

# Cells – revision notes essay sample



**ASSIGN  
BUSTER**

1. All living things are made up of cells
2. Cells are the smallest unit of life
3. All cells arise from pre-existing cells

1. All living things are made up of cells which have an outer boundary, nucleus, cytoplasm and organelles. However there are many exceptions to this rule.

Eg: Muscle cells are multi nucleated, fungi have no cell membrane or cell wall, viruses behave like non-living entities, RBC's have no nucleus

2. Cells are the smallest unit of life that can show all the characteristics of a living organism. Its functions are carried out by organelles. Eg: mitochondria and chloroplasts are autonomous organelles and have their own DNA

3. All cells arise from pre-existing cells by the process of cell division. In primitive organisms like amoebas, it occurs by binary fission while in higher organisms, it occurs by mitosis. The first cell however was formed by spontaneous generation. This bio-molecule should have been self-replicating like macromonial RNA

#### UNICELLULAR ORGANISMS

They carry out all the functions with the help of a single cell. The main functions of such cells are:

1. Response to change in environment
2. Homeostasis: maintenance and regulation of the internal environment

3. Metabolism: respiration, synthesis of ATP
4. Growth: increase in cell size and volume
5. Reproduction: asexual methods
6. Nutrition: synthesis of organic molecules, absorption of organic matter

## MULTI-CELLULAR ORGANISMS

1. Differentiation/Specialization- It is the process by which cells within a multi-cellular organism specialize in their functions. It takes place due to the switching off of genes in particular groups of cells. As a result, cells modify themselves to have specific shapes, functions and adaptations. It helps in making the multi-cellular organism more efficient when competing for a specific resource. Eg: transport in plants can take place from one cell to another by diffusion. However this process becomes more efficient when there is a specialized group of cells like xylem and phloem
2. Emergent Properties- It is the occurrence of unexpected characteristics or properties in a complex system. These properties are from all the components present in a particular system

## STEM CELLS

They are undifferentiated cells which retain the capacity to divide and they have the ability to differentiate along different pathways. Under the right conditions, they can be modified to express particular genes and to differentiate into a particular type of cell stem cells are two types:

1. Embryonal Cells - They are obtained from an undifferentiated embryo and have the capacity to differentiate into any kind of cell. They can be cultured easily. However the chances of rejection are high especially if it is from a donor

2. Adult Cells - They differentiate cell types depending upon the tissue from which it was obtained. They are not easy to culture but the chances of rejection are low especially if it is from the same person. Adult marrow, blood vessels, the skeletal muscles, the skin and the liver possess stem cells. They can be used for treatment of a large number of diseases like diabetes and nerve disorders. They are also used for producing certain cells like heart muscles, blood cells, bone marrow cells, epithelial cells and nerve cells.

#### THERAPEUTIC STEM CELL THERAPY

1. Isolate the nucleus from a healthy cell
2. Introduce this nucleus into an egg cell from which the nucleus has been removed already
3. The cell is stimulated to divide forming a group of clones of the cell
4. The cell mass forms a blastocyst which contains totipotent cells which can be used to obtain various types of cells
5. There, new cells are transferred to the patient. Since they are from the patient's body itself, the chances of rejection are less

There are a lot of ethical and moral issues associated with stem cell cultures

3. As a result the rate of exchange depends as the rate of exchange depends upon the surface area that is in contact with surroundings

4. In large organisms like elephants the exchange rate with the surroundings occurs much slower. As a result heat exchange slows down. And so large ears are developed to increase surface area for heat exchange

5. In smaller organisms there is rapid exchange with the environment. It rapidly loses heat. In order to produce heat, it consumes food at a fast rate to produce heat by respiration

6. In order to maintain surface area - volume ratio, cells continuously divide to form smaller cells

7. They may develop additional features like extensions, foldings, cilia etc. to increase surface area

8. Smaller cells have:

- faster rates of diffusion
- faster rates of absorption
- efficient removal of heat
- production and utilization of energy is better

## MICROSCOPES

### Light Microscopes

\* Uses light (0.4 - 0.7  $\mu\text{m}$ )

<https://assignbuster.com/cells-revision-notes-essay-sample/>

- \* Uses lenses to focus light
- \* Dead and living cells can be seen
- \* Staining is not required
- \* Real colours can be seen
- \* Less expensive

### Electron Microscopes

- \* Uses electrons (0.005nm)
- \* Uses electromagnets
- \* Dead cells are observed
- \* Staining is required
- \* Only black and white images are obtained
- \* More expensive

Resolution Power - It is the ability to distinguish between two points very clearly

Human eye - 0.1mm

Light microscope - 200nm

Electron Microscope - 0.2nm (finer details are clear)

Magnification - The number of times or the extent to which the image has been enlarged

## RELATIVE SIZES OF CELLS

1. Molecules - 1nm

2. Cell membrane - 10nm

3. Virus - 100nm

4. Bacteria - 1µm to 5µm

5. Organelles < 10 µm

6. Cells - 100µm

- prokaryotic: 1 to 5µm

- eukaryotic: 10 to 100 µm

7. Plant cells are bigger than animal cells

1cm =  $10^{-2}$  m

1mm =  $10^{-3}$ m

1µm =  $10^{-6}$ m

1nm =  $10^{-9}$ m

1 Å =  $10^{-10}$ m

## LINEAR MAGNIFICATION

<https://assignbuster.com/cells-revision-notes-essay-sample/>

Magnification = measured length of image/ measured

Length of actual specimen

Calculation Magnification

1. Using a scale measure the size of a large clear feature on the image
2. Measure the same length on the specimen (usually given)
3. Calculate magnification using the formula after converting it to the same unit of measurement

SCALE BARS

It is the horizontal line drawn on the image. The scale bar shows how long the line is in the real specimen

1. Measure the length of the diagram using a scale
2. Measure the length of the scale bar
3. Divide the length of the diagram by the length of the scale bar
4. Multiply the answer obtained with the value given on the scale bar

PROKARYOTIC CELLS

Structure of E. Coli

1. Size: 1-2um
2. No membrane bound organelles



3. No true nucleus with a nuclear membrane
4. Ribosomes are smaller than in eukaryotic cells
5. Slime capsules are used as a means of attachment to a surface
6. Some have flagella (bacteria)
7. Plasmids are present, they are very small circular pieces of DNA that may be transferred from one bacteria to another

#### Cell Wall

1. Made of murein which is a glycoprotein or peptidoglycan (protein/carbohydrate complex)
2. There are two kinds of bacterial cell walls which are identified on the basis of gram staining
3. Gram positive bacteria stain purple while gram negative bacteria stain pink

Plasma Membrane - Controls the entry and exit of substances by passive or active mechanisms

Cytoplasm - It contains all the enzymes needed for all the metabolic reactions as there are no organelles

#### Ribosomes

1. Smaller ribosomes (70s)

2. Free in cytoplasm

3. Helps in protein synthesis

#### Nucleoid

1. Region in the cytoplasm that contains DNA

2. Not surrounded by a nuclear membrane

3. The DNA is a closed circular loop

4. The DNA is not associated with any protein to form a chromatin

#### Flagella

1. Long thread like attachments for movements

2. Has an internal protein that allows the flagella to be actively moved as a form of propulsion

3. Flagellate organisms are generally pathogens

4. 20nm in diameter

#### Pilli

1. Thread like projections

2. More numerous than flagella

3. Helps in attachment

4. Could transfer DNA from one cell to another

## Slime Capsule

1. Thick polysaccharide layer outside of the cell wall
2. Used for sticking cells together, as a food reserve as protection against desiccation and chemicals and as protection against phagocytosis
3. Many cells may fuse together to form a biofilm. Eg: dental plaque

## Plasmids

1. Extra nucleoid DNA
2. Can replicate particularly before binary fission
3. Associated with conjugation
4. May contain antibiotic resistance gene

## Binary Fission

1. Prokaryotic cells divide by binary fission
2. Asexual reproduction methods in which a cell divides into two same sized cells
3. Cells formed are clones
4. Replicates once every 40mins at 37°C. If more carbohydrates are provided than it can reduce once in 20mins
5. Takes place in 4 steps

- \* Reproduction Signal - Signals may be internal or external
  
- \* Replication of DNA - Replication starts at one point of the circular DNA (origin - ori) and proceeds around the loop until 2 loops are formed. The process finishes at a single point call (termination - ter) position
  
- \* Segregation of DNA - The two loops are separated by using energy and more to opposite ends of the cell
  
- \* Cytokinesis - The plasma membrane forms a constriction in the middle and forms two cells