2018 Eukaryotic Cell Structure and Cell Membranes MCQ

2018 / H2 / ACJC PRELIM / P1 Q1

1 The electron micrographs show two different types of cells (not shown to scale).



Cell A



Cell B

Which row matches the structures to their correct function?

| | Structure in cell A | Structure in cell B | Function |
|---|---------------------|---------------------|---------------------------------|
| Α | 3 | 7 | Provide energy for the cells |
| в | 1 | 5 | Maintain the shape of the cells |
| С | 2 | 6 | Photosynthesise |

| D | 4 | 6 | Secrete proteins |
|---|---|---|------------------|
| | | | |

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2 The plasma membrane is the cell's protective barrier as it prevents foreign molecules from entering the cell. However, in drug research experiments, foreign molecules such as drugs or short DNA fragments need to be transported into the cell.

Electroporation is a technique used to increase the permeability of the membrane transiently by treating the cell with short electrical pulses.

Which statement most likely explains how electroporation works?

- A The short electrical pulses denature the membrane proteins, allowing foreign molecules to pass through.
- **B** The short electrical pulses cause the foreign molecules to be attracted to the surface of the membrane.
- **C** Electricity increases the hydrophobic nature of foreign molecules, allowing them to pass through the hydrophobic core of the phospholipid bilayer.
- **D** Electroporation causes the phospholipids to move apart to create pores for foreign molecules to pass through.

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- 3 Which row matches the descriptions of biological molecules to where they are found?
 - 1 Polymer of glucose molecules linked by β-1,4 glycosidic bonds to form a straight chain
 - 2 An unbranched and helical polymer of glucose molecules linked by α-1,4 glycosidic bonds
 - 3 An amphipathic, phosphate-containing molecule

| | 1 | 2 | 3 |
|---|--|----------------------------------|---|
| A | Cell wall of eukaryotes only | Storage granules in animal cells | Plasma membrane of prokaryotes and eukaryotes |
| В | Cell wall of prokaryotes and eukaryotes | Storage granules in plant cells | Plasma membrane of eukaryotes only |
| С | Cell wall of prokaryotes and eukaryotes | Storage granules in animal cells | Plasma membrane of prokaryotes only |
| D | Cell wall of eukaryotes only | Storage granules in plant cells | Plasma membrane of prokaryotes and eukaryotes |

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4 The electron micrograph shows cells from an aquatic plant.

Which of the following about structures 1 to 4 is correct?

| | contains DNA | contains rRNA | contains tRNA | contains proteins |
|---|--------------|---------------|---------------|-------------------|
| Α | 1, 2 | 2 | 2, 3, 4 | 1, 4 |
| в | 1, 3, 4 | 2, 3 | 2, 4 | 3, 4 |
| С | 2, 3 | 2, 3, 4 | 3, 4 | 1, 2, 3, 4 |
| D | 2 | 3, 4 | 1, 3 | 1, 2 |

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5 The diagram shows the cell surface membrane of an actively respiring liver cell placed in a solution of glucose with a lower water potential than that of the liver cells. Arrows P, Q, R and S show the movement of various particles across the cell surface membrane.



Which arrows correctly reflect the movements of oxygen, carbon dioxide, glucose and water across the surface membrane of this cell?

| | Oxygen | Carbon dioxide | Glucose | Water |
|---|--------|----------------|---------|-------|
| Α | Р | Q | R | S |
| в | Q | S | R | S |
| С | Q | S | Р | Р |
| D | R | S | Р | R |

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6 An electron micrograph of a cell is shown below.



Match the organelles E, F, G, H and J associated with the cellular processes listed.

| | E | F | G | н | J |
|---|---------------------------|-----------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Α | DNA replication | Digestion of material | Organizes the spindle | Oxidative phosphorylation | Packaging of secretory products |
| В | Oxidative phosphorylation | Organizes the spindle | Digestion of material | DNA replication | Packaging of secretory products |
| С | Organizes the spindle | Digestion of material | Oxidative phosphorylation | Packaging of secretory products | DNA replication |
| D | DNA replication | Organizes the spindle | Packaging of secretory products | Oxidative phosphorylation | Digestion of material |

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7 Which organelle(s) is / are required for the formation of the hydrolytic enzymes found in lysosomes?



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A B

С

8 Which of the following curves best represent the movement of substances by simple diffusion and facilitated diffusion?



D

С

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9 Sometimes scientists need to isolate organelles. This can be achieved by taking a number of cells and breaking their cell surface membranes to release the contents of the cells into a buffer solution.

In zonal centrifugation the suspension of cell contents is placed on top of a sucrose density gradient. The tube is then placed in a centrifuge and spun at high speed. The larger and denser particles will move towards the bottom of the tube faster than smaller and less dense particles as shown below.



before centrifugation

after centrifugation

If a sample of intact prokaryotes had been added to a suspension of eukaryotic cell contents, where would you expect them to be found?

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10 The diagram represents stages in glucose uptake through a cell surface membrane.



low glucose concentration

d

Which process is shown?

- **A** active transport
- **B** facilitated diffusion
- **C** osmosis
- **D** simple diffusion

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QUESTION 11

The diagram shows an electron micrograph of a cell.



Which row correctly describes structures $\mathbf{P} - \mathbf{R}$?

| | Р | Q | R |
|---|---|---------------------------------------|-------------------------------|
| Α | synthesis of ribosomes | substrate level phosphorylation | active replication of genes |
| В | provision of large surface area for attachment of ribosomes | formation of ATP from light energy | active transcription of genes |
| С | synthesis of membrane proteins | oxidative decarboxylation | active transcription of genes |
| D | transport of proteins to Golgi apparatus | modification of mRNA transcripts | active replication of genes |

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QUESTION 12

A ribosome consists of a large and a small subunit, each subunit containing ribosomal RNA (rRNA) complexed with proteins.

Which sequence of events concerning ribosomes is correct?

- A Within the nucleolus, rRNA and proteins are synthesised and subunits are formed. They become membrane bound as they are exported through the nuclear envelope to the cytoplasm and rough endoplasmic reticulum (rER).
- **B** rRNA and proteins are synthesised in the Golgi body and are transported to the nucleolus for subunit formation.
- **C** rRNA is synthesised in the nucleolus and proteins are synthesised by the rough endoplasmic reticulum (rER). Subunit formation occurs within the cytoplasm for free ribosomes and on the surface of the rER for attached ribosomes.
- **D** rRNA synthesised within the nucleolus is complexed with proteins that have been imported from the cytoplasm. The subunits formed are exported to the cytoplasm via the nuclear pores.

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QUESTION 13

The following are all observations about cell surface membranes.

- 1 Phospholipids labelled with radioactive phosphate groups change position over time.
- 2 Proteins labelled with fluorescent dyes change position over time.
- 3 Lectins are proteins that bind to polysaccharides. They only attach to the outside of membrane samples.
- 4 Electron microscope images of membranes fractured by freezing show a large number of regularly arranged particles interrupted by larger particles.
- 5 Some membranes contain more cholesterol and unsaturated fatty acid chains than other membranes.

6 Some proteins can only be separated from the membrane by disrupting the membrane with detergent.

Which observations provide evidence for the fluid mosaic model of cell surface membranes?

A 1, 2 and 4 **B** 1, 2 and 6 **C** 3, 4 and 5 **D** 3, 5 and 6

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Most wild plants contain toxins that deter animals from eating them. A scientist discovered that a toxin produced by a certain plant was also toxic to the same plant if it were applied to the roots of the plant. To find out why the plant was not normally killed by its own toxin, he fractionated some plant cells and found that the toxin was in the fraction that contained the largest cell organelle. He also found that the toxin was no longer toxic after it was heated.

- 14 Which statements are consistent with the scientist's observations?
 - 1 The toxin is stored in the central vacuole.
 - 2 The toxin cannot cross the membrane of the organelle in which it is stored.
 - 3 The toxin is stored in chloroplast.
 - 4 The toxin is likely to be lipid-soluble.
 - 5 The toxin may be an enzyme.
 - **A** 1, 2 and 5
 - **B** 1, 4 and 5
 - **C** 2, 3 and 4
 - **D** 3, 4 and 5

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15 A certain cell surface membrane is made entirely of phospholipids and is 7 nm thick. A volume of 1 mm³ of this membrane was homogenised and dropped onto the surface of water in a large tray. The phospholipids spread out to form a continuous thin film.

What is the expected surface area of this film?

- **A** 143 000 mm² because the phospholipids formed a single layer
- **B** 143 000 mm² because the phospholipids formed a double layer
- **C** 286 000 mm² because the phospholipids formed a single layer
- **D** 286 000 mm² because the phospholipids form a double layer

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16 The diagram shows a stage micrometer scale viewed with an eyepiece graticule, using a magnification of ×200.



Using the same magnification, a chloroplast is measured as 4 eyepiece graticule divisions long.

How long is the chloroplast?

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- **17** Which of these processes allow movement in both directions across cell surface membranes?
 - a. active transport
 - b. diffusion
 - c. facilitated diffusion
 - d. osmosis

| Α | 1, 2, 3 | and 4 | в | 1 and 4 only | С | 2 and 3 only |
|---|---------|--------|---|--------------|---|--------------|
| | D | 2 only | | | | |

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18 The diagram represent a partially permeable membrane separating two solutions, **1** and **2**.

The relative diameters and concentrations of the ions and molecules in the solutions and the pore diameter of the partially permeable membrane are drawn proportionately in the diagram.



Which statement about the movement of the molecules and ions between solution **1** and solution **2** is correct?

- A Net movement of water occurs down a water potential gradient from solution 2 to solution 1, movement of glucose occurs down a diffusion gradient from solution 1 to solution 2, and no movement of sodium and chloride ions occurs across the partially permeable membrane.
- B Sodium and chloride ions pass through the partially permeable membrane equally in both directions because they are of the same concentration in solution 1 and solution 2, but glucose and water diffuse in opposite directions until concentration of solution 1 and solution 2 are equal.
- C Solution 1 has a lower water potential than solution 2 causing net movement of water from solution 2 to solution 1 until the water potentials are the same; all the solutes are too large to pass through the membrane.
- **D** The difference in water potential causes water to move by osmosis from solution **1** to

solution **2**, a diffusion gradient causes net movement of glucose from solution **1** to solution **2**, and sodium and chloride ions do not move between the two solutions

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19 The diagram below is drawn from an electron microscope of an animal cell.



Which represents the same cell, seen under a light (optical) microscope at x400 magnification?



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20 The diameter of living cells varies considerably. Typical diameters are:

| a prokaryote, such as Streptococcus | - 750 nm |
|--|----------|
| an eukaryotic cell, such as a white blood cell | - 15 µm |

Given these measurements, the diameter of the white blood cell is how many times greater than the prokaryote?

- **A** x 2
- **B** x 20
- **C** x 50
- **D** x 200

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21 Beetroot cells contain a water-soluble red pigment. Two test tubes were set up as described in the table.

| tube 1 | Pieces of washed raw beetroot in water |
|--------|--|
| tube 2 | Pieces of washed raw beetroot in water containing 3 drops of cyanide, a respiratory inhibitor. |

After 30 minutes, the water in tube 2 contained a red pigment but the water in tube 1 did not.

Which of the following statements are false for tube 2?

- I Pigment molecules passed out and were replaced by cyanide.
- II The cell membrane was unable to retain the red pigment.
- **III** Water entered the tissue by osmosis and caused the cells to burst.
- **IV** Water passed out of the cells by osmosis and carried the soluble pigment with it.
- **V** The same result will occur if ethanol was used instead of cyanide.
- A I and III only
- B III and IV only
- C II and V only
- D I, III and IV only

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22. The electron micrograph shows part of an organelle in a cell.



What describes a function of the cisternae in the organelle shown?

- A Moving protein to places where they are covered by phospholipid membranes for secretion outside the cell
- **B** Producing proteins and covering them with phospholipid membranes for secretion outside the cell
- **C** Producing proteins, covering them with phospholipid membranes and moving them for use inside the cell
- **D** Producing ribosomes and proteins and storing them in phospholipid membranes for use inside the cell

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23. Glycophorin, an integral membrane protein, has a single transmembrane α helix. Which of the following plots most likely represents glycophorin?



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- 24 Which of the following correctly describes the process of exocytosis?
 - 1 The secretory vesicle diffuses from the *trans* face of the Golgi apparatus towards the cell surface membrane.
 - 2 Secretory vesicles tend to contain small molecules that cannot pass through the hydrophobic core of the membrane.
 - 3 The membrane of the secretory vesicle fuses with the cell surface membrane, releasing the molecules into the extracellular fluid.
 - A 3 only
 - **B** 1 and 3 only
 - **C** 1 and 2 only
 - **D** All of the above

2018 / H2 / RVHS PRELIM / P1 Q2

25 The figure below shows the structure of an animal cell.



Which of the following correctly identifies the functions of the labelled structures?

| | Synthesising polypeptides from amino acids | Transporting proteins | Carrying out glycosylation | Secreting digestive enzymes |
|---|--|-----------------------|----------------------------|--------------------------------|
| Α | 2 | 1 | 4 | 3 |

| В | 1 | 4 | 2 | 3 |
|---|---|---|---|---|
| С | 2 | 3 | 4 | 1 |
| D | 1 | 3 | 2 | 4 |

2018 / H2 / TJC PRELIM / P1 Q1

Tuberculosis and candidiasis are two opportunistic infections that may develop during AIDS. Candidiasis is caused by *Candida albicans*, a yeast-like fungus that lives in human lungs. The figure below shows the structure of *Candida*.



Which of the structure(s) can also be found in the causative agent that causes tuberculosis?

- 26 A None
 - B F only
 - C F, J, K only
 - D H, J, K only

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The images below show the electron micrographs of some organelles found in eukaryotic cells.





The following statements are descriptions of membranous cell structures.

- 1 formed by a single membrane and enclosing a large fluid-filled space and regulating the osmotic pressure of the cell
- 2 formed by a single membrane and enclosing inactivated enzymes
- 3 formed by a single membrane that has flattened sacs and tubular structures interconnected throughout the cell, sometimes with a complex of nucleic acid and protein attached
- 4 formed by a single membrane that has tubular structures and containing enzymes to add carbohydrate side chains to proteins
- 5 formed by two membranes and internal membranes that contain pigments
- 6 formed by two membranes whereby the inner membrane is folded extensively
- 7 formed by two membranes, the outer membrane is continuous with another membranous organelle

Which of the following row correctly matches the descriptions of the cell structures?

| Р | Q | R | S |
|---|---|---|---|
| 5 | 3 | 6 | 1 |
| 5 | 2 | 4 | 7 |
| 6 | 4 | 5 | 3 |
| 7 | 1 | 2 | 6 |

| 2018 Eukaryotic Cell Structure and Cell Membranes MCQ ANS | | | | |
|---|--------|----------|--------|--|
| | | | | |
| Question | Answer | Question | Answer | |
| 1 | B | 21 | | |
| 2 | D | 22 | А | |
| 3 | D | 23 | D | |
| 4 | C | 24 | А | |
| 5 | B | 25 | С | |
| 6 | D | 26 | а | |
| 7 | A | 27 | С | |
| 8 | B | | | |
| 9 | D | | | |
| 10 | В | | | |
| 11 | C | | | |
| 12 | D | | | |
| 13 | A | | | |
| 14 | A | | | |
| 15 | C | | | |
| 16 | A | | | |
| 17 | A | | | |
| 18 | A | | | |
| 19 | C | | | |
| 20 | | | | |