

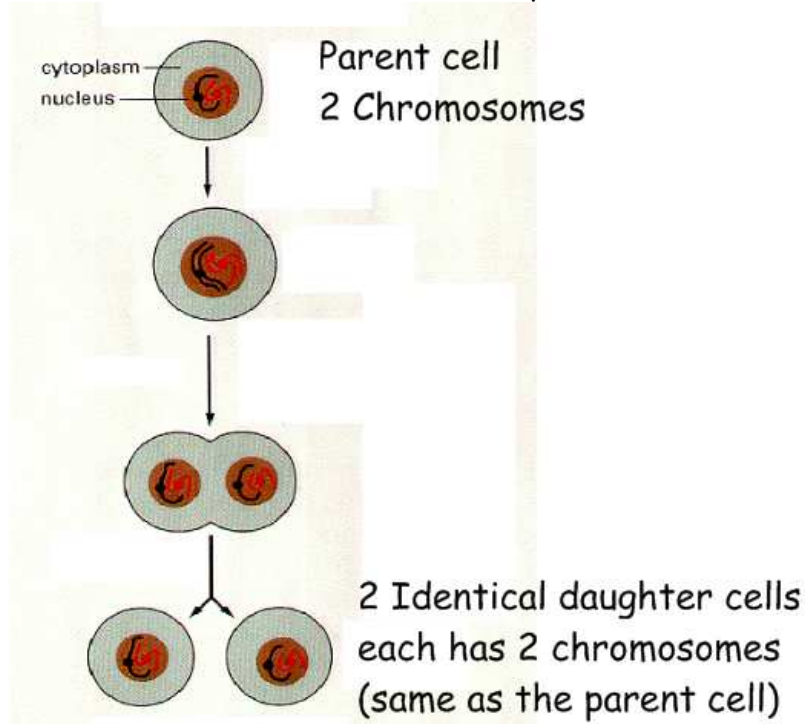
National 4 Biology
Unit 1 summary notes

Cell division and its role in growth and repair.

In order to make more new cells cell division must take place.

New cells are needed in plants and in animals so that they can grow and so that they can repair themselves if they are damaged (for example cuts to skin or broken bones).

During cell division 1 parent cell divides to produce 2 identical cells. Each of the new 'daughter' cells is identical to the parent, and has exactly the same number of chromosomes as each other and as the parent.



Sometimes cell division becomes uncontrolled in parts of the body. This means that cells continuously divide over and over again and the body can not stop cell division in the ways it usually does. When this happens it causes cancer.

DNA, genes and chromosomes

Chromosomes are found in the nucleus of all cells.

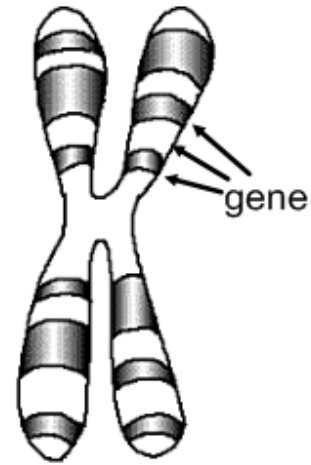
Chromosomes are made from DNA.

DNA is wrapped up and tightly organised into chromosomes so that it doesn't get tangled or muddled in the nucleus.

DNA is a code which gives living things the instructions they need to make protein.

Proteins are very important biological molecules which help control lots of different reactions and processes which take place.

Chromosomes can be split up into bands called genes. Each gene has the code with the instructions to make a protein.



Chromosome

Therapeutic use of cells

Bacteria can be re-programmed with human DNA so that they have the code which allows them to make human proteins. This is called genetic engineering. It is useful as some humans have conditions which are caused because their bodies can not make certain proteins. An example of this is the condition diabetes, which happens when people can't make their own insulin. In the past, insulin from the pancreas of pigs was used to treat people with diabetes, but there were problems with getting enough insulin and also some people were allergic to pig insulin. Because bacteria can be grown in the lab easily there are no problems in getting enough insulin to treat everyone. Also, when bacteria are programmed to make insulin they are given the instructions to make **human** insulin. This means that there are no issues with allergies. In genetic engineering, the insulin gene is firstly removed from a human cell. A plasmid (a circular piece of DNA) is then removed from a bacteria and the human insulin gene is inserted into the plasmid. The plasmid is put back into the bacteria which are grown and reproduce in the lab. The bacteria produce lots of insulin, which is finally separated from the bacteria before being used.

Stem cells could also be used to save lives by growing replacement organs or testing drugs, however this is not natural and there may be safety concerns.

Properties of enzymes and use in industries

Enzymes are chemicals made by and found in all living cells.

They speed up chemical reactions in cells

They can be re-used over and over again because they are unchanged in the reactions they speed up.

Enzymes are specific, this means that each enzyme only takes part in one type of reaction, they can only work with one substrate molecule.

Enzymes work in 2 types of reaction, they can **build-up** large molecules from lots of small ones, or they can **break-down** small molecules from one big molecule.

Enzymes are important in many biotechnological industries. e.g. they are used in cheese production.

Properties of microorganisms and use in industries

Microorganisms are cells which live as unicellular organisms, i.e. cells that exist on their own. They are useful because;

- They grow (divide) quickly so there can be big large numbers produced in a short period of time.
- They also feed from a variety of different food sources and produce a lot of different products.

Yeast cells are useful because they produce alcohol when they are kept in conditions with no oxygen (for more information look at the section on respiration). Yeast is used in the production of beer, wine and many other types of alcoholic drink. Yeast is also used in baking because it produces carbon dioxide which helps dough rise for bread and pizza.

Bacteria also help in many different processes. Bacteria are used to turn milk into yoghurt and to help turn milk into cheese. Bacteria can also be used in the production of biofuels.

Photosynthesis

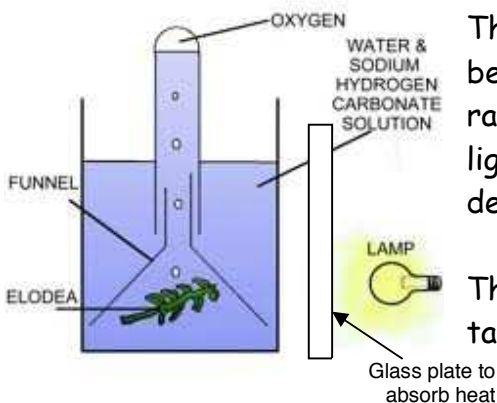
Photosynthesis is the process that cells in green plants carry out to use the light energy from the sun to **make food**.

Photosynthesis relies on the correct conditions being present in the environment, and will happen more quickly if the conditions are correct.

The environmental factors which affect the speed of photosynthesis are the availability of;

- light
- water
- carbon dioxide
- a suitable temperature

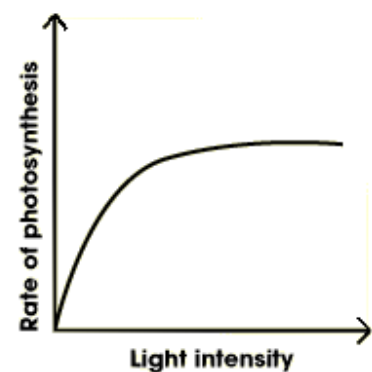
Farmers need to try and balance the cost of providing the ideal conditions (e.g. heating) with the profit they will make from the crops they produce in order to make the best crop possible without spending more money than they will earn from selling the crop.



This diagram shows an example of an experiment that can be used to measure the effect of light intensity on the rate of photosynthesis. The light is moved to change the light intensity and the number of bubbles are counted to determine the rate of photosynthesis.

The more bubbles produced, the more photosynthesis is taking place.

The graph shows the results of the experiment. At the start as the light intensity goes up so does the rate so this means that light intensity is the limiting factor. The graph then levels off, so even though the light is increasing there is no increase in photosynthesis. This means that one of the other limiting factors are now limiting the rate of photosynthesis.



Factors affecting respiration

Respiration is a process carried out by all cells **to release energy**.

Respiration usually happens when there is oxygen present, however it can also take place if there is no oxygen.

If there is **oxygen available** then cells change glucose into carbon dioxide, water and a lot of energy.



If there is **no oxygen** available then the products are different depending on the type of cell.

Animal cells

In animal cells if there is no oxygen present then Glucose is changed into lactic acid (which causes muscle cramps in humans) and a little bit of energy.



Plant and Yeast cells

In plant cells if there is no oxygen present then Glucose is changed into alcohol and carbon dioxide and a little bit of energy



This is how alcohol is produced for industrial processes like brewing.

There is a lot more energy produced when oxygen is present than there is if there is no oxygen.

Respiration is controlled by enzymes.