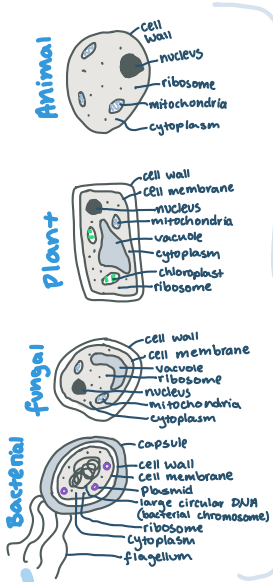
Cell Biology

Cell Structure

Cell Ultrastructure	All the parts that make up a cell.
Cell wall	Provides structure to a cell and helps it keep its shape.
Cell membrane	Controls what enters and exits a cell (is selectively permeable).
Selectively permeable	only certain molecules can pass through.
Chloroplast	Where photosynthesis occurs
Cytoplasm	Site of many chemical reactions.
Nucleus	contains DNA controls cell activities.
Ribosome	Site of protein synthesis.
Mitochondria	site of aerobic respiration.
Organelle	Any part of a cell.
Cellulose	chemical that makes up plant walls.
Vacuole	contains cell sap.
Plasmid	circular ring of DNA found in bacteria cells.

Cell Structure diagrams

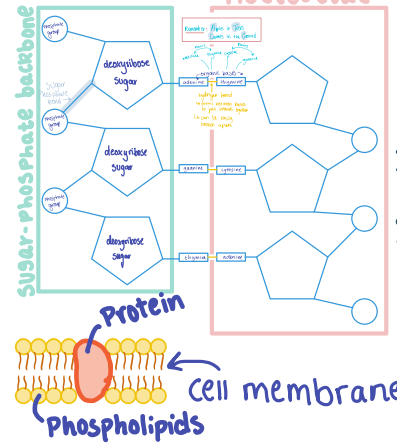


DNA & the production of proteins

DNA = Deoxyribonucleic acid
- double helix shaped
- DNA is a double-stranded helix held by complementary base pairs
- located in the NUCLEUS
- contains all the genetic material an organism will ever need
- Chromosomes are made from very long and tightly coiled DNA

Proteins are made from amino acids. The shape of a protein depends on the sequence of amino acids, which depends on the sequence of bases in DNA.

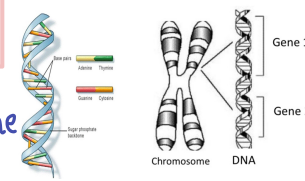
A gene = a section of DNA that codes for a protein



mRNA (messenger RNA)
- Single stranded
- smaller
- Contains ribose sugar
- doesn't have base pairs, has nucleotides
- the organic base Thymine (T) is replaced with Uracil (U)

Protein production takes place in 2 stages:

1. A complementary copy of a gene is made in the nucleus, this is mRNA. (transcription)
2. mRNA travels to the ribosome to determine the order of amino acids, which then form a protein. (translation)



CELL TRANSPORT

Passive transport: movement of molecules that doesn't require energy
- OSMOSIS
- diffusion
- from high to low (along the concentration gradient)

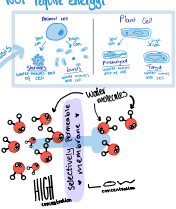
Active transport: movement of ions + molecules that requires energy
- requires ATP
- from low to high
- against the concentration gradient

diffusion

Diffusion is the movement of molecules, down a concentration gradient, from an area of HIGH concentration to an area of LOW concentration.

It is called passive transport and DOES NOT require energy!

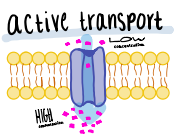
OSMOSIS



OSMOSIS is the movement of water molecules from an area of HIGH water concentration to an area of LOW water concentration through a selectively permeable membrane.

This is an example of passive transport and doesn't require energy!

active transport



Active transport uses Protein molecules to move molecules or ions from an area of LOW concentration to an area of HIGH concentration AGAINST THE CONCENTRATION GRADIENT!

It requires energy to do this!

Genetic engineering

genetic engineering is the Process of removing genetic information from one organism and inserting it into another.

Genetic information (genes) can be transferred from one cell to another by **genetic engineering**. This means that organisms like bacteria can be altered so that they **make proteins from other organisms**, such as humans.

- The process usually involves ***bacterial cells*** as it is easier to alter their genetic material.
- Genetic engineering is useful for ***making medicines like insulin.***

Genetic engineering is carried out in a scientific laboratory. The process has a sequence of steps.

Step 1
Identify the section of DNA that contains the required gene from the source chromosome.

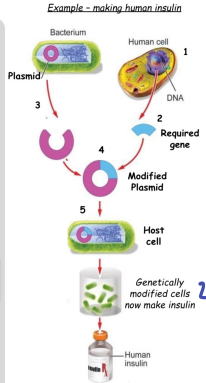
Step 2
Extract the required gene using enzymes.

Step 3
Extract plasmid from bacterial cell.

Step 4
Insert required gene into bacterial plasmid and seal using enzymes.

Step 5
Insert plasmid into host bacterial cell to produce a genetically modified organism.

Example - making human insulin



Remember!
Enzymes *are needed to cut out the genes and plasmid and to seal them into the plasmid*

PROTEINS

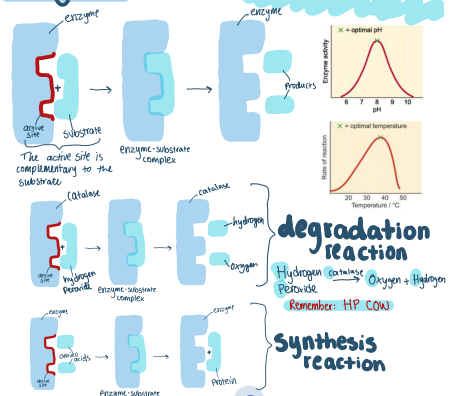
catalyst: something that speeds up a chemical reaction without being changed / used up itself.

enzyme: biological catalysts made by all living cells.

TYPES OF PROTEINS

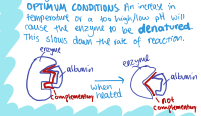
Remember: SHARE!
- Structural
- Hormonal
- Antibodies
- Receptors
- Enzymes

Enzymes



OPTIMAL CONDITIONS

Enzymes are most active at their OPTIMUM CONDITIONS. For instance, pH will cause the enzyme to be denatured. This slows down the rate of reaction.



Respiration

Respiration is a series of chemical reactions that convert energy from glucose to ATP.

word equation: Glucose + oxygen → Energy + water + CO_2

cellular activities requiring ATP
- Mitosis
- Muscle contraction
- Active transport
- Nerve impulse transmissions
- Protein synthesis

Remember: Mr Meikle Always Needs Peanut butter

Aerobic respiration

occurs only when oxygen is available

Stage 1: glycolysis (splitting glucose)

Glucose → Pyruvate
- occurs in cytoplasm
- 6 carbon glucose is broken down into 3 carbon pyruvate
- produces 2 ATP molecules
- does not require oxygen

2 ATP

Pyruvate + O_2 required → $CO_2 + H_2O$ + 36 ATP

Stage 2: aerobic respiration path
- takes place in mitochondria
- pyruvate is broken down into CO_2 and water
- this occurs as a series of enzyme controlled reactions
- Produces many ATP (36)

Fermentation

occurs when oxygen levels are poor and exercising vigorously

Glucose → Lactate + ATP (word equation)

Stage 1: glycolysis (splitting glucose)

Glucose → Pyruvate
- occurs in cytoplasm
- 6 carbon glucose is broken down into 3 carbon pyruvate
- produces 2 ATP molecules
- does not require oxygen

2 ATP

Pyruvate → Lactate
- O_2 debt builds up

Stage 2:
- occurs in cytoplasm
- pyruvate broken into lactate. No ATP produced
- lactate build up reduces efficiency and causes muscle fatigue.

When O_2 becomes available again, the O_2 debt can be repaid and lactate is converted back into pyruvate so aerobic respiration can take place.

Stage 2 in animal cells is REVERSIBLE!

Plants

occurs when: root cells are waterlogged (roots cells are used to make word equation) Glucose → CO_2 + Ethanol + ATP

Stage 1: glycolysis (splitting glucose)

Glucose → Pyruvate
- occurs in cytoplasm
- 6 carbon glucose is broken down into 3 carbon pyruvate
- produces 2 ATP molecules
- does not require oxygen

2 ATP

Pyruvate → Ethanol + CO_2

Stage 2:
- occurs in the cytoplasm
- pyruvate converted into ethanol + CO_2
- Lasts ATP produced
- CO_2 is toxic to the environment during this process

It is not possible to reform pyruvate if oxygen becomes available. This type of fermentation is NOT REVERSIBLE!