

Cell: The Unit of Life

Case Study Based Questions

Read the following passages and answer the questions that follow:

1. Cells are something which are present in all living beings whether they are unicellular or multicellular. Unicellular organisms have an independent existence but anything less than a complete cell does not have an independent existence. Anton Van Leeuwenhoek was the first to observe and describe a live cell. Robert Brown discovered the presence of a nucleus. Schwann and Schleiden together put forward the cell theory. On the basis of the membrane-bound nucleus, cells are of two types- prokaryotic and eukaryotic. The cell envelope of prokaryotes is made up of three layers- glycocalyx, cell wall and cell membrane.

(A) Who gave the cell theory that is widely accepted now?

- (a) Anton van Leeuwenhoek
- (b) Rudolf Brown
- (c) Rudolf Virchow
- (d) Schwann and Schleiden

(B) Which of the following statement is correct with regard to glycocalyx?

- (a) They are of three types.
- (b) They differ in composition and thickness among different bacteria.
- (c) Thick and tough layer is called a loose sheath.
- (d) Glycocalyx is the innermost layer.

(C) Which thing differentiates living things from non-living things?

- (a) Atoms
- (b) Molecules
- (c) Compounds
- (d) Cells

(D) Rudolf Virchow said that:

- (a) New cells do not arise from pre-existing cells.
- (b) Unicellular organisms are capable of independent existence.
- (c) New cells arise from pre-existing cells.
- (d) Anything less than a complete cell does not have an independent existence.

(E) Prokaryotic cell envelope is made up of.....cell wall and cell membrane.

(a) glycocalyx

(b) chitin

(c) lipid

(d) protein

Ans. (A) (c) Rudolf Virchow

Explanation: Revised cell theory, that is widely accepted, was given by Rudolf Virchow. Others were part of the discoveries that led to the final one.

(B) (b) They differ in composition and thickness among different bacteria.

Explanation: Glycocalyx (outermost layer) differ in composition and thickness among different bacteria. It could be a loose sheath called the slime layer in some, while in others it may be thick and tough, called the capsule.

(C) (d) Cells

Explanation: Cells are something which are present in all living beings whether they are unicellular or multicellular. Others are present in both living and non-living.

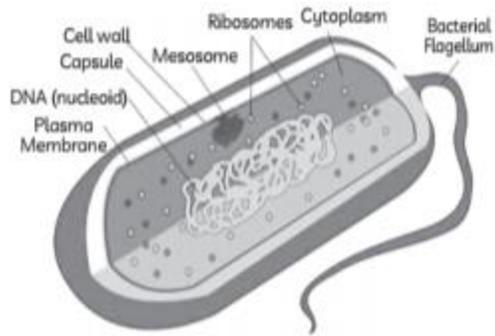
(D) (c) New cells arise from pre-existing cells.

Explanation: Revised cell theory was given by Rudolf Virchow and according to it, new cells arise from pre-existing cells. Other options like (b) and (d) were given by other scientists.

(E) (a) glycocalyx

Explanation: The cell envelope of prokaryotes is made up of three layers- glycocalyx, cell wall and cell membrane.

2. Prokaryotes are different from eukaryotes in various aspects. Cells that have membrane- bound nuclei are called eukaryotes whereas cells that lack a membrane-bound nucleus are prokaryotic. Prokaryotes lack membrane bound organelles. In prokaryotes, ribosomes are of the 70S type. Division of labour is absent in prokaryotes. Many prokaryotes also have additional small circular DNA entities called plasmids. Bacteria with plasmid DNA have distinct phenotypic characteristics. One is resistance to antibiotics. They have something unique in the form of inclusions. Mesosome is the characteristic of prokaryotes. It is the infolding of the cell membrane.



- (A) Why are plasmids present in prokaryotes only?
- (B) How does the nucleoid stay in one place in the cell even though they do not have a membrane surrounding them in prokaryotic cells?
- (C) Why is there no division of labour in prokaryotes?

Ans. (A) Only prokaryotes have plasmids. Plasmids are small circular DNA. Besides genomic DNA, many bacterial cells contain plasmids. Bacteria with plasmid DNA have distinct phenotypic characteristics. One is resistance to antibiotics. Plasmid helps in the transfer of genetic material from one cell to another.

(B) DNA and proteins make up the majority of the nucleoid. Proteins that carry out dynamic spatial organisation are in charge of keeping the nucleoid's compact form and position. Mutations in chromosomal DNA, on the other hand, can disrupt nucleoid shape and cause the origins to be mislocated.

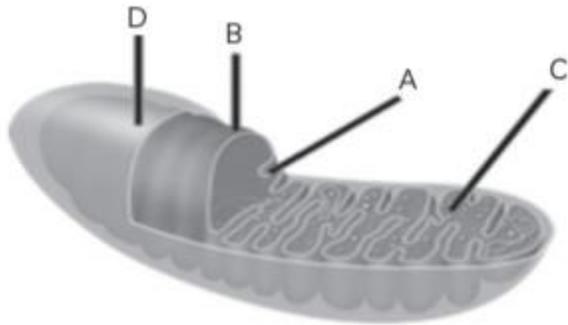
(C) Prokaryotes are single-celled organisms. Their body structure is not so complex and they lack organelles. Whole organisms work as a single unit as no division of labour is present.

3. Tarun studied about mitochondria in a magazine which he bought from a local shop. He concluded the following points about it. The number of mitochondria is variable in each cell depending on their physiological activity and they are not visible under the microscope unless stained specifically. Their shape and size are also variable but typically, they are sausage-shaped or cylindrical having a length of 1.0-4.1 μm and a diameter of 0.2-1.0 μm .

(A) Which statement is incorrect about the mitochondria?

- (a) They are the site for aerobic respiration.
- (b) They have 80S ribosomes.
- (c) They divide by fission.
- (d) They produce cellular energy.

(B) Identify the parts of the mitochondrion correctly.



- (a) A-Matrix, B-Inner membrane, C-Cristae, D-Outer membrane
- (b) A-Matrix, B-Outer membrane, C-Inner membrane, D-Cristae
- (c) A-Crista, B-Inner membrane, C-Matrix, D-Outer membrane
- (d) A-Crista, B-Outer membrane, C-Inner membrane, D-Matrix

(C) Each cell organelle has a particular function, what is the function of the mitochondria?

- (a) Digestion
- (b) Packaging
- (c) Respiration
- (d) Protein synthesis

(D) The mitochondria are also known as:

- (a) cell's gatekeeper
- (b) cell's powerhouse
- (c) cell's garbage man
- (d) nucleus's assistant

(E) How do the mitochondria divide?

- (a) Fission
- (b) Budding
- (c) Fragmentation
- (d) Parthenogenesis

Ans. (A) (b) They have 80S ribosomes.

Explanation: As mitochondria have 70S ribosomes, option (b) is incorrect as it states that mitochondria have 80S ribosomes. Rest all other statements are correct for mitochondria.

(B) (a) A-Matrix, B-Inner membrane, C-Cristae, D-Outer membrane

(C) (c) Respiration

Explanation: The mitochondria are the site of aerobic respiration and they produce cellular energy, so only option

(c) is the correct one. Mitochondria do not help with digestion, packaging or protein synthesis. Lysosomes help in digestion as they contain a variety of hydrolytic enzymes. Golgi bodies help in packaging.