

Biology Section 3.1: Movement of Molecules Into and Out of Cells

Osmosis

- That osmosis is the movement of water molecules across a partially permeable membrane from a region of high concentration to a region of low concentration.
 - How differences in the concentration of water molecules inside and outside of a cell will cause water molecules to move into or out of the cell by osmosis.
 - That if the balance between the water and ion content of the body is wrong it could damage cells or mean they don't work as well, so water and ions must be replaced in the body.
 - That a sports drink contains water and ions (to restore those lost in sweat) and sugar (to replace the sugar used up by the muscles during exercise).
 - How to evaluate claims made about the effectiveness of sports drinks.
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Active Transport

- That active transport is the movement of particles against a concentration gradient (i.e. from an area of low concentration to an area of high concentration) using energy released during respiration.
 - That active transport allows cells to absorb ions from very dilute solutions.
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Gas and Solute Exchange

- That dissolved substances move by diffusion and active transport, and that water moves by osmosis.
 - How exchange surfaces are adapted for exchanging materials — they're thin (so substances only have a short distance to diffuse), they have a large surface area (so lots of a substance can diffuse at once), they have lots of blood vessels (in animals, to get stuff in and out of the blood quickly), they're often ventilated (for gas exchange in animals).
 - That exchanging materials with the environment is more difficult in larger, more complex organisms than in simpler organisms — so complex organisms often need a specialised organ system for exchange.
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Exchange in Humans

- That alveoli (tiny air sacs) increase the surface area of the lungs in humans, maximising the diffusion of oxygen into the blood and carbon dioxide out of the blood.
 - That villi increase the surface area of the small intestine in humans, aiding the absorption of nutrients (by active transport and diffusion) into the blood.
 - That villi also contain a network of capillaries to aid the absorption of nutrients (by active transport and diffusion) into the blood.
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The Breathing System

- That the function of the breathing system is to get air into and out of the lungs for gas exchange.
- That the lungs are found in the thorax (the top part of your body), which is separated from the abdomen (the lower part of your body) by a muscle called the diaphragm.
- That the ribcage protects the lungs.
- That ventilation is the movement of air into and out of the lungs.
- That to breathe in, the intercostal muscles and diaphragm contract, causing the volume of the thorax to increase. This decreases the pressure in the thorax, drawing air into the lungs.
- That to breathe out, the intercostal muscles and diaphragm relax causing the volume of the thorax to decrease. This increases the pressure in the thorax, forcing air out of the lungs.
- How to evaluate the development and use of artificial ventilators, such as the 'iron lung' (which worked by pumping air in and out of a case into which the patient was sealed) and the more modern ventilator (which works by pumping air into a patient's lungs).

Exchange in Plants

- That carbon dioxide diffuses into a plant leaf from the air through the stomata (tiny holes on the underside of the leaf).
- That the flattened shape of the leaf and the internal air spaces between cells increase the surface area of the leaf for gas exchange.
- That plants lose most of their water through the stomata.
- That if a plant loses water from its leaves faster than it can be replaced by the roots, the stomata can be closed by the guard cells.
- That closing the stomata helps to stop a plant losing so much water that it wilts (droops).
- That guard cells surround stomata and control their size.
- That evaporation is quickest in hot, dry windy conditions.
- How to evaluate the environmental conditions that affect water loss in plants.
- That root hair cells on the surface of plant roots stick out into the soil and increase the surface area of the roots for the absorption of water and mineral ions.