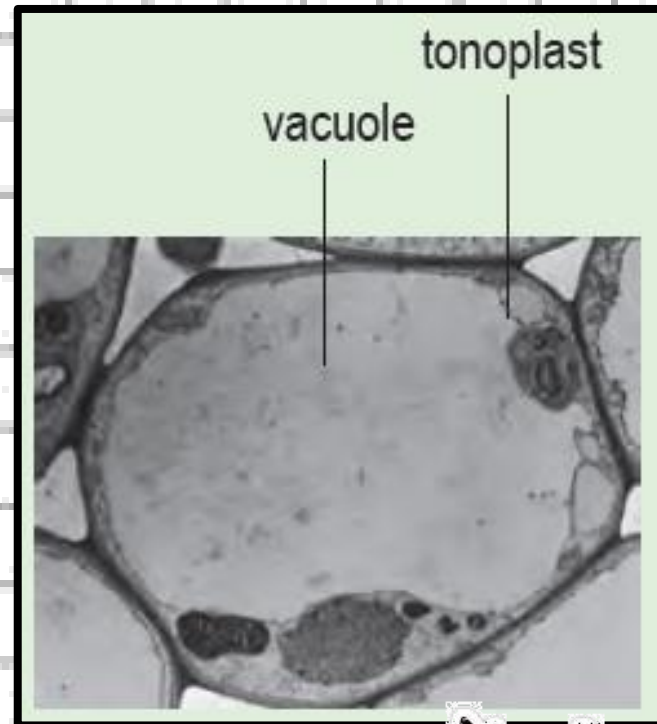
- CHLOROPHYLL ABSORBS SUNLIGHT AND CONVERTS IT TO CHEMICAL ENERGY DURING PHOTOSYNTHESIS.

VACUOLE

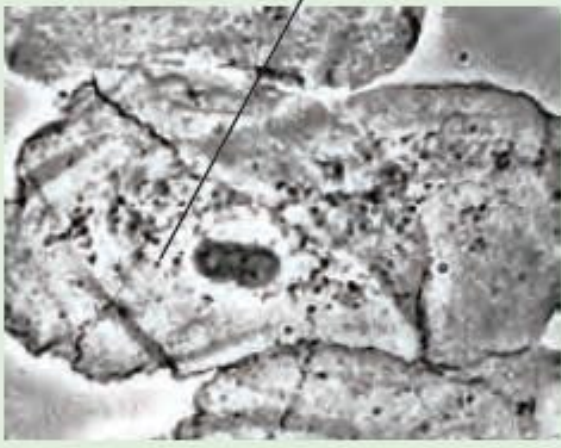
- Liquid-filled sac, which is the cell sap.
- A vacuole is surrounded by the tonoplast membrane.
- Young plant cells have many small vacuoles while mature plant cells have a large vacuole.
- The vacuole in animal cells is small.
- Cell sap contains water, organic acids, sugars, amino acids, enzymes, mineral salts, oxygen, carbon dioxide and metabolic by-products

function

- Water is absorbed into the vacuole plant cell and the cell becomes turgid.
- In unicellular animals, the vacuole contracts during osmoregulation, osmosis and excretion.



cytoplasm



CYTOPLASM

- consists of a jelly-like medium that contains components of the suspended cells
- contains organic compounds (such as protein, lipid and carbohydrate) and inorganic compounds (such as potassium ions)

function

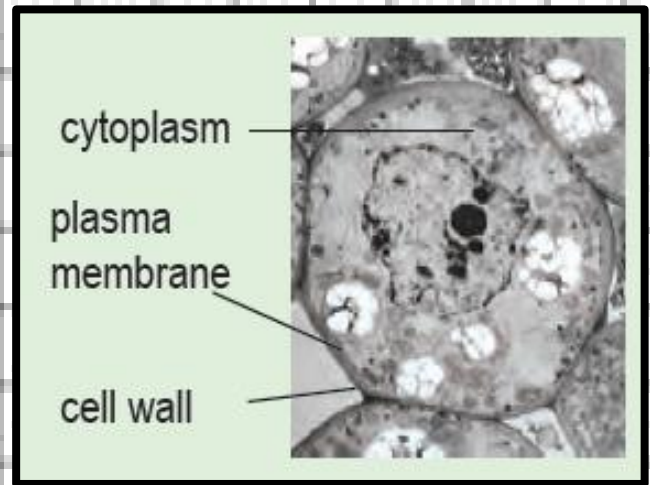
- Acts as a medium for biochemical reactions in cells

CELL WALL

- A strong and rigid outer layer
- Made from cellulose fibre
- Fully permeable

function

- Maintains the shape of plant cells
- Provides mechanical support to plant cells



COMPARE AND CONTRAST THE COMPONENTS OF ANIMAL CELLS AND PLANT CELLS

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SIMILARITIES

Both cells are made of nucleus, cytoplasm, plasma membrane, Golgi apparatus, mitochondrion, endoplasmic reticulum and ribosomes.

PLANT CELLS

- Has a fixed shape
- Has a cell wall
- Has chloroplasts
- Has a large vacuole
- Stores carbohydrate in the form of starch
- Does not have a centriole

DIFFERENCES

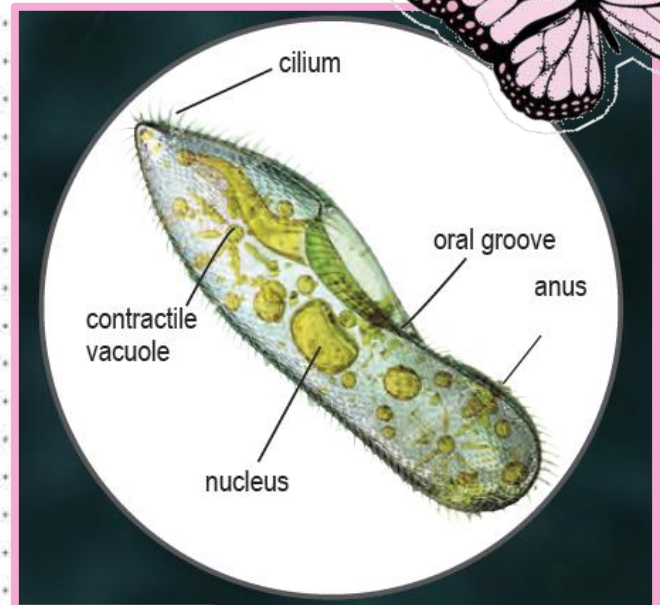
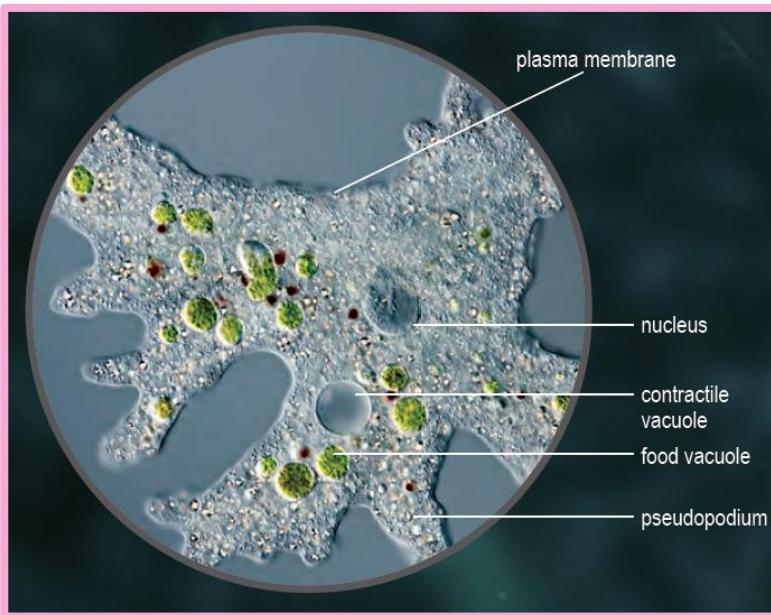
ANIMAL CELLS

- Does not have a fixed shape
- Does not have a cell wall
- Does not have chloroplasts
- No vacuole/if present, it is small
- Stores carbohydrate in the form of glycogen
- Has centrioles



2,2 Living Processes in Unicellular Organisms

- Unicellular organisms are made up of only one cell.
- However, this cell is a complete unit of life like multicellular organisms.
- Unicellular organisms carry out all life processes: respiration, movement, nutrition, responding to stimulus, reproduction, growth and excretion.
- Protozoans are the simplest form of unicellular organisms. Examples of protozoa are Amoeba sp. and Paramecium sp. Let



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Movement

- Amoeba sp. constantly changes its shape when it encounters obstacles. Amoeba sp. moves by extending out its pseudopodium (false feet). This is followed by the flow of cytoplasm into the extended pseudopodium.
- Paramecium sp. moves using rhythmic cilia beats.



Responding to Stimuli

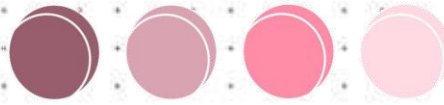
- Amoeba sp. and Paramecium sp. respond to stimuli such as chemicals, touch or bright light by moving away from the stimuli.

Respiration

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- Exchange of oxygen and carbon dioxide gases occur through the plasma membrane by simple diffusion on the surface of the cell

Nutrition



- Amoeba sp. moves towards food by extending its pseudopodium to trap food particles by phagocytosis (Figure 2.3). For Paramecium sp. the presence of cilium beat helps transfer food particles into the oral groove.

1

- The food vacuole is combined with lysosome. The food particles are hydrolysed by the enzyme lysozyme in the lysosomes.

2

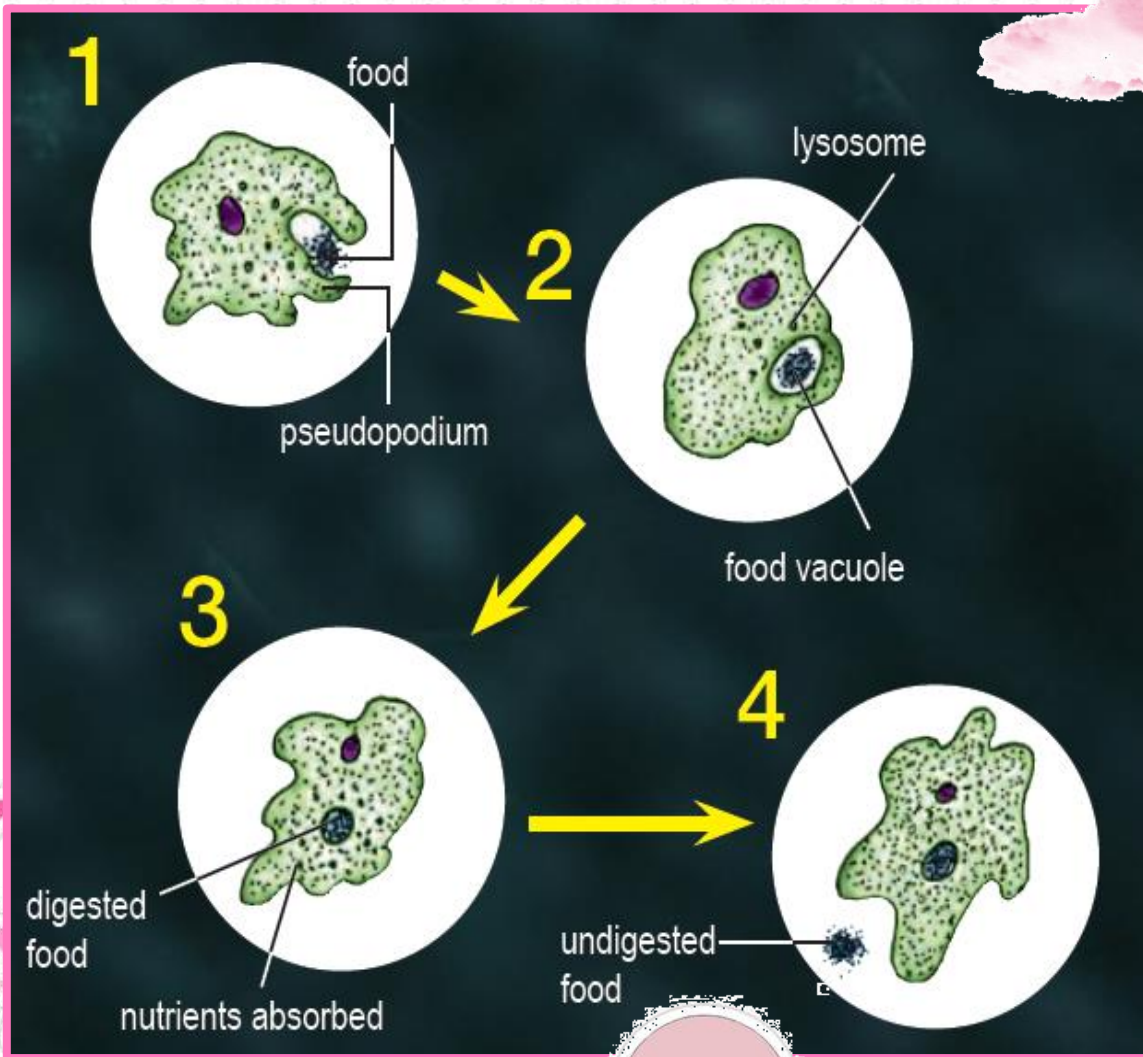
- The nutrients are absorbed into the cytoplasm



3

- Undigested food is discharged when the Amoeba sp. moves. Undigested food in the Paramecium sp. is discharged through the anus.

4



GROWTH

- Amoeba sp. and Paramecium sp. grow by synthesising new cytoplasm

EXCRETION

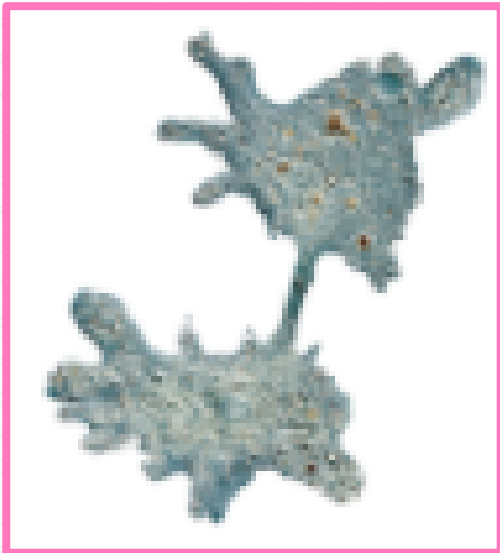
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- Waste such as carbon dioxide and ammonia are removed by diffusion.
- As Amoeba sp. and Paramecium sp. live in freshwater environments, water will diffuse by osmosis and fill the contractile vacuole.
- When the vacuole expands to the maximum size, contraction occurs and water is excreted from time to time.
- This process is called osmoregulation

REPRODUCTION

- When the conditions are suitable and there is plenty of food, Amoeba sp. and Paramecium sp. will reproduce via asexual reproduction that is binary fission through mitosis
- However, when the environmental conditions are not suitable, such as dry conditions, low temperature and food shortage, the Amoeba sp. forms spores that will only germinate when the environment improves.
- For Paramecium sp., sexual reproduction, that is conjugation occurs when environmental conditions are not suitable

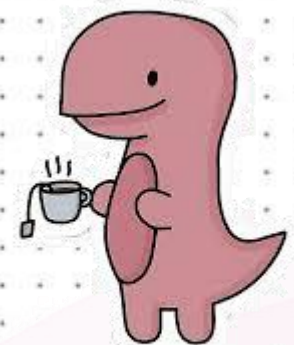
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Binary fission



Conjugation



TEA-REX

2.3 LIVING PROCESSES IN MULTICELLULAR ORGANISMS

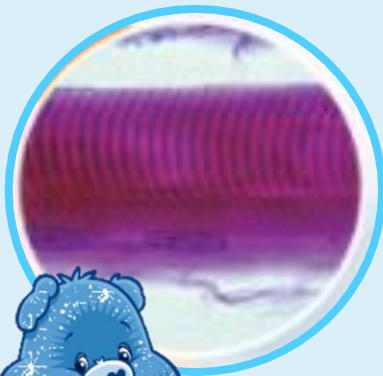
- There are various types of cells in multicellular organisms which are different in size, shape and arrangement
- The cell structure correlates to its function, and each type of cell is specialised to carry out a specific function.

HUMAN CELLS

MUSCLE CELL



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- Arranged as multinuclear striated fibres
- Contract and relax to generate movement



NERVE CELL

- Long and thin in shape
- Functions in sending nerve impulses



WHITE BLOOD CELL



- Can change shape
- Functions in destroying pathogens

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EPITHELIAL CELL



- Thin and flat cells
- Coats the surface of organs such as the digestive tract

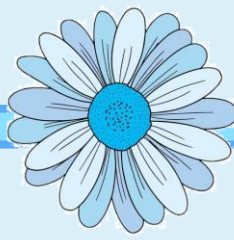


RED BLOOD CELL



- Does not contain a nucleus
- Shaped as a biconcave disc
- Functions to optimise transportation of oxygen





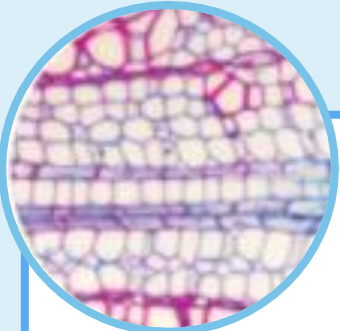
SPERM CELL

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- Has a long tail to enable it to swim towards the ovum in the Fallopian tube
- The head carries a set of chromosomes from the male

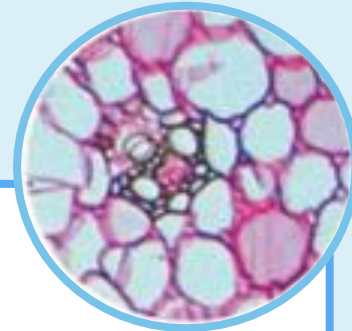


PLANT CELLS



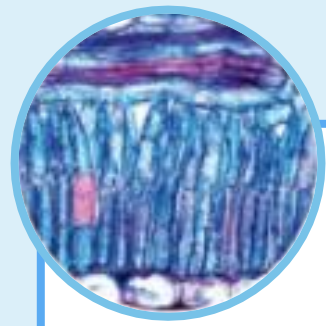
SIEVE TUBE ELEMENT

- Long cylindrical tubes arranged from end to end
- Transports organic materials from leaves to storage organs such as fruits



XYLEM VESSEL

- Long, continuous hollow tube
- Functions in transporting water and mineral salts from the roots to the other parts of the plant



PALISADE MESOPHYLL CELL

- Consists of long cylindrical cells, arranged vertically and close to each other
- Contains high chlorophyll density
- This arrangement allows maximum absorption of sunlight for photosynthesis.

SPONGY MESOPHYLL CELL

- Cells are loosely arranged with lots of air space in between
- Large air space allows exchange of gas from the inside of the leaves to the palisade mesophyll cells



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GUARD CELL

- Modified lower epidermal cells with the thicker cell wall on the inner side
- Controls the opening and closing of the stoma. Stoma is the opening that allows the exchange of oxygen and carbon dioxide



ROOT HAIR CELL



- Has a long projection which adds surface area for the absorption of water and mineral salts

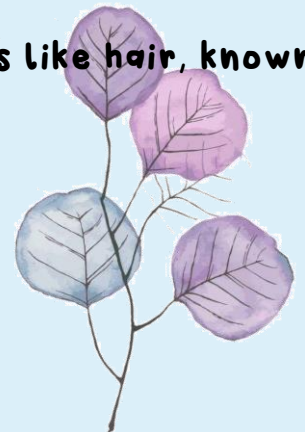
CELL ORGANISATION in humans

- In multicellular organisms, cells of the same type and performing the same function are organized into tissues.
- Tissues are a group of cells that have the same structure and function and are arranged together to carry out a specific function.
- In organisms, tissues can be classified into four different types which are epithelial tissue, muscle tissue, nerve tissue and connective tissue.

EPITHELIAL TISSUE

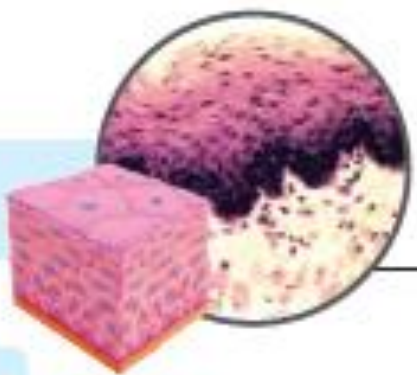


- Epithelial tissue covers the outer surface (skin) and hollow surfaces in the body (digestive tract and respiratory tract)
- The epithelial tissue structure is adapted based on its function
- For example, the epithelial tissue on the skin protects against infections, injuries, chemicals and Dehydration
- Epithelial tissues that coat the trachea have projections like hair, known as cilia





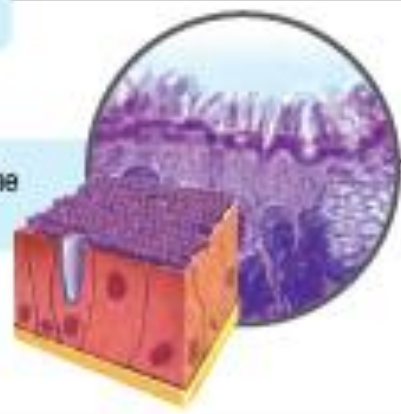
Epithelial tissue covers the surface of the mouth and oesophagus



Epithelial tissue covers the surface of lungs, body cavities and blood vessels



Epithelial tissue covers the surface of the trachea and bronchus



Epithelial tissue lines tubules, glands and kidney ducts



Epithelial tissue covers the small intestine

FIGURE 2.4 Types of epithelial and muscle tissues

2.3.1 2.3.2

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you know it's gonna get better

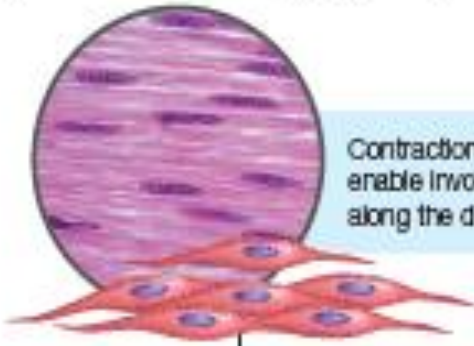


MUSCLE TISSUE

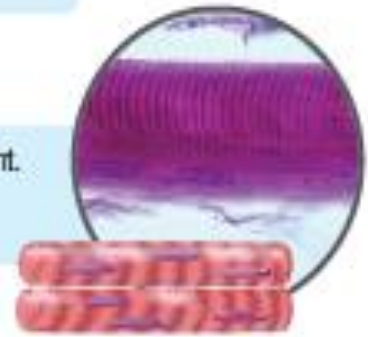
- There are three types of muscle tissue
- smooth muscle (found in the digestive tract, blood vessel, urinary tract and reproductive tract)
- skeletal muscle (found in legs and hands)
- cardiac muscle (found in the heart wall)

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Contraction and relaxation of smooth muscle enable involuntary activities such as peristalsis along the digestive tract.



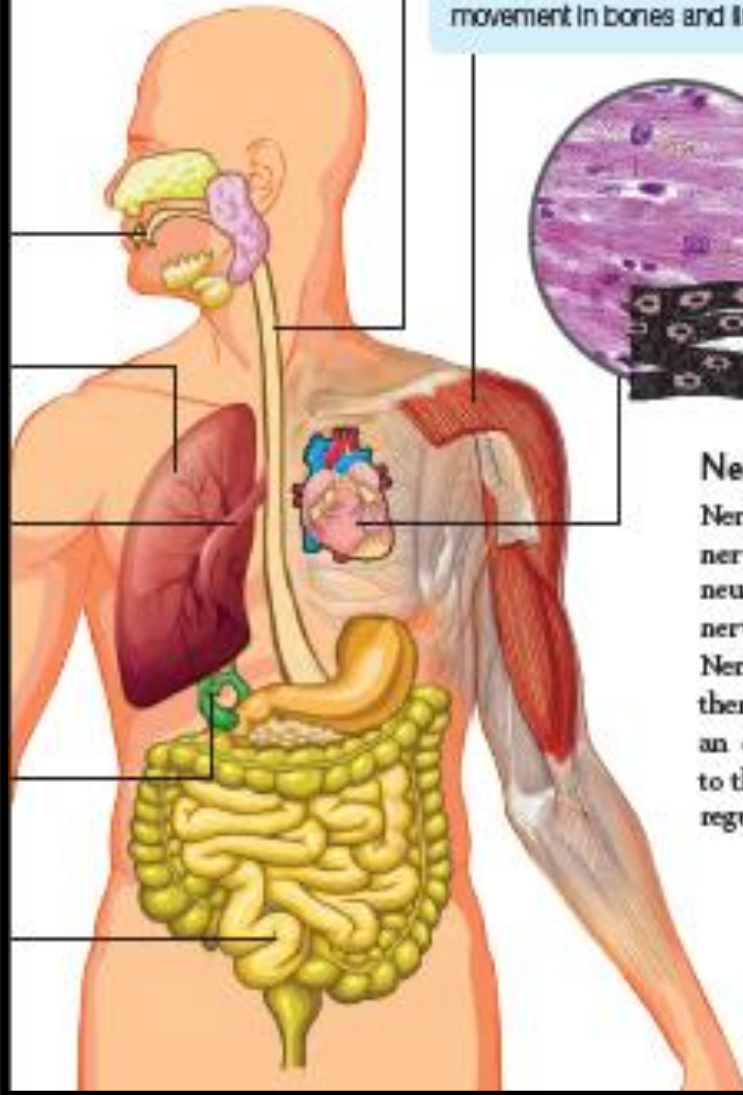
Skeletal muscle is involved in controlled movement. Skeletal muscles contract and relax to generate movement in bones and limbs.



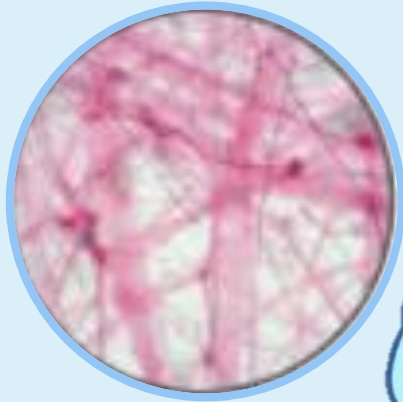
Cardiac muscle builds walls of the heart that contract to pump blood to the whole body. Cardiac muscle contraction is involuntary.

Nerve tissue

Nerve tissue is made of neuron or nerve cells (Photograph 2.6). Each neuron consists of a cell body and nerve fibre called dendrite and axon. Nerve tissues can detect stimuli and then send information in the form of an electrical signal (nerve impulses) to the muscles or glands. Nerve tissue regulates and controls body activity.

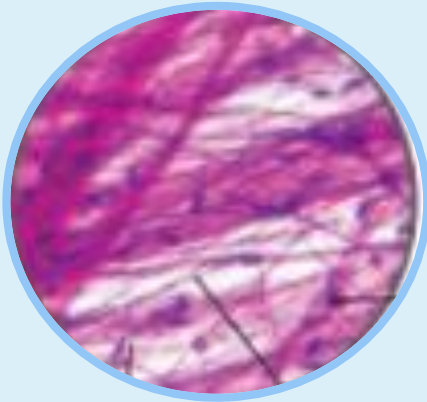


CONNECTIVE TISSUE



Loose connective tissue

It links the epithelial tissue to the tissue below it, and fixes the organs in their positions



Fibrous connective tissue

These tissues form tendons and ligaments. The tendon connects bones and muscles while the ligaments connect bones to bones

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Blood tissue

Blood plays a functional role in regulation, transportation and protection



Bone

Bone forms the body frame and protects the internal organs



Adipose tissue

Connective tissues keep fat under the skin dermis and the surface of all main organs



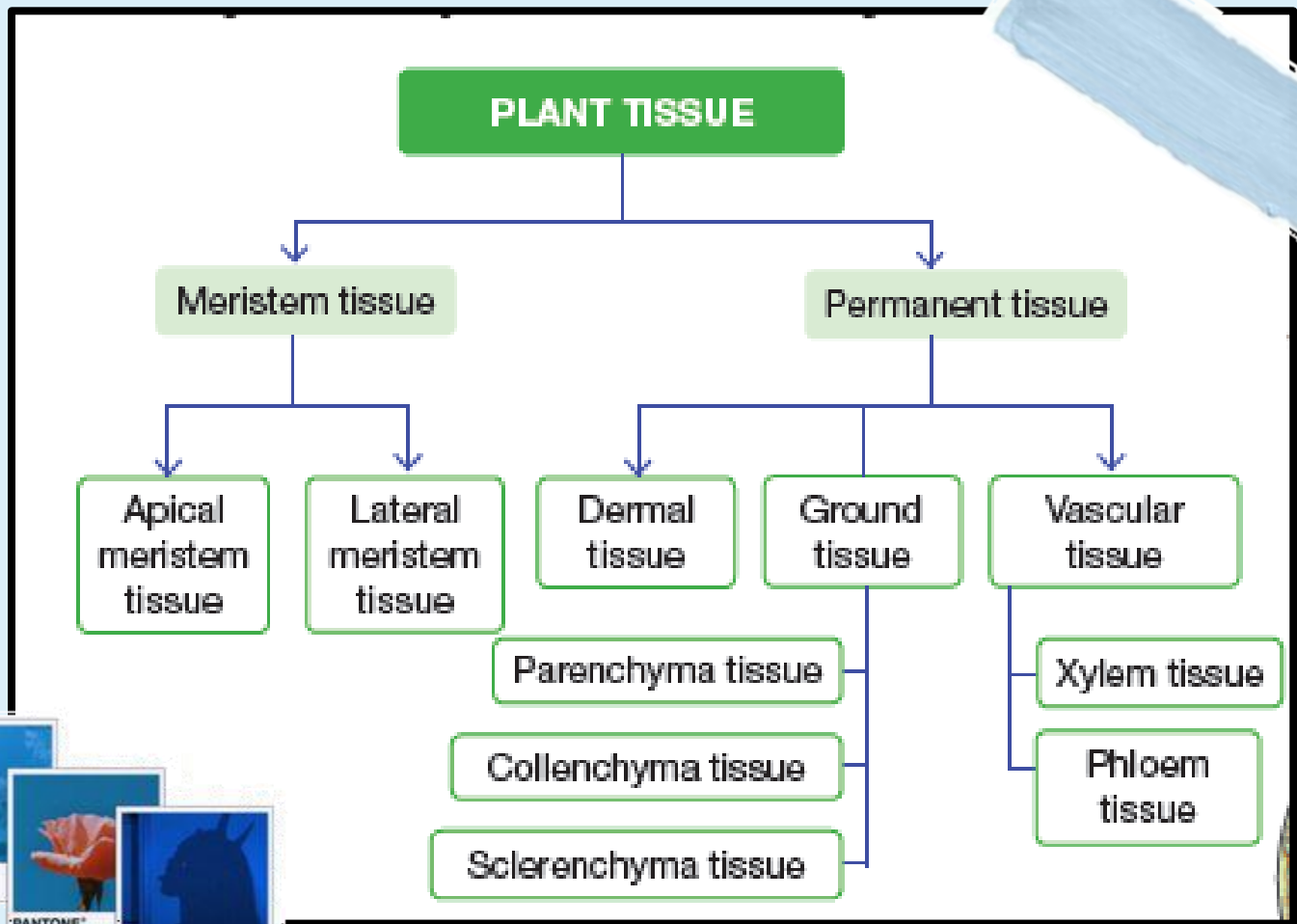
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Cartilage

Cartilage encloses bone tips to prevent the bone from wearing out



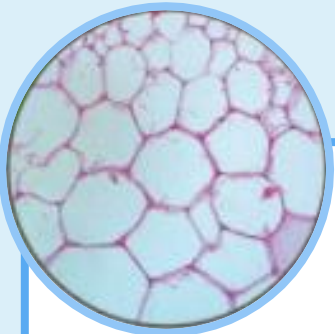
TISSUE ORGANISATION in PLANTS

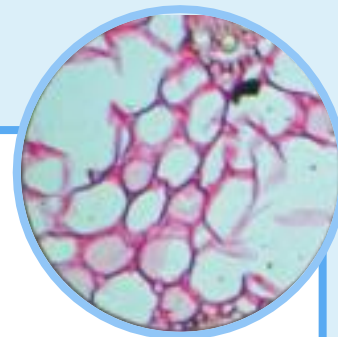


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PARENCHYMA TISSUE

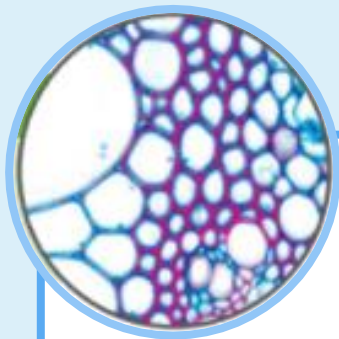
- Functions to store starch, protein and water. This tissue can also carry out photosynthesis.





COLLENCHYMA TISSUE

- Functions in giving support to young, non-woody stems (herbaceous plants)



SCLERENCHYMA TISSUE

- Functions in providing support and mechanical strength to all mature parts of the plant..



XYLEM TISSUE



- The xylem functions in transporting water and mineral salts from the roots to other parts of the plant. Ligneous xylem tissue wall provides support and mechanical strength to the plants.

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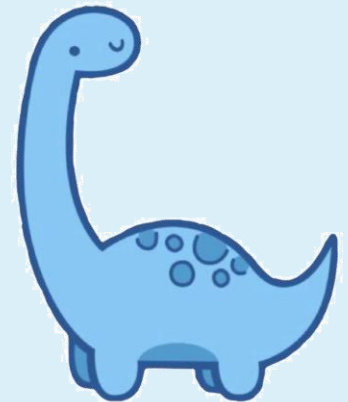


PHLOEM TISSUE

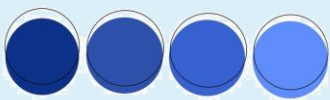
- The phloem functions in transporting organic matters such as sucrose from the leaves to all parts of the plant.

DENSITY OF CERTAIN CELL COMPONENTS AND SPECIALISED CELL FUNCTIONS

- Since the functions performed by cells are different, some cells have a higher density of certain cell components
- The density of a cell component in a particular cell is related to the specific function of the cell..



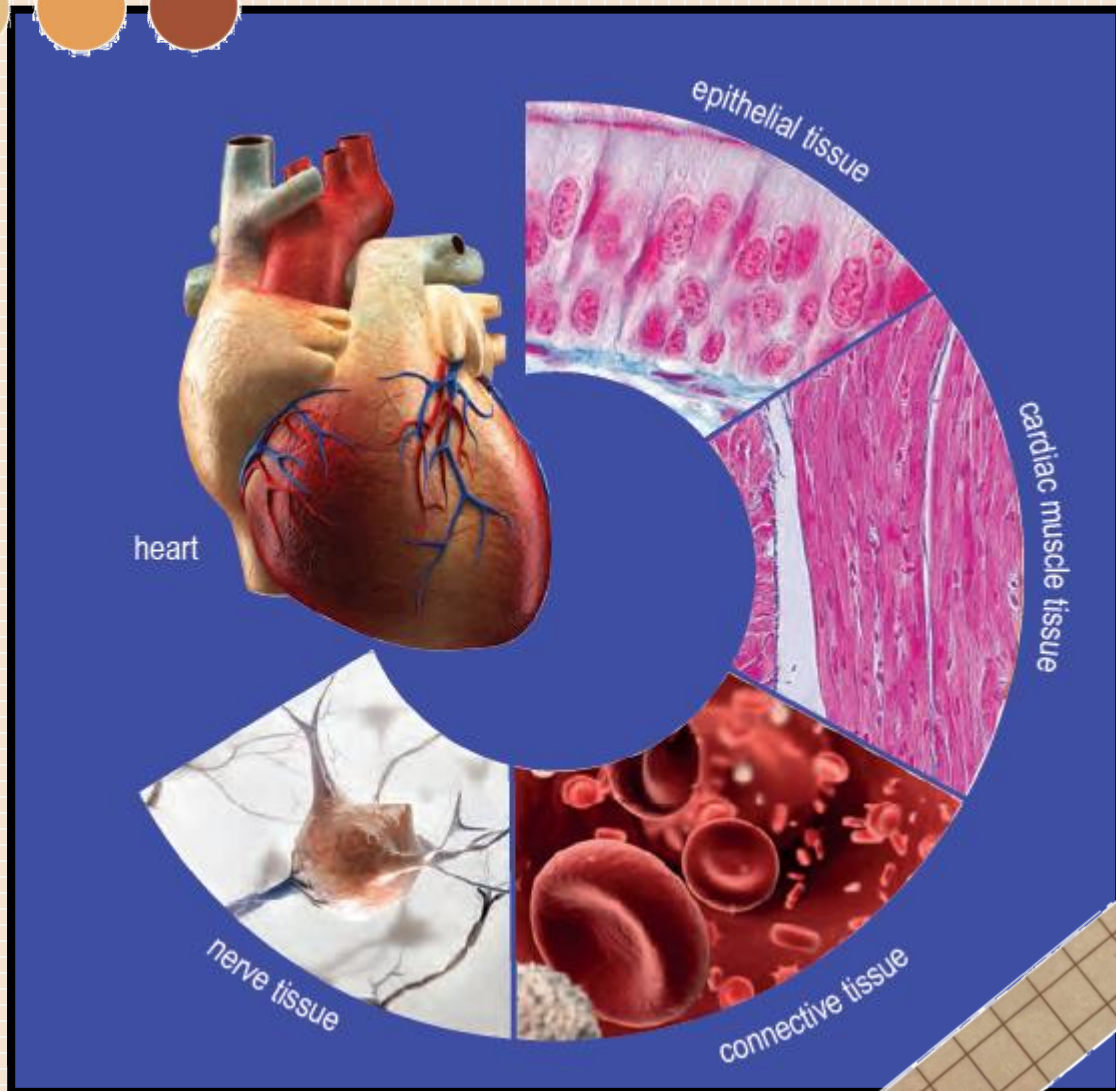
Types of cell	Cell component found in abundance	Function
Sperm cell	Mitochondrion	Requires a lot of energy to swim towards the uterus and Fallopian tube to fertilise the secondary oocytes
Muscle cell such as flight muscle cells in insects and birds		Requires a lot of energy to contract and relax to enable movement and flight
Plant meristem cell		Requires a lot of energy to carry out active cell division process to produce new cells
Palisade mesophyll cell	Chloroplast	Absorbs more sunlight to carry out the process of photosynthesis
Spongy mesophyll cell		
Pancreatic cell	Rough endoplasmic reticulum Golgi apparatus	Increases synthesis and secretion of digestive enzymes
Goblet cell in intestinal epithelium and respiratory tract		Produces mucus
Liver cell		<ul style="list-style-type: none"> Metabolises carbohydrates Detoxification of drugs and poisons



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2.4 LEVELS OF ORGANISATION



- A group of different tissues combine to form organs..
- Organs perform special functions as a result of the combination of tissues that form the organ..
- For example, the heart organ is composed of epithelial tissue, cardiac muscle tissue, connective tissue and nerve tissue.
- The epithelial tissue fills up space in the heart
- Cardiac muscle tissue functions in pumping blood to the rest of the body.
- Connective tissues such as the blood, connect the systems in the organ.
- Nerve tissue regulates the rhythm of the heartbeat..



Endocrine system



- The endocrine gland that secretes hormones
- Main function - coordinates body activities with the nervous system



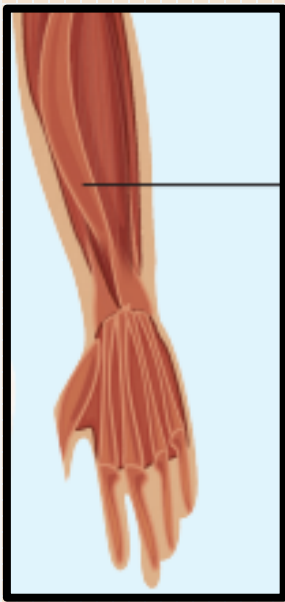
Respiratory system

- Trachea, nose, Lungs and diaphragm
- Main function - Exchange of oxygen and carbon dioxide gases between the body and external environment



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Muscular system

- Skeletal muscles, smooth muscles and cardiac muscles
- Main function - contracts and relaxes to produce movements in different parts of the body



Male reproductive system

- Testes, prostate gland and penis
- Main function - Produces sperm and male sex hormone

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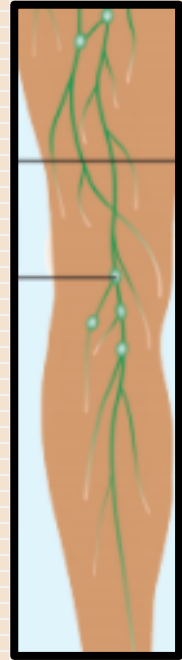


Female reproductive system

- Ovary, uterus, fallopian tube, vagina and cervix
- Main function - Produces ovum and female sex hormones

Lymphatic system

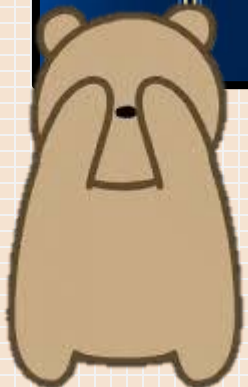
- SPLEEN, Lymph nodes and Lymph vessels
- Main function - Maintains balance of bodily fluids and prevents infectious diseases



Nervous system

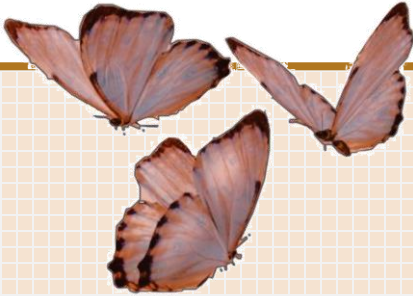
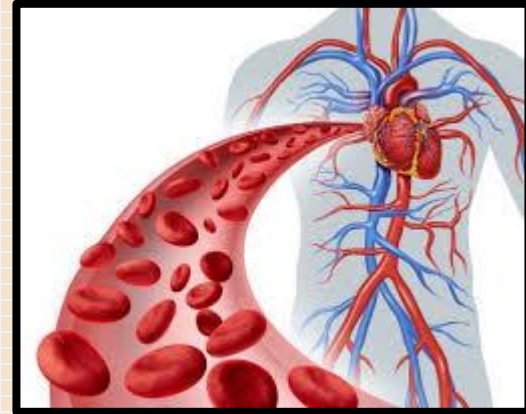
- Otak, saraf tunjang dan saraf periferi
- Main function - Mengesan dan menghantar maklumat dalam badan serta mengkoordinasi aktiviti badan

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Blood circulatory system

- Heart, artery, vein and blood capillary
- Main function - Transports nutrients, respiratory gases and waste products



Digestive system

- Mouth, oesophagus, stomach, Liver, pancreas, small intestine and large intestine
- Main function - Digests food into a simpler form for easy absorption

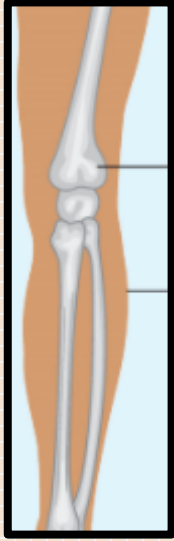


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Urinary system

- kidney, ureter, urethra and bladder
- Main function - Eliminates waste products such as urea and uric acid from the body



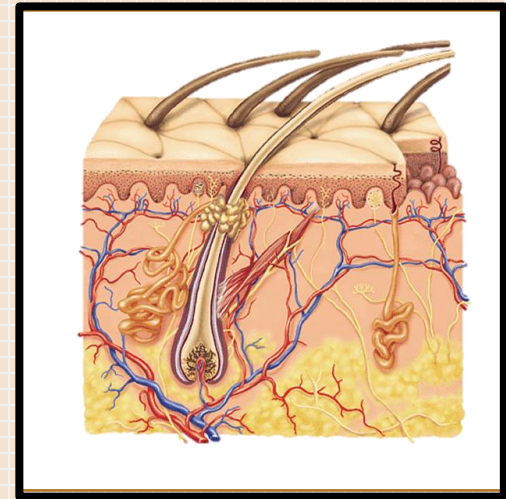


Skeletal system

- Bone, cartilage, Ligament and tendon
- Main function - Supports the body, protects the internal organs and provides a base for muscle adhesion

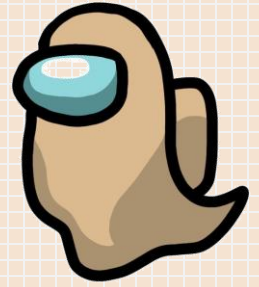
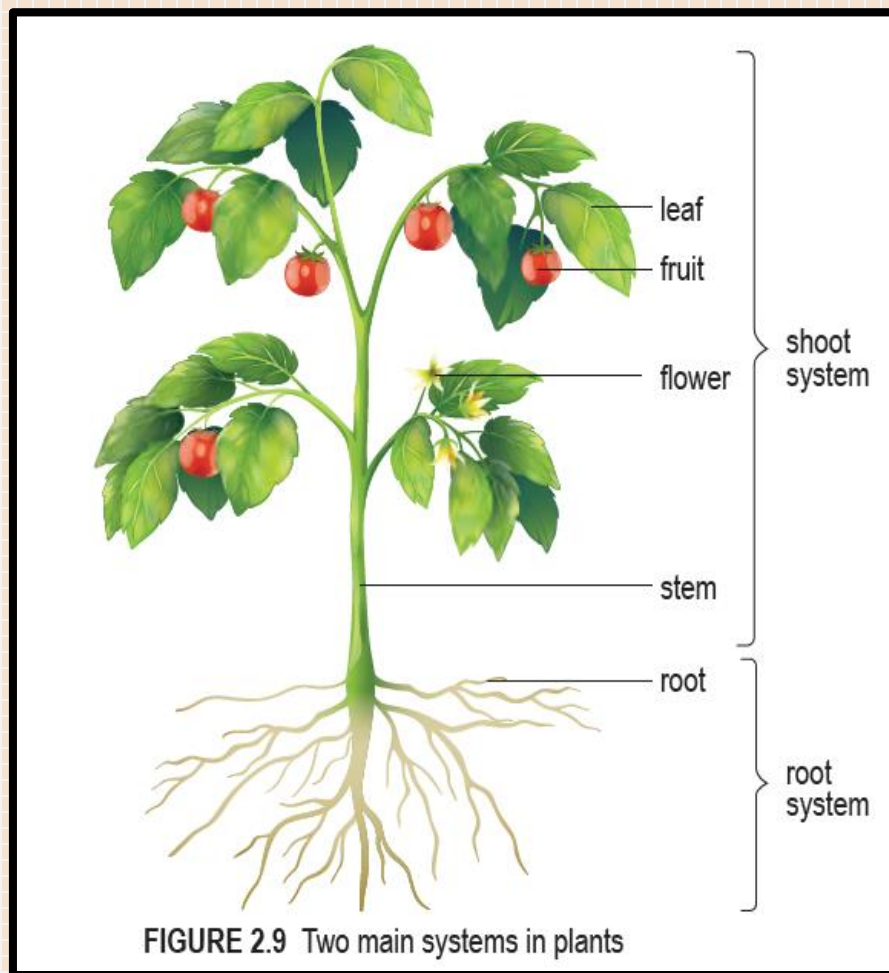
Integumentary system

- Skin
- Main function - Protects the body from physical injury, infection and dehydration



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The plant system is divided into the shoot system and the root system

- The shoot system consists of stems, leaves, shoots, flowers and fruits.
- Stems and twigs are support systems that support the leaves at a vertical position to allow maximum absorption of sunlight during photosynthesis.
- Flowers are involved in the pollination process.
- The root system consists of all roots in a plant that function in absorbing water and mineral salts as well as providing support for plants.