**The cell membrane**

The drawing shows a cell.



cell membrane



nucleus





mitochondria

1. Which statement about the cell membrane is true?

|  |  |
| --- | --- |
| **A** | The cell membrane decides which substances can enter and leave a cell. |
| **B** | The cell membrane controls which substances can enter and leave a cell. |
| **C** | The cell membrane allows all substances to enter and leave a cell. |

1. How would you explain your answer to question 1?

|  |  |
| --- | --- |
| **A** | It has holes in it that all substances can move through. |
| **B** | It stores information that controls processes in the cell. |
| **C** | It has holes in it that only some substances can move through. |
| **D** | It knows which substances the cell needs. |

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cell membrane



nucleus





mitochondria

1. Which words describe the cell membrane?

|  |  |
| --- | --- |
| **A** | Fully permeable |
| **B** | Selectively permeable |
| **C** | Not permeable |

1. How would you explain your answer to question 3?

|  |  |
| --- | --- |
| **A** | It has holes in it that all substances can move through. |
| **B** | It does not let any substances move through it. |
| **C** | It has holes in it that only some substances can move through. |

*Biology > Big idea BCL: The cellular basis of life > Topic BCL1: Cells > Key concept BCL1.4: Diffusion and the cell membrane*

|  |
| --- |
| **Diagnostic question** |
| **The cell membrane** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Molecules move through the cell cytoplasm by diffusion, and some molecules can enter and leave a cell by diffusing through the cell membrane. |
| Observable learning outcome: | Use ideas about the needs and life processes of cells to explain the role of the cell membrane and why it must be selectively permeable. |
| Question type: | Two-tier multiple choice |
| Key words: | cell, membrane |

**What does the research say?**

Dreyfus and Jungwirth (1988) found that many 16-year-olds struggled to explain how cells and cell structures carry out life processes. Incorrect animistic and anthropomorphic views were commonly expressed, including the belief that cells and organelles have desires and intentions (e.g. that the cell or the cell membrane ‘knows’ or ‘decides’ to take in and discard particular substances).

Various researchers (e.g. Odom, 1995; Tomažič and Vidic, 2012; Oztas and Oztas, 2016) have described the use of a series of two-tier multiple choice questions to diagnose students’ misconceptions related to diffusion in the context of cells, including a series of questions known as the ‘Diffusion and Osmosis Diagnostic Test’ (DODT), as described by Odom and Barrow (1995).

**Ways to use this question**

Students should complete the questions individually. This could be a pencil and paper exercise, or you could use the PowerPoint presentation with an electronic voting system or mini white boards.

The answers to the questions will show you whether students understand the passive but important role of the cell membrane in controlling which substances can diffuse into and out of a cell, and the meaning of the term “selectively permeable”.

*Differentiation*

You may choose to read the questions to the class, so that everyone can focus on the science. In some situations it may be more appropriate for a teaching assistant to read for one or two students.

**Expected answers**

1. B – The cell membrane controls which substances can enter and leave a cell.
2. C – It has holes in it that only some substances can move through.
3. B – Selectively permeable
4. C – It has holes in it that only some substances can move through.

**How to respond - what next?**

If there is a range of answers, you may choose to respond through structured class discussion. Ask one student to explain why they gave the answer they did; ask another student to explain why they agree with them; ask another to explain why they disagree, and so on. This sort of discussion gives students the opportunity to explore their thinking and for you to really understand their learning needs. Responses often work best when the activities involve paired or small group discussions, which encourage social construction of new ideas through dialogue.

A number of researchers have described constructivist approaches that enable students to build their own explanations of the cell membrane and diffusion, which may help to develop students’ understanding and overcome misconceptions, including group discussion (Christianson and Fisher, 1999) and asking students to create and use models (Winterbottom, 2011).

If students have misunderstandings about the nature of the selectively permeable cell membrane, the following BEST ‘response activity’ facilitates modelling and group discussion that will enable students to work together to construct explanations, and thus could be used in follow-up to this diagnostic question:

* Response activity: What does the cell membrane look like?

**Acknowledgments**

Developed by Alistair Moore (UYSEG), adapted in part from Q12 in the ‘Diffusion and Osmosis Diagnostic Test’ (DODT) as described by Odom and Barrow (1995).

Images: cell outline – UYSEG; mitochondria – pixabay.com/argzombies (3016868); nucleus – UYSEG

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