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

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

**Overview**

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| 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. |
| Activity type: | Discussion, critiquing a representation |
| Key words: | cell, membrane |

This activity can help develop students’ understanding of the nature of the selectively permeable cell membrane through discussion of physical models. It can be used in response to the following diagnostic question:

* Diagnostic question: The 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).

A number of researchers have described constructivist approaches that enable students to build their own explanations of diffusion across the cell membrane (Christianson and Fisher, 1999). Winterbottom (2011) advocates teaching about the movement of substances across the selectively permeable cell membrane using readily available implements such as colanders and sieves as physical models, and asking students in small groups to develop a functional model of the membrane as a surface with holes in it that will allow particles to pass through.

**Ways to use this activity**

Students should complete this activity in pairs or small groups. Give each pair or group a selection of things that act as physical models of a cell membrane as a surface with holes in it. Try to provide examples of things made from different materials, some rigid and some flexible, and with a range of size of hole from tiny to very large. Some examples are given in the *Equipment* section, below, though there is considerable scope to improvise!

Ask the students in each group to critique each thing, using the following questions as prompts for discussion, if necessary.

* How closely does the model represent a cell membrane?
* In what ways is it like a cell membrane?
* In what ways is it different?
* If a cell membrane looked like that, what effect would it have on the membrane’s ability to control what can enter and leave the cell?
* How could the model be improved?

The focus of the activity should be on group discussion to reach a consensus on how closely the model resembles a selectively permeable cell membrane. It is through the discussions that students can check their understanding and develop their explanations. Listening in to the conversations of each group will often give you insights into how your students are thinking.

The quality of the discussions can be improved with a careful selection of groups; or by allocating specific roles to students in the each group. For example, you may choose to select a student with strong prior knowledge as a scribe, and forbid them from contributing any of their own answers. They may question the others and only write down what they have been told. This strategy encourages contributions from more members of each group.

After their discussions, each group should be prepared to report the key points of their discussion to another group, or to the class.

*Differentiation*

More able students could be challenged to build their own model out of Lego (or similar), as a sheet made of bricks (to represent the molecules or particles from which the membrane is made) with some bricks missing (to represent holes/channels in the membrane or spaces between the molecules through which substances can move).

**Equipment**

For each pair/group:

* a selection of things that act as physical models of a cell membrane as a surface with holes in it, such as:
  + colanders, sieves
  + filter paper
  + materials with different sized holes, e.g. muslin, dishcloth, knitted or crocheted socks or similar, a string vest or bag, etc.

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Images: strainer – pixabay.com/OpenClipart-Vectors (1300599); colander – pixabay.com/OpenClipart-Vectors (2027210)

**References**

Christianson, R. G. and Fisher, K. M. (1999). Comparison of student learning about diffusion and osmosis in constructivist and traditional classrooms. *International Journal of Science Education,* 21(6)**,** 687-698.

Dreyfus, A. and Jungwirth, E. (1988). The cell concept of 10th graders: curricular expectations and reality. *International Journal of Science Education,* 10(2)**,** 221-229.

Winterbottom, M. (2011). Transport in organisms. In Reiss, M. (ed.) *ASE Science Practice: Teaching Secondary Biology.* London, UK: Hodder Education.