What is Membrane Transport?

Worksheet

Membrane transport is how molecules cross the cell membrane, either passively down their concentration gradient (diffusion, facilitated diffusion, osmosis) or actively against their gradient using ATP energy (active transport, such as the sodium-potassium pump).

Questions

1. Which of these transport types requires ATP energy?

A) Simple diffusion
B) Osmosis
C) Active transport
D) Facilitated diffusion

2. A membrane has SA = 10 cm, C = 20 mmol/L, and d = 2 m. What is the relative diffusion rate?

A) 50
B) 100
C) 200
D) 20

3. What happens to a cell placed in a hypertonic solution?

A) It swells and bursts
B) It shrinks as water leaves by osmosis
C) Nothing changes
D) It actively pumps out ions only

4. Which best describes facilitated diffusion?

A) Requires ATP and moves against the gradient
B) Uses a membrane protein channel but still moves down the gradient
C) Only occurs in plant cells
D) Involves engulfing large particles

5. A cell membrane has a surface area of 20 cm, a concentration difference of 15 mmol/L across it, and a thickness of 2 m. Find the relative diffusion rate.

6. A red blood cell is placed in a hypertonic solution (higher solute concentration outside than inside). Predict what happens to the cell and name the process.

7. A nerve cell uses the sodium-potassium pump to move 3 Na ions out and 2 K ions in per cycle, against their concentration gradients. Which type of transport is this, and what powers it?

8. Define: What is diffusion?

9. Define: What is osmosis?

10. Define: What is facilitated diffusion?

Answer Key

1. C) Active transport - Active transport moves substances against their concentration gradient, which always requires ATP.

2. B) 100 - Rate = (SA C)/d = (10 20)/2 = 200/2 = 100.

3. B) It shrinks as water leaves by osmosis - In a hypertonic solution, water leaves the cell by osmosis, causing it to shrink (crenate).

4. B) Uses a membrane protein channel but still moves down the gradient - Facilitated diffusion uses protein channels to help molecules cross the membrane, but it is still passive, moving down the gradient.

5. Use Rate = (SA C) / d. Rate = (20 15) / 2 Rate = 300 / 2 = 150 relative units.

6. Water moves by osmosis, from an area of high water concentration to low water concentration. Inside the cell there is more water (less solute) than outside, so water flows out of the cell. The cell loses water and shrinks - this is called crenation.

7. Both ions move against their concentration gradients (Na out despite being more concentrated outside already growing, K in despite being more concentrated inside), so this is active transport. Moving substances against a gradient always requires energy. The energy is supplied by ATP hydrolysis, which is why it is called the sodium-potassium ATPase pump.

8. The passive movement of particles from an area of high concentration to an area of low concentration.

9. The passive diffusion of water across a selectively permeable membrane, from high to low water concentration.

10. Passive transport of molecules through a membrane protein channel, still moving down the concentration gradient, no ATP needed.