All living things share the characteristics described in MRS C GREN

Biology is the study of living things. A living object is an object that carries out life functions. A non-living object is an object that has not been alive. A dead object is an object that was once alive.
All living organisms are composed of one or more cells. A cell is a small, living unit that contains all the chemicals and molecules that help support an organism's life.

Classifying objects as living or non-living

How would we know if a car or cow is living? They both move and need "feeding" to keep them going. So why is only the cow living?

All living things share the characteristics described in MRS C GREN

We use the acronym MRS C GREN to remind us living objects show ALL of the life processes, not just some, and are made up of CELLS.

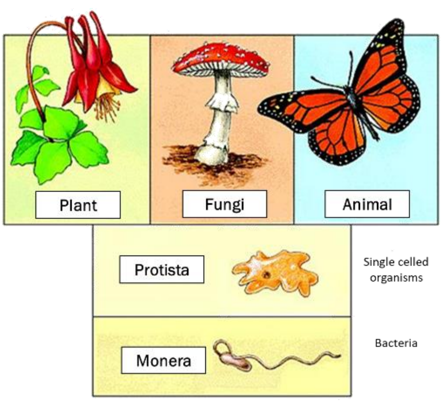
| Life function | Gives us the ability to.... |
|---|---|
| Movement | Move through space |
| Respiration | Obtain energy through reactions in cells |
| Sensitivity | Respond to the outside environment |
| Cells | Smallest unit of life – makes up the bodies of bigger organisms |
| Growth | Increase in size |
| Reproduction | Create more living things |
| Excretion | Dispose of waste chemicals |
| Nutrition | Extract useful chemicals from the environment |

Living things are classified into groups based on similarities / features

Biologists classify all living things into overall groups, called Kingdoms. The members of each kingdom are alike in key ways, such as the nature of their cells, their body features or the way they obtain energy. Classification keys are used to identify living things (and other objects) in each group.

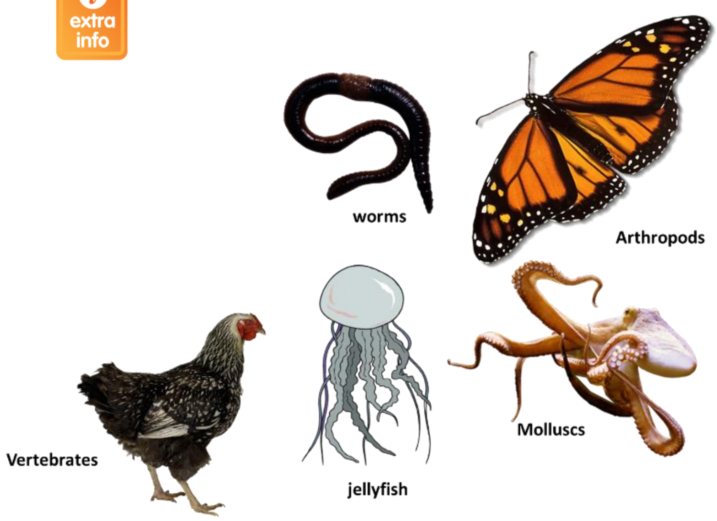
The main groups that living things are classified into; Bacteria (Monera), Protista, Animals, Plants, Fungi

Traditional classification of organisms into five kingdoms is based on differences in body structure



Vertebrates and Invertebrates

The Kingdoms have been broken down into smaller groups called Phylum. Most of the groups are invertebrates – they have no internal spine or backbone and they include the sponges, Jellyfish, worms, molluscs, Arthropods (Insects/spiders/crustaceans). One group is the Vertebrates (all animals with backbones) which we are part of.

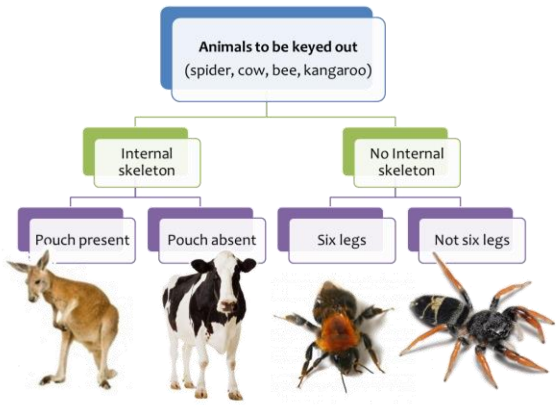



What is a dichotomous identification key?

The Dichotomous keys are used as tools to help identify unknown organisms using careful observations and matching those observations in an organised manner against choices given at each step. Each two choices are known as a couplet. Dichotomous means branched.

*Rules for Using Dichotomous Keys:*

1. Read both choices in a couplet (pair) carefully.
2. When reading a couplet, make sure you understand all of the terms used.
3. If you are unsure of which choice to make in a couplet, follow both forks (one at a time). After working through a couple of more couplets, it may become apparent that one fork does not fit your sample at all.
4. Work with more than one sample if possible. This will allow you to compare.
5. When a measurement is given make sure that you take the measurement and do not take a guess.



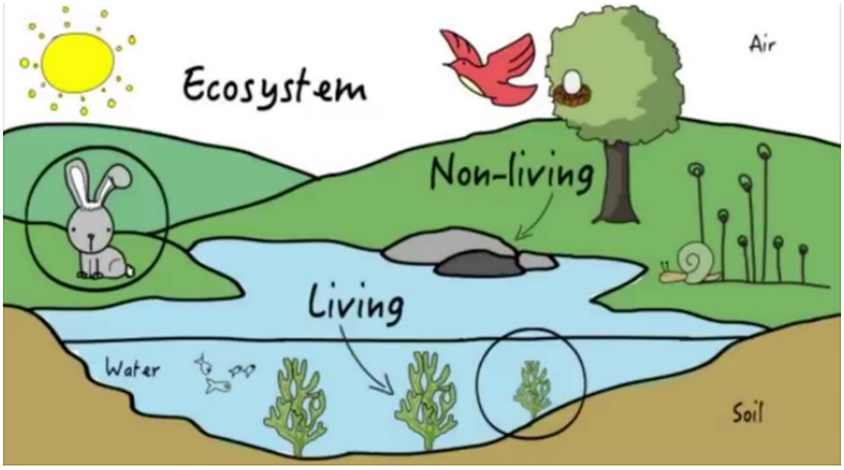

Making a simple dichotomous identification key.

If we are making a key based on observations of physical features that we can see, the first step must be a feature that can divide all of the living organisms into two groups.

For example below, we could divide the birds into those that have tuffs of feathers on their heads (spotted shag and crested penguin) and those that do not (wax-eye, brown kiwi, paradise duck, kingfisher, yellow head, spotted dotterel). Other features such as thickness of beak, tail or not, one colour or many colours – can be used to further divide each bird group.


The key is finished when each individual has its own path and the key leads to a name for each.

An ecosystem is the habitat and the community considered together.




An ecosystem includes all of the living organisms in a specific area. These systems consist of a living part called the community made up of all the plants and animals, which interact with their non-living environments (weather, Earth, Sun, soil, atmosphere) which determine the habitats available.

The niche is the way in which an organism interacts with its environment including its feeding role, type of activity and habitat

The niche of a species describes how members "make a living" in the environment in which they are found. Describing the niche of a species would include:

- ❑ The habitat, which means where the species lives, feeds and reproduces.
- ❑ When the organism is active (day or night)
- ❑ The feeding role that the species has in the community. (producer, consumer or decomposer)
- ❑ The adaptations the organism has to best survive.

Habitat examples

A NZ Keas habitat is in South Island alpine regions

Emperor penguins found only in the Antarctic polar region

All birds form a separate group of animals that evolved from the same ancestor. Bird species are found all across the world in many different habitats. Diversity in a bird adaptations help each type of species survive in different habitats.

Adaptations assist an organism to survive in an ecosystem

An adaptation is a feature of an organism that aids the survival and reproduction of individuals of that species in its environment.

*Whio (Blue Duck) live in rivers or streams that are:*
- *fast-flowing*
- *surrounded by trees*
- *rocky-bottomed and clean and clear (not polluted!!)*

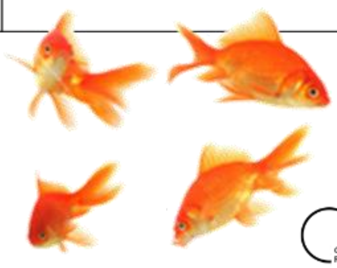

**Whio adaptations to its environment:** The whio has large, webbed feet to give it power in fast-flowing water, and well-developed claws for rough terrain to hold on tight to rocks.
The whio has a tough rubbery tip to its beak to push between rocks and find aquatic invertebrates (water insects)

Adaptations are genetically inherited traits that allow species to survive better in their habitat

Adaptations can be classified into three main group. Structural adaptations are often seen as physical characteristics but all three types are genetically inherited and controlled by genes.

| Structural | Physiological | Behavioural |
|---|---|---|
| A structure/physical feature of an organism that helps it to successfully live in it's habitat.<br><br>e.g.: the long beak of a kiwi to get food in the soft forest ground | A chemical or process inside an organism that helps it survive.<br><br>e.g.: bad tasting chemicals inside beetles to stop being eaten | An activity that an organism does that helps it (or its group) to survive.<br><br>e.g.: fish swimming in groups for safety |





Organisms vary and that some variations give advantages over others in a given environment

Individuals of a species occupy a niche and they have adaptations to survive in their habitats. The adaptations may help them to best obtain food, seek mates, raise offspring, find shelter or escape predators.

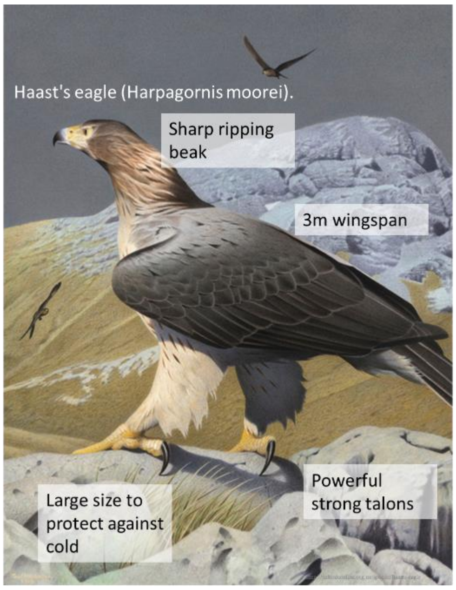

Adaptations are physical characteristics (phenotypes) an organism can genetically pass onto their offspring. Because there is variation between individuals of a species, some individuals may have an advantage over others when one or more of their adaptations is better suited for survival in their habitat.

Predator and Prey Adaptations

Predators hunt, catch and eat other animals. The animals they hunt are known as prey. Many animals can also be both – the predator of one type of animal but the prey for another species. Both predator and prey have evolved adaptations to help them survive in their habitat. The predator species has adaptations to help it better catch prey, and the prey species has adaptations to help it better avoid being eaten. The best hunters and the best escapers go on to have the most offspring.

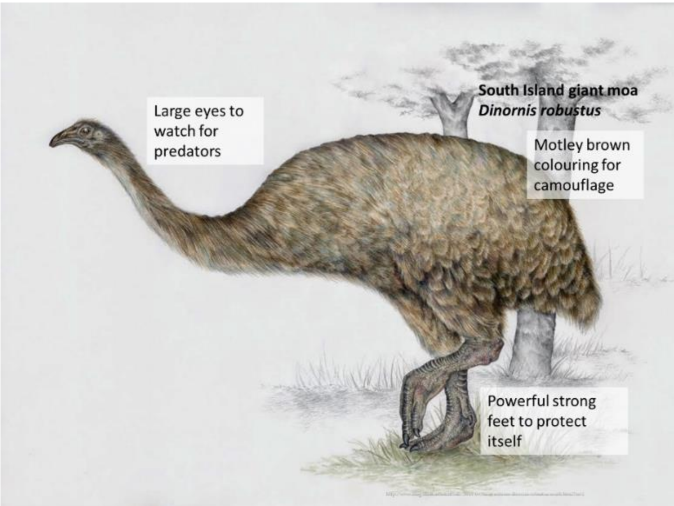
In New Zealand in the past, we did not have any Mammal predators but we did have a very large predator bird called the Haast's eagle. Sadly, this giant eagle is now extinct, and we are not entirely sure what colour the feathers were but the bird was a terrifying sight for species of Moa (also extinct) that was its prey.

Predator adaptations - Haast's eagle




Haast's eagle is the largest, heaviest eagle species that has ever lived, weighing up to 18 kg and had a wingspan up to 3 metres. The Eagle was the predator of moa such as the South Island giant moa that was nearly 4 m and over 10 times the eagle's weight. The Eagle dived on its moa prey from a high spot and killed moa by flying into their hindquarters and grappling the moa with its large feet and talons, which were stronger than a tigers, before crushing the Moa's skull. Haast's eagle became extinct 500-600 years ago, around the same time that New Zealand's moa species, its food sources, became extinct.

Prey adaptations - South Island Giant Moa



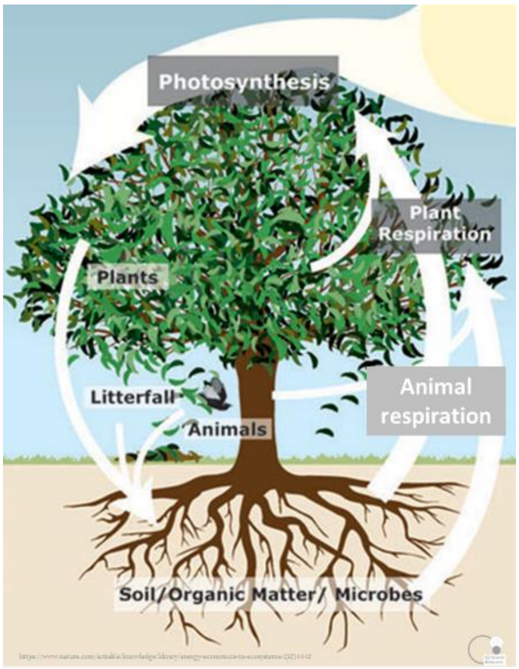

The South Island Giant Moa was a main prey species for Haast's Eagle. It was a herbivore, browsing and eating small shrubs, plants and berries. The Eagle needed light to hunt so the moa may have done much of its eating early morning or dusk when it was darker. The large feet could help defend it and long legs to help it run for cover. It also had a very good sense of smell.

Plants fill the role of Producers in a community

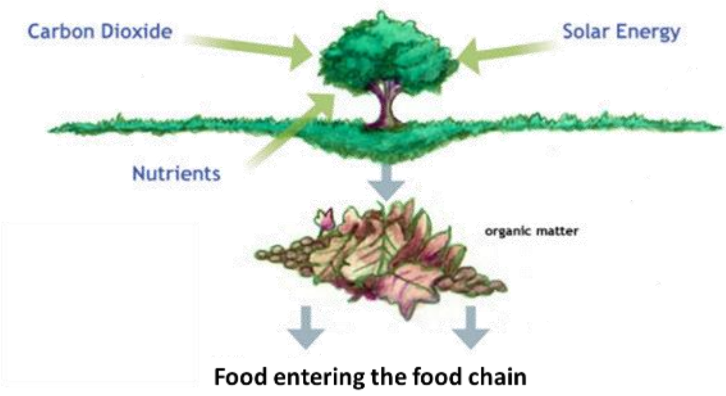
Plants are special because they have leaves and are able to produce their own food by the process of photosynthesis from sunlight using raw materials that they get from the air and soil.

Plants can be thought of as 'food factories' which provide most living organisms on Earth with a source of energy and food. They produce the energy that is at the start of any food chain and therefore the group of plants are known as Producers.

Community – a group of different species living together and interacting



The importance of plants as producers.

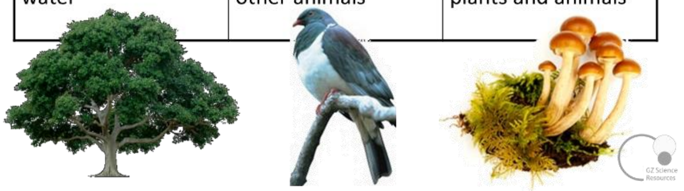



Producers are at the beginning of a food chain. On land, Producers are plants. Plants are at the beginning of every food chain that involves the Sun. All energy comes from the Sun and plants make food with that energy using the process of photosynthesis. Energy in the form of nutrients and food are passed onto other organisms when they eat (consume) the plants.

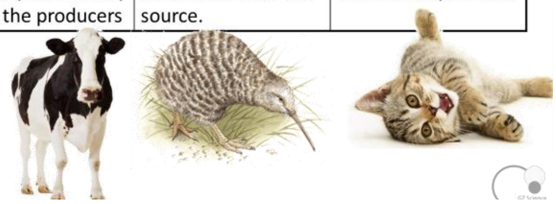
The role of producers, consumers and decomposers in food chains and webs.

Three feeding roles that species can have in a community are as producers, consumers or decomposers.

| Producers | Consumers | Decomposers |
| --- | --- | --- |
| Plants that make food from carbon dioxide, light and water | Herbivores that eat plants and carnivores that eat other animals | Fungi and bacteria that break down the bodies of dead plants and animals |

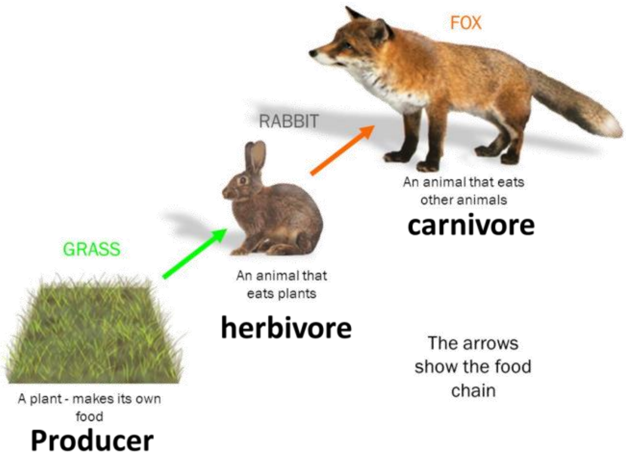


| Herbivores | Omnivores | Carnivores |
| --- | --- | --- |
| Herbivores are animals that eat plants only. (plant eaters) In a food web they are directly above the producers | Omnivores eat both plants and other consumers. They obtain their food from more than one source. | Carnivores eat only other consumers (meat eaters). This also includes birds that eat only insects. |



The role of producers in food chains.

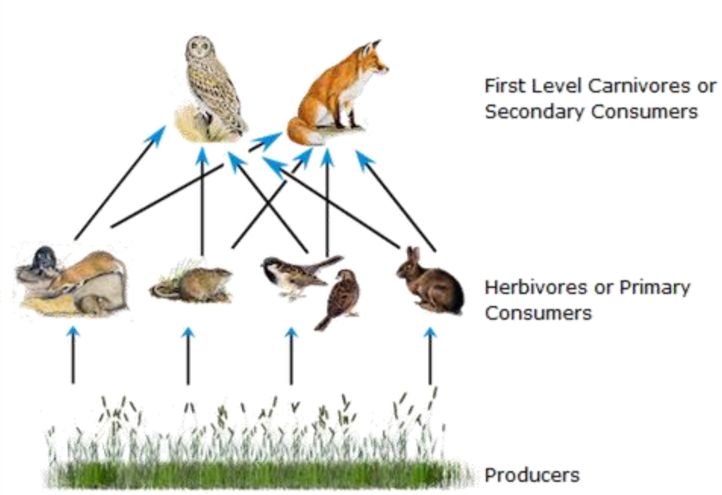
A food chain is a series of organisms through which energy flows; first link is always a producer, such as a plant. The producer stores energy from the Sun through the process of photosynthesis. Each organism above the producer eats the one below it in the chain. Energy flows in one direction only.




Food Webs

In an ecosystem, there are many different food chains and many of these are cross-linked to form a food web. Ultimately, all plants and animals in an ecosystem are part of this complex food web.

If one species in the food web changes in numbers, it will affect all other species in the food web. For example, if all the rabbits were removed the predators would need to start eating more of the birds, mice and rats. The grass that the rabbits ate would increase and feed more of the other herbivores.




Energy enters an ecosystem in sunlight, which is transferred to energy in plants by photosynthesis and that energy is then passed along food chains.

Trophic levels are the feeding positions in a food chain such as primary producers, herbivore, primary carnivore, etc. Green plants and phytoplankton form the first trophic level, the producers. Herbivores form the second trophic level, while carnivores form the third and even the fourth trophic levels, all called the consumers.

Energy is passed from one trophic level to another starting from the producers. Food webs and food chains are used to show which species of organism is at each level and how energy moves between them.

The structure and functions of the plant

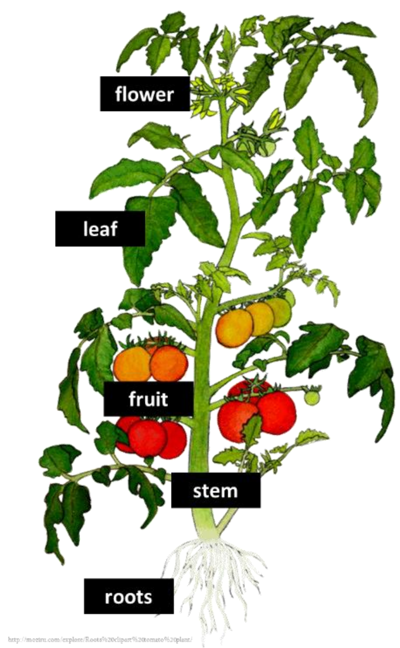
Many parts of the plant are involved with the process of photosynthesis, either by helping collect the substances needed (roots, stem, leaves), storing products formed (roots, stem) or providing a place for the process to take place (leaf cells).

The Shoot System - Above ground (usually)

Lifts the plant above the soil. Main functions include:
- Leaves - photosynthesis
- Flowers - reproduction
- Fruit – seed dispersal
- Stem - food and water transport

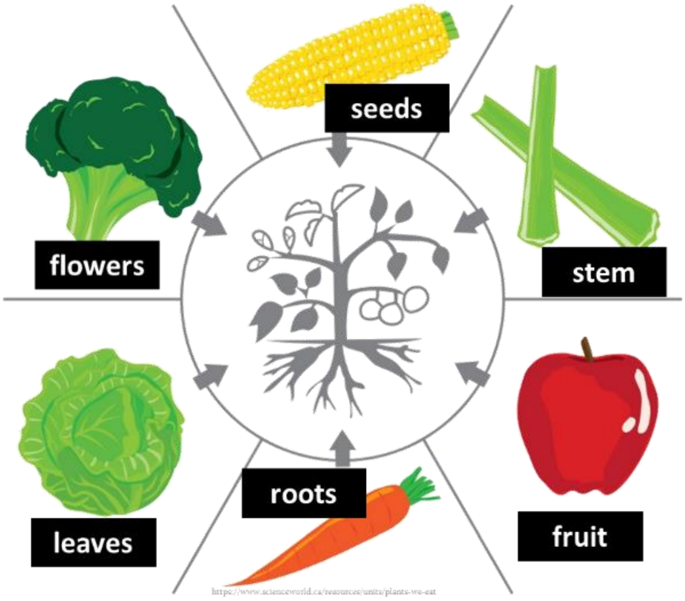
The Root System - Underground (usually)

Anchor the plant in the soil. Main functions include:
- Absorb water and nutrients
- Transport water and nutrients
- Food Storage




Parts of a plant we eat

We use many types of plants for food. The fruit and vegetables that we eat, and grow for eating, come from various parts of the plant. We often breed types of plant for food by exaggerating a part of a plant, such as flowers of the plant to grow broccoli, to make better use of them.




The significance of photosynthesis in making food

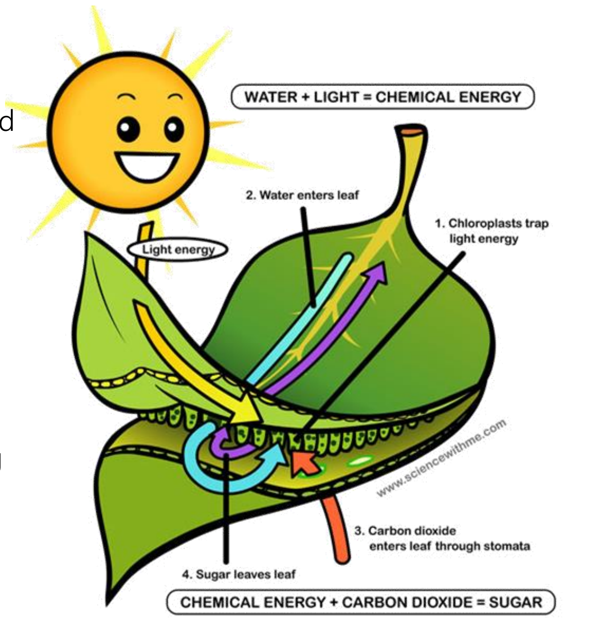
Most living organisms depend on plants to survive. Plants convert (change) energy from sunlight into food stored as carbohydrates through photosynthesis. Because animals cannot make their own food, they must eat plants (producers) to gain nutrition. Plants produce oxygen, which is released during photosynthesis, which all organisms need for respiration.

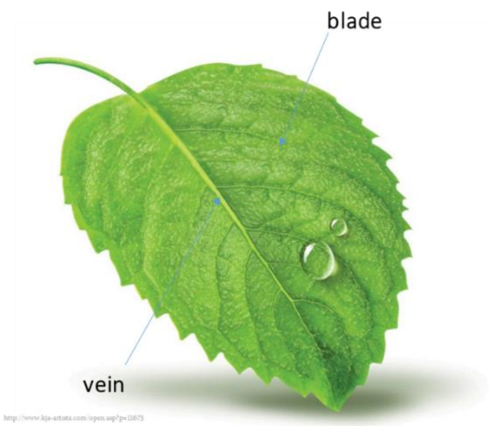
Photosynthesis transfers energy from sunlight into energy in chemicals such as glucose and starch.

Light enters the leaf and is trapped by a green substance called chlorophyll contained within structures called the chloroplasts in the cells.

Water is transported via water tube cells called xylem, to the leaf cell and the carbon dioxide enters through the stomata and diffuses (spreads) to the leaf cells.

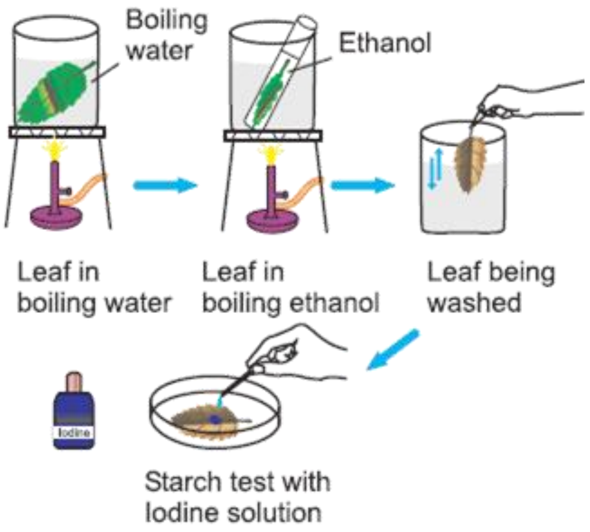
These substances react chemically within the chloroplasts; powered by the light then glucose (a sugar) is produced along with oxygen, which diffuses out. The sugar leaves the leaf via sugar/food tube cells.




The leaf is the location of most photosynthesis

The flat surface of the leaf called the blade helps capture maximum sunlight for photosynthesis. The leaf is attached by a stem to the plant, which branch out into veins. The large surface area of the leaf helps capture as much sunlight as possible. The green colour is due to chlorophyll in the leaf cells that captures the light, and where photosynthesis takes place. The leaf is thin to allow light (and carbon dioxide gas from the air) to circulate to every cell in the leaf.




Starch test

A positive test for starch is the leaf turning blue- black when iodine is added. The starch is the storage product of the plant when it produces photosynthesis. A positive test means photosynthesis has occurred.

Step 1. The leaf is boiled in water to soften it.

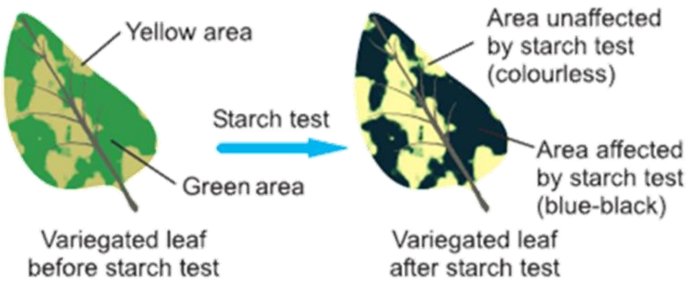
Step 2. The leaf is then placed into a boiling tube of ethanol, which is placed in a beaker of water and heated gently. This will remove the green chlorophyll.

Step 3. The leaf is washed in water to remove all of the ethanol.

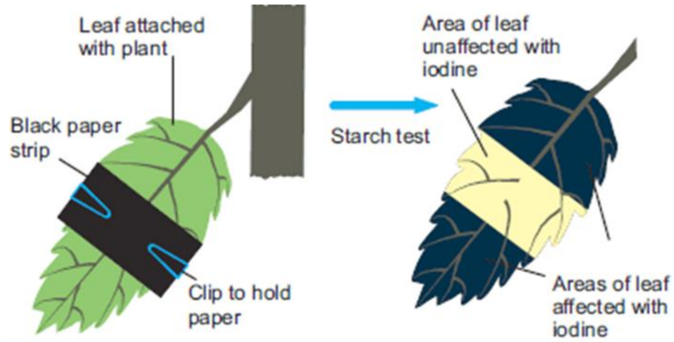
Step 4. Iodine added to the leaf. It will turn blue-black in the presence of starch. The starch indicates photosynthesis and the production of glucose has occurred.

Investigations into photosynthesis requirements

We can investigate that photosynthesis happens in the chloroplasts/chlorophyll in the leaf cells and use the starch test as evidence. When a plant undergoes photosynthesis, it produces glucose, which is converted into starch for storage. If we want to investigate what factors are required for photosynthesis we use the starch test to enable us to reach a conclusion. Factors include chlorophyll, water, carbon dioxide and light present.




Investigating if Chlorophyll is required for photosynthesis:
Select a leaf that is variegated leaf. The green parts contain chlorophyll and the white parts do not. To show chlorophyll is required for photosynthesis only the previous green areas will turn **blue - black**.




Investigating if light is required for photosynthesis:
Place a piece of black paper over a leaf and leave for a few days still on the plant. To show light is required for photosynthesis only the uncovered areas will turn **blue - black**.

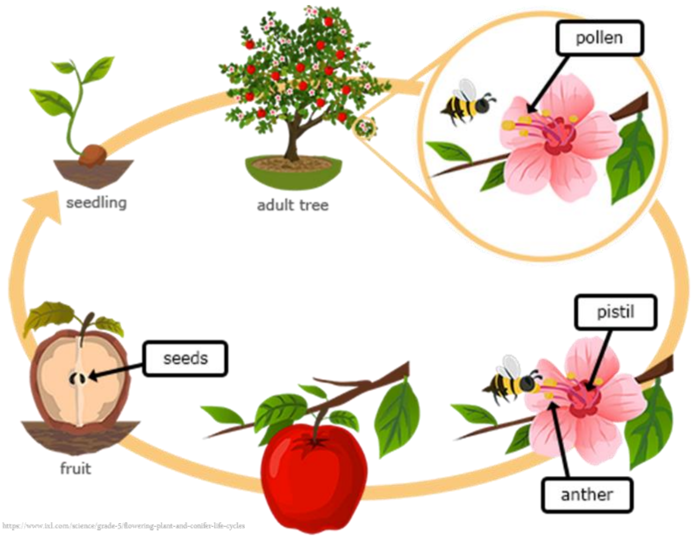
Flowering Plants

Plants that produce flowers are known as Flowering Plants (angiosperms). The flowers are the reproductive structures where fertilisation occurs and seeds are produced. Flowering plants include many of our common New Zealand such as kōwhai, harakeke (flax) and pōhutakawa, as well as flowering grasses like toetoe. Many of our New Zealand Flowering plants have been discovered by Māori to be useful for medicine, food, clothing and housing.

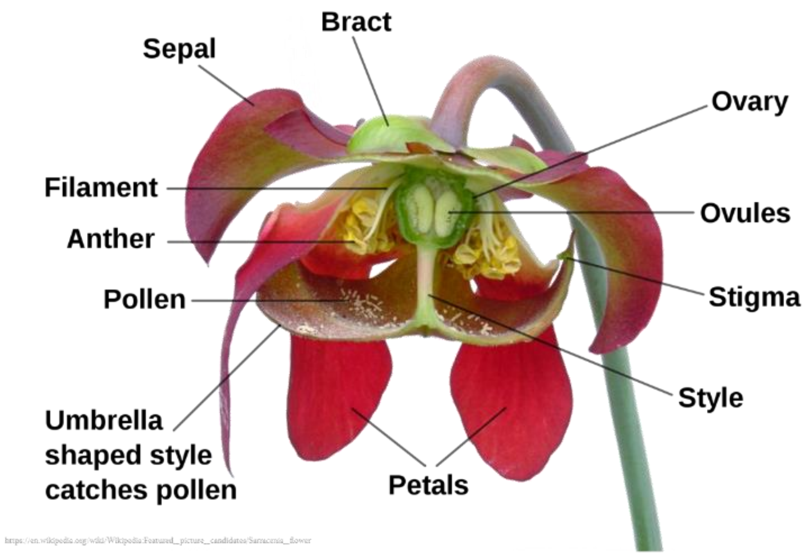
Flowering Plant life cycle

All flowering plants develop flowers that produce male pollen and female eggs. The number and structure of these depend on the species of plant.

The reproductive cycle involves the transfer of pollen to the egg in the flower (pollination), the joining of the pollen and egg to make a seed (fertilisation) and the spreading of seeds to grow a new plant (seed dispersal)



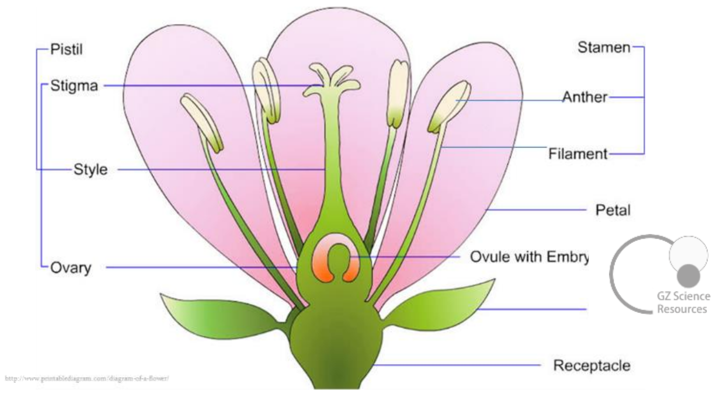

The structure of a flower




Insect / bird -pollinated flowers have visible, often colourful petals that surround the flower's sexual reproduction parts. The petals can "advertise" for specific pollinators through their shape, size, colour and sometimes smell. The flowers are surrounded by sepals, which are small and usually green structures that protect the flower as its developing.

Drawing and labelling a flower

The main parts of a typical flower that are pollinated by an animal such as a bird or insect, is shown beside in a cross-section drawing. Many flowers often have many anther/filaments surrounding one central stigma/style. When labelling, one of each is required.

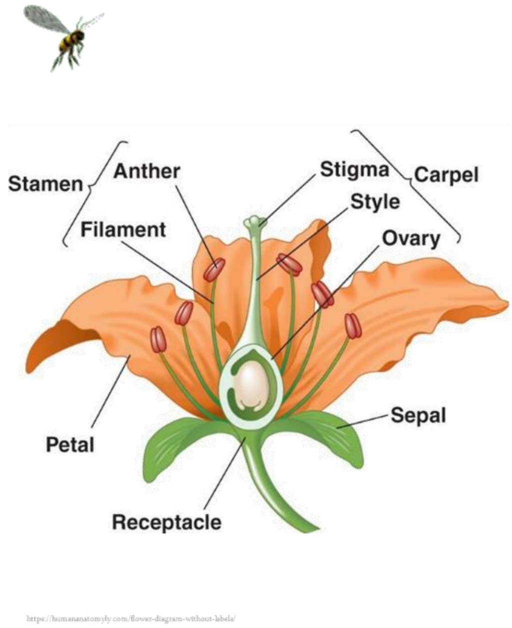



Reminders for Biological drawing:

- ❑ Clean single lines
- ❑ Label all parts
- ❑ Do not cross over lines

The reproductive parts of an insect-pollinated flower

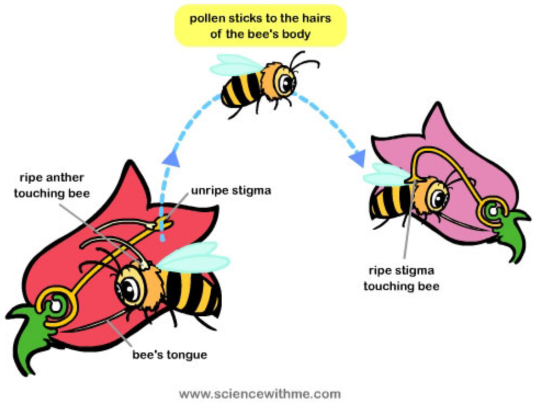
<u>The male part</u> of a flower is called the **stamen**. The pollen is produced in the **anther** which is held up by the **filament**. The pollen is collected by a pollinator. (or spread by wind) The pollen contains male sex cells (**gametes**) which will later join with the female gametes in the ovule during fertilisation.




<u>The female part</u> of the flower is called the **pistil (or carpel)**. The pollen from a male part of a flower is brought to the stigma by a pollinator. This process is called **pollination**. The pollen travels down the **style** into the **ovary** to join with an egg cell inside the ovules in a process called **fertilisation**.

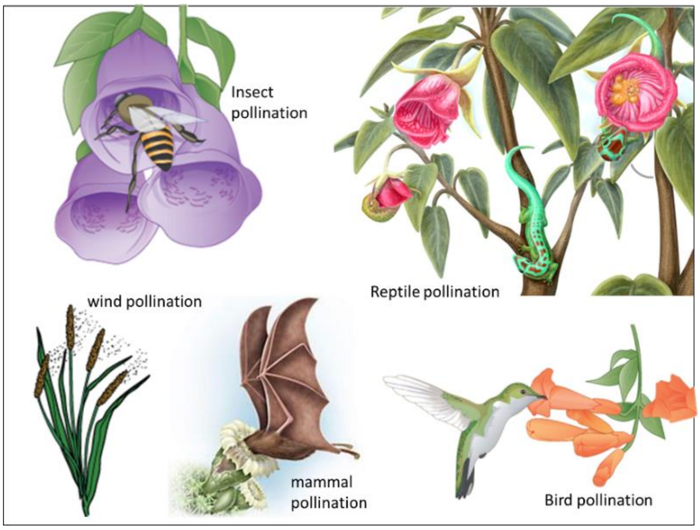
Pollination

Pollination is the transfer of pollen from the male part of the flower to the female (stigma) part of another flower. Flowers can be wind-pollinated or animal-pollinated. Animals that assist in pollinating a flower are known as pollinators. Insect-pollinated flowers often contain nectar, a sweet sugar produced by the plant, to attract an insect. As the insect reaches into the flower for the nectar, it may be brushed with pollen from the anther. If the insect moves to another flower, it may brush the pollen against the stigma and therefore pollinate the flower. Flowers ripen their male and female parts of the flower at different times to prevent self-pollination.




1. The male parts of the flower are the anther and filament
2. The female parts of the flower are the stigma, style and ovary
3. Male gametes are found in Pollen Produced in the Anther
4. Pollen needs to be moved to the female part called the Stigma of the same species of plant to reproduce
5. This process is called Pollination
6. Pollination can be helped by Wind Or Animal
7. An example of wind pollination is grass plants
8. A wind pollinated flower is most likely to look like  - small, green, unscented
9. An example of animal pollination is a rose plant pollinated by insects
10. An animal pollinated flower is most likely to look like – colourful, with large petals, perhaps with a scent

Different ways pollen may be transferred.

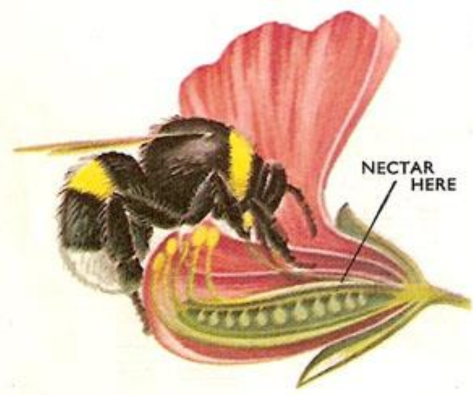



Pollen grains are tiny and they are light enough to be carried by the wind or on the bodies of flying and crawling animals. Plants and their flowers have adapted to transfer their pollen from one flower to another in many different ways that include using wind, insects, birds, mammals and reptiles.

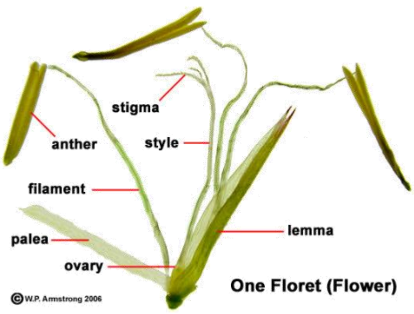
| Examples of insect-pollinated flowers | Examples of wind-pollinated flowers |
|---|---|
|  |  |

The differences in structure between insect-and wind-pollinated flowers

Insect pollinated flowers are easily seen and often contain scent and nectar to attract the insects. The male parts are adapted so they make contact with the insect as it feeds from the flower.




The differences in structure between insect-and wind-pollinated flowers




Wind pollinated flowers are often small and green with no scent. Male anthers protrude out from the flower to allow the wind to pick up the pollen and disperse it away from the plant. Male and female parts develop at different times.

| Feature | Wind pollinated | Insect pollinated |
|---|---|---|
| petals | Small dull coloured petals | Large brightly coloured flowers |
| scent | Flowers do not have any scent | Flowers have scent to attract insects |
| stamen | Stamen is thin and hangs outside flower | Stamen is strong and inside the flower |
| pollen | Pollen grains are light and numerous | Pollen grains are sticky or hairy and are few in amount |
| stigma | Stigma is feathery to catch pollen and hangs outside the flower | Stigma is also hairy and sticky and is inside the flower |
| nectar | No nectar or nectary | Many have sweet nectar in a nectary to attract insects |

All living organisms are made up of cells.

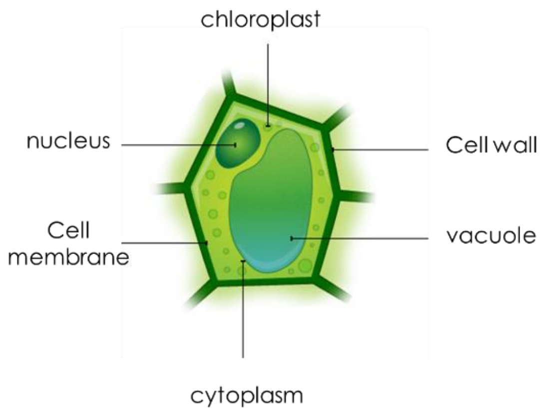
All living organisms are made up of cells, the smallest structural (how it looks) and functional (How it works) unit. Organisms can be Unicellular – consisting of one independent cell, or be multicellular – organised networks of cells with different functions and structures; humans have over 100 trillion cells.

The structure of a typical plant cell includes a cell membrane, cytoplasm, nucleus, cell wall, vacuole, and chloroplast.

Cell Wall - Gives the cell rigidity and a more angular appearance.

Chloroplasts - The site of photosynthesis, gives the cell its characteristic green colour

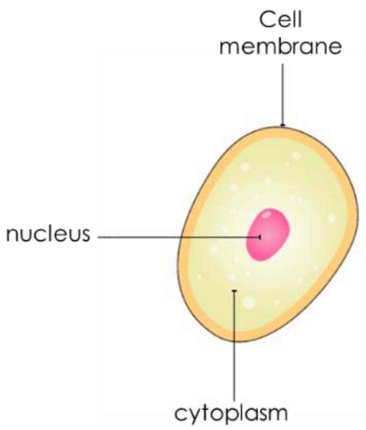
Vacuole - Assists with storage and structure




The structure of a typical animal cell includes a cell membrane, cytoplasm and nucleus

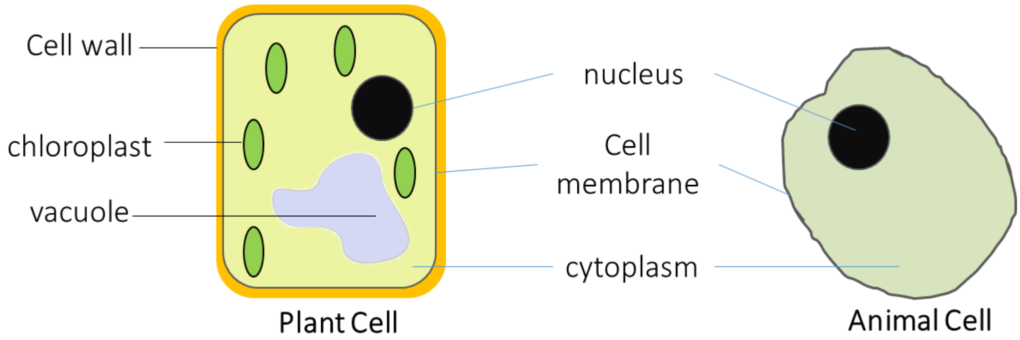
Cell membrane - Surrounds cell and controls passage of nutrients and chemicals. Flexible and allows cell to change shape.

Cytoplasm - A liquid filling the cell and containing all the chemicals the cell needs to function



Plant and animal cells similarities and differences.

| Similarities | Differences |
|---|---|
| 1. BOTH cells have a 'skin', called the membrane, protecting it from the outside environment.<br><br>2. BOTH cells have a nucleus. The 'information storage' of the cell.<br>3. BOTH cells have Cytoplasm, a fluid that protects the inside of the cell and carries nutrients | 1. ONLY Plants have a cell wall that help define the shape and give structure to the plant.<br><br>2. ONLY plant cells contains chloroplasts that helps in the plants photosynthesis.<br>3. Plant cells are generally larger than animal cells.<br>4. Plants have a larger Vacuole. |




Using a Microscope

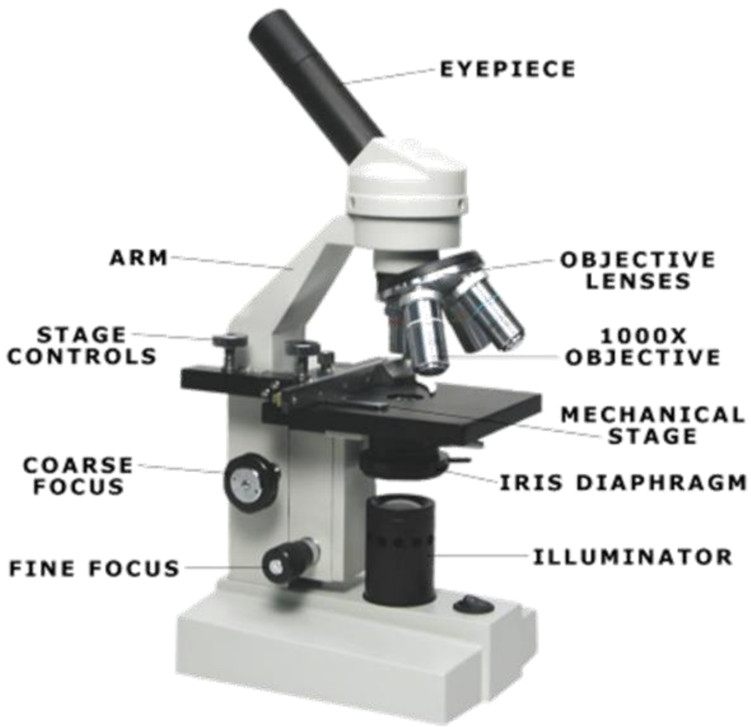
Most cells are too small to be clearly seen by eye and require a microscope to view.

Definitions:

Magnification: the number of times the image is enlarged

Resolution: the clarity (how clear) and ability to see detail in the image

Microscope parts and function




Arm - this attaches the eyepiece and body tube to the base.
Base - this supports the microscope.
Coarse focus adjustment - a knob that makes large adjustments to the focus.
Eyepiece - where you place your eye.
Fine focus adjustment - a knob that makes small adjustments to the focus (it is often smaller than the coarse focus knob).
High-power objective - a large lens with high magnifying power.
Low-power objective - a small lens with low magnifying power.
Mirror (or illuminator) - this directs light upwards onto the slide.
Stage - the platform on which a slide is placed.

Using a microscope safely

1. Make sure the lowest power objective lens (e.g. 4x) is clicked into position.

2. Place the microscope slide on the stage and fasten it with the stage clips.

3. Look at the objective lens and the stage from the side and turn the course focus knob so the stage moves upward. Move it up as far as it will go without letting the objective touch the coverslip.

4. Look through the eyepiece and move the course focus knob down until the image comes into focus.

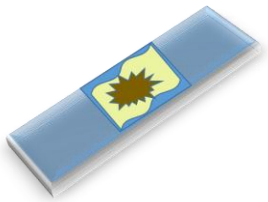
5. Adjust the mirror for the greatest amount of light.

6. Use the fine focus knob for the clearest image

7. When you have a clear image of your sample with the lowest power objective, you can change to the next objective lenses. You might need to readjust the sample into focus

8. When finished, lower the stage, click the low power lens into position and remove the slide

Making a Microscope Slide



Onion Cell Slides

1. Collect onion, slide and cover slip, lamp and microscope.
2. Peel the epidermal cells (skin between layers) from the onion tissue.
3. Place the cell sample on your slide – spread it out and make sure it is not folded.
4. Add 2 drops of iodine (or other stain) to the onion slide.
5. Lower cover slip onto the slide one side at a time so there are no bubbles
6. Focus under the microscope – remember to start with low power!!
7. Draw 2-3 cells about 10 lines big into your books.
8. Return used slides and slips to the ice cream container with disinfectant.

Biological drawings are a useful way of recording information from your observations.

Rules for drawing a cell
1. Use unlined paper.
2. Draw in pencil.
3. Always print.
4. Give the drawing a title
5. Use a large area of the paper
6. Label all visible parts and never cross lines.
7. Name the specimen
8. Print your name and other Information such as scale or magnification used on the microscope