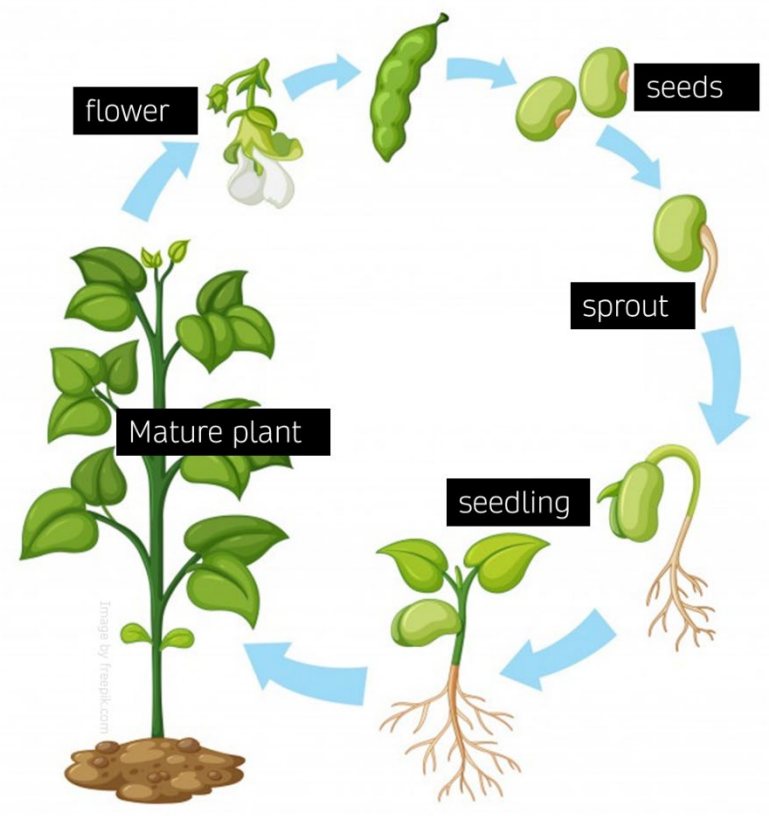
Flowering Plants

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.

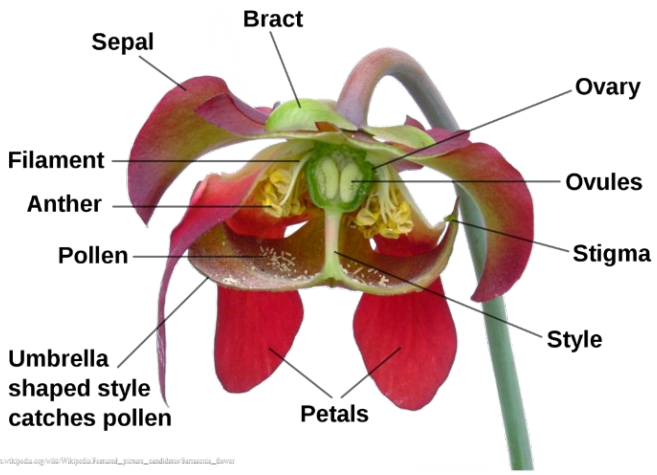
Flowering Plant life cycle

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

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



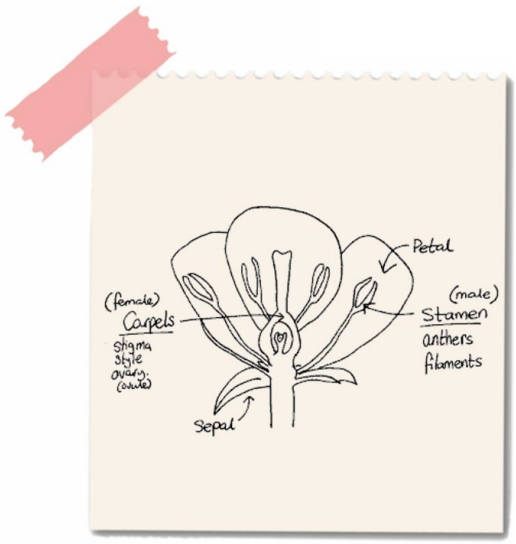
The structure of a flower



Insect and 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.

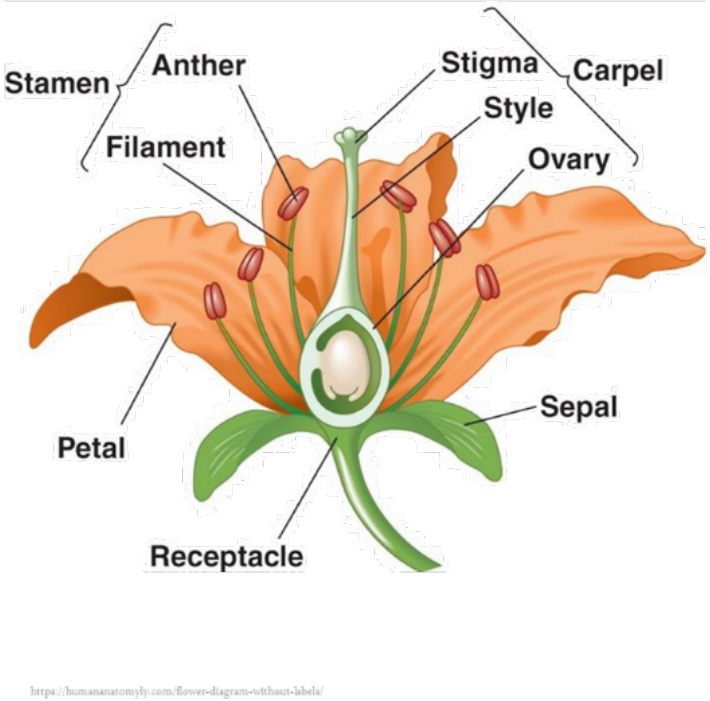


Reminders for Biological drawing:

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

The reproductive parts of an insect-pollinated flower

The male part 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.



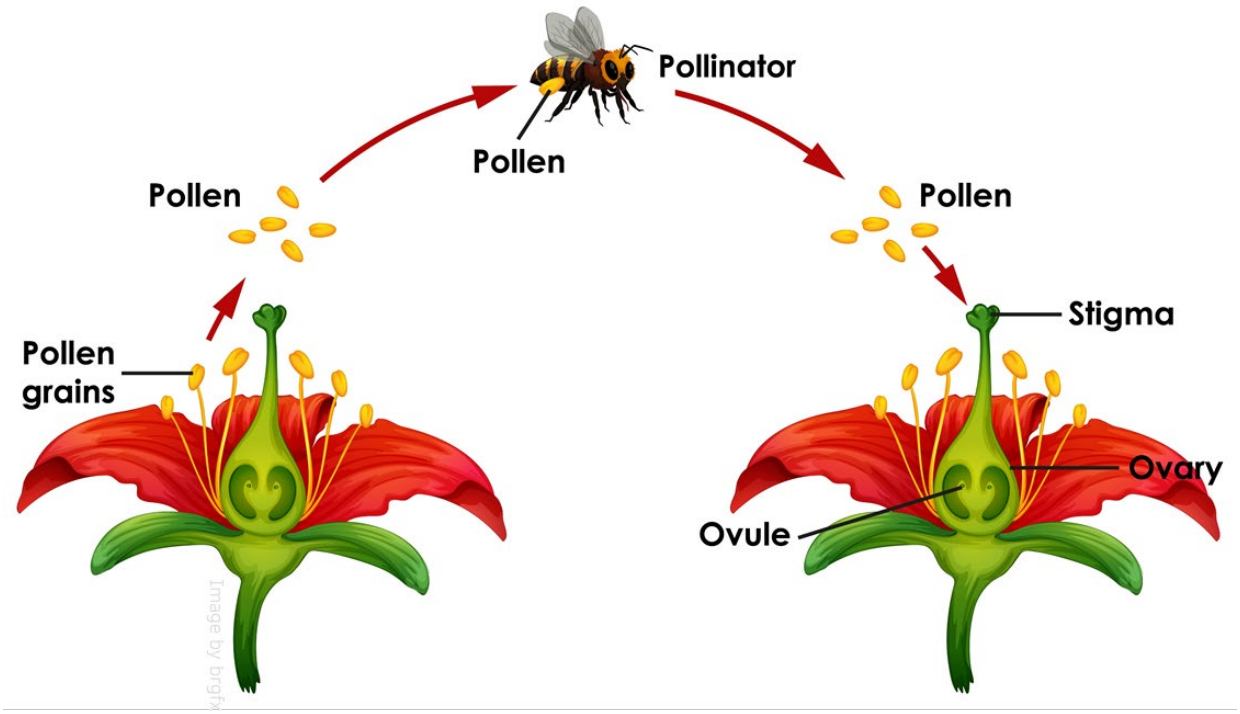
https://humananatomyly.com/flower-diagram-without-labels/

The female part 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**.

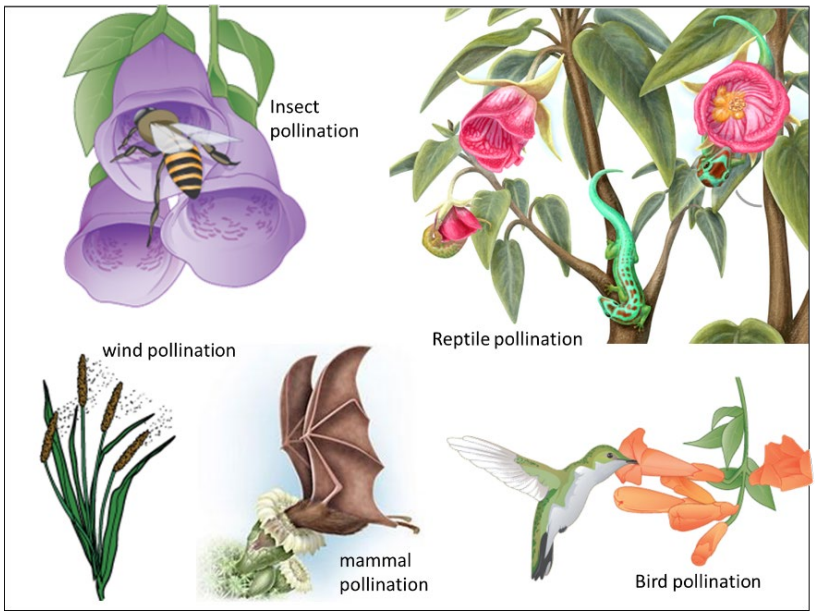


1. The male parts of the flower are the **anther** and **filament**
2. The female parts of the flower are the **stigma**, **style** and **ovary**
3. Male gametes are found in **Pollen** Produced in the **Anther**
4. Pollen needs to be moved to the female part called the **Stigma** of the same species 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.

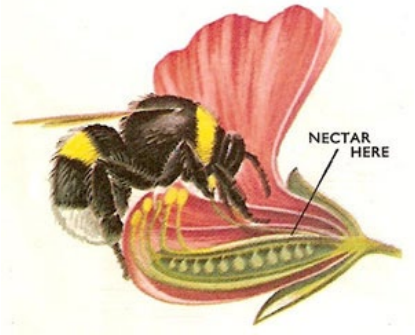
The pollen must be light enough to either be moved by wind or be attached to a pollinator and still enable it to fly. The ovule, once fertilised, will become the seed. The number of ovules will determine the maximum possible seeds each flower will produce, as either fruit, nuts or pods.

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 ways that include using wind, insects, birds, mammals and reptiles.

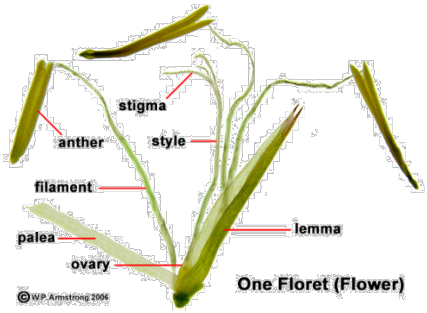


The differences in structure between insect-and wind-pollinated flowers

Examples of insect-pollinated flowers	Examples of 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 contact the insect as it feeds from the flower.



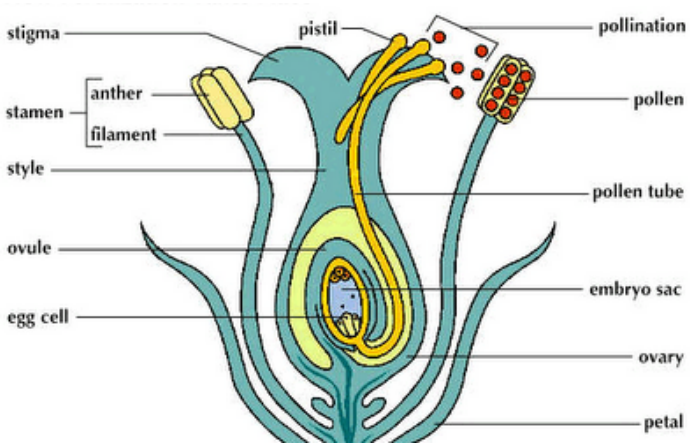
Wind pollinated flowers are often small and green with no scent. Male anthers protrude out from the flower to allow the wind to pick up the pollen and disperse it away from the plant. Male and female parts develop at different times.

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

Adaptations of tūī pollinated flowers

Some New Zealand plants, such as NZ Flax, pūriri and kōwhai use the tūī as a pollinator. Both the plants and tūī have evolved together to the advantage of both and have adaptations to help their survival. The tūī is a nectar eating bird and the flowers of these plants produce nutritious nectar to attract the tūī, which then transfers pollen to other plants, ensuring pollination with another flower. The curve and length of the flowers (see flax flowers to the right) and the tūī's bill are a good match.

To deliver the correct pollen to the correct species, when the tūī feeds from a particular flower species, the anther of each flower species deposits pollen on a **specific area** of the tūī's head. When it feeds on another flower of the same species, a sticky stigma-tipped style will brush the same spot, picking up pollen. The flowers are often red / yellow and scentless, as the tūī has limited sense of smell and can see the reddish colour range the best.



Fertilisation in flowering plants

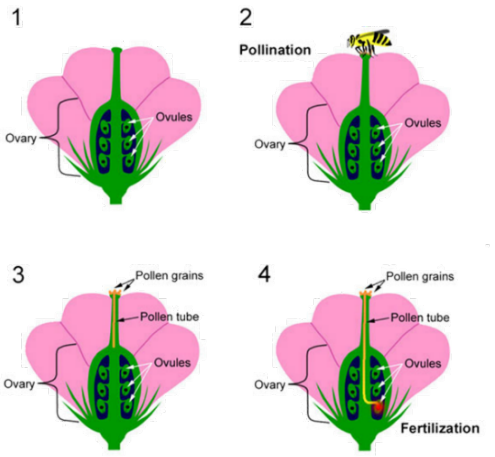
1. Pollen from either the same plant (self-pollination) or another plant (cross-pollination) needs to arrive on the flower's stigma
2. The pollen sends a tube down the style to reach the ovule, and the male gametes (there are two in every pollen grain) enter the ovule to fertilise the egg (female gamete)
3. One male gamete joins with one female gamete to form a **zygote** and the plant is fertilised. (The fertilised ovule develops into a seed)

The differences between pollination and fertilisation in flowering plants

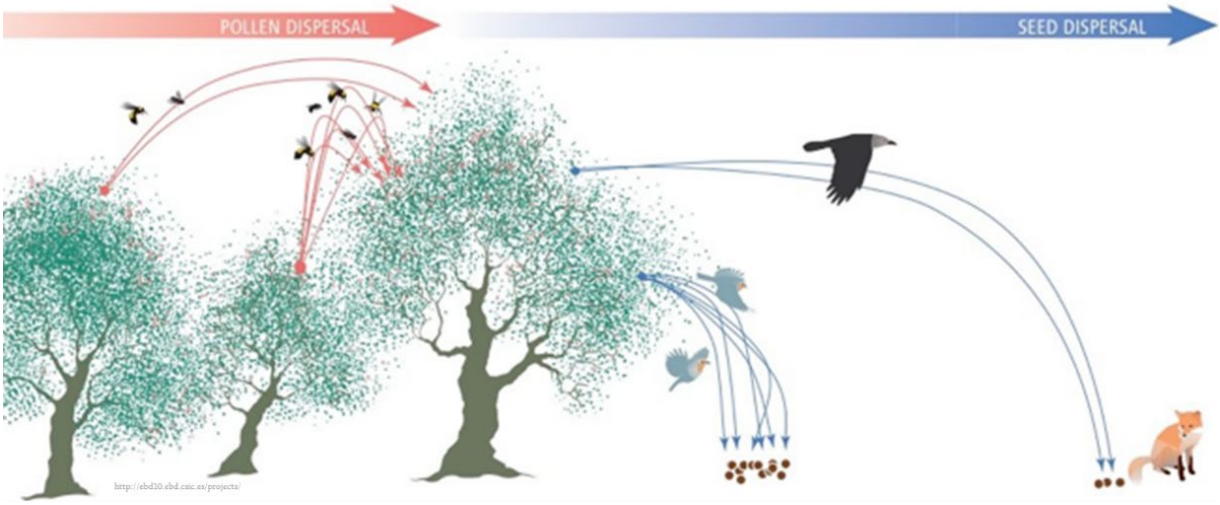
Pollination just refers to pollen landing on the female stigma of the plant. This can be with either a pollinator or wind.

Fertilisation refers to the sperm cell (that was in the pollen grain) joining with the egg cell to form a single cell (zygote).

Pollination does not always lead to fertilisation



Seed dispersal



Pollen is dispersed (or spread) from plant to plant so the flowers can be pollinated, and fertilised seeds produced. Once the seeds are mature, they then also need to be dispersed so they are not competing with the parent plant for space, light, water and nutrients.

Seed structure is linked to Seed dispersal

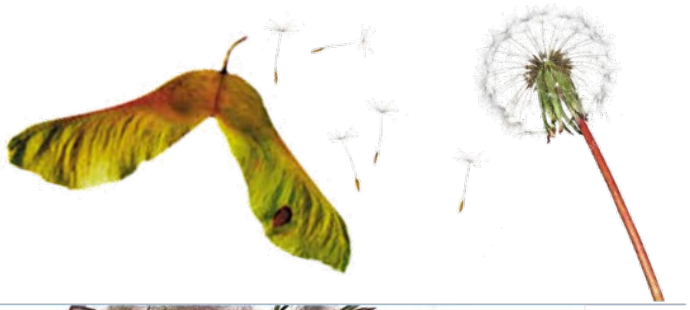
There are various ways that plants have evolved to disperse their seeds; forming inside fruit that animals will eat and spread, forming structures on the seed so the wind will carry them away, can float away, be forced away or tangle in the coat of an animal to be carried away.

Animals

These fall into two main groups: fruits to attract animals to eat them or seed pods that are sticky or have hooks to attached to animals coats and be carried away

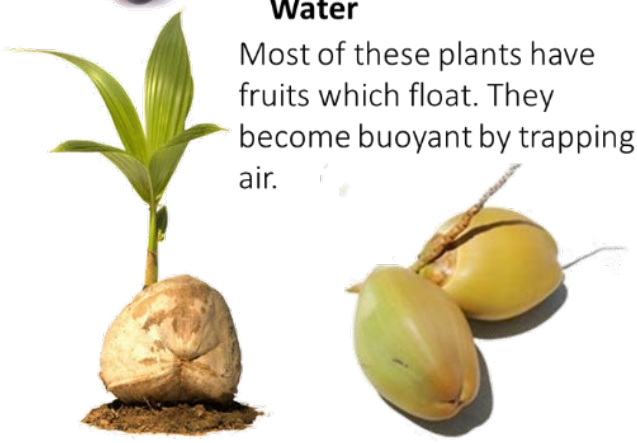
Wind

Most of these seeds are light and either have wings or plumes



Water

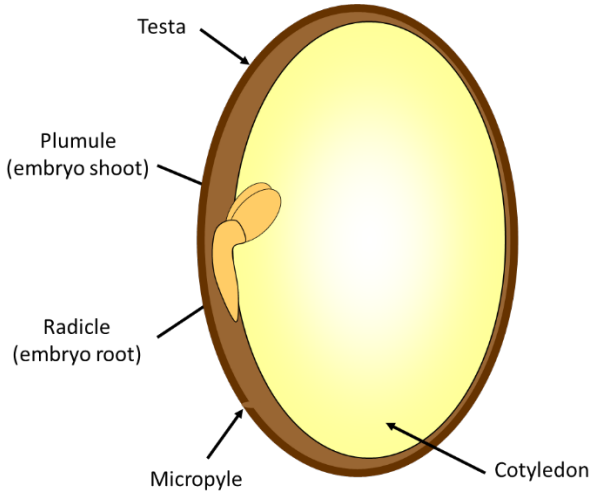
Most of these plants have fruits which float. They become buoyant by trapping air.



Expulsion

Fruits explode or burst and seeds are flicked away

The Structure of seeds



A seed is a fertilised ovum (egg) containing a small embryonic plant and a supply of food to help it germinate and grow before it can start to photosynthesis and make its own food. The seed consists of the seed coat or the **testa,** which surrounds the **cotyledons** or the food storage area. The embryo consists of the **radicle** which is the embryonic root and the **plumule,** which forms the first shoots and leaves of the plant. A small pore in the seed may be seen called the **micropyle**. This is where the pollen originally entered the ovule.

The conditions needed for germination of seeds

Seeds will remain **dormant** until they receive (WOW)

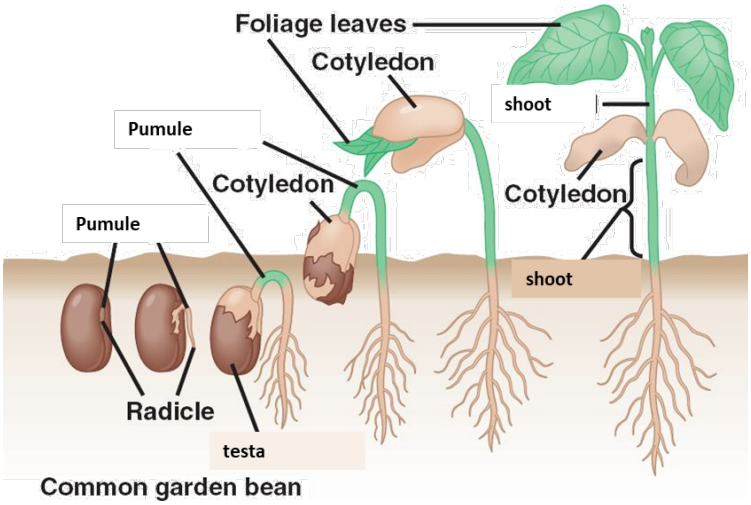
Water
Oxygen
Warmth

Then they will **germinate.**

Other types of seeds may also require

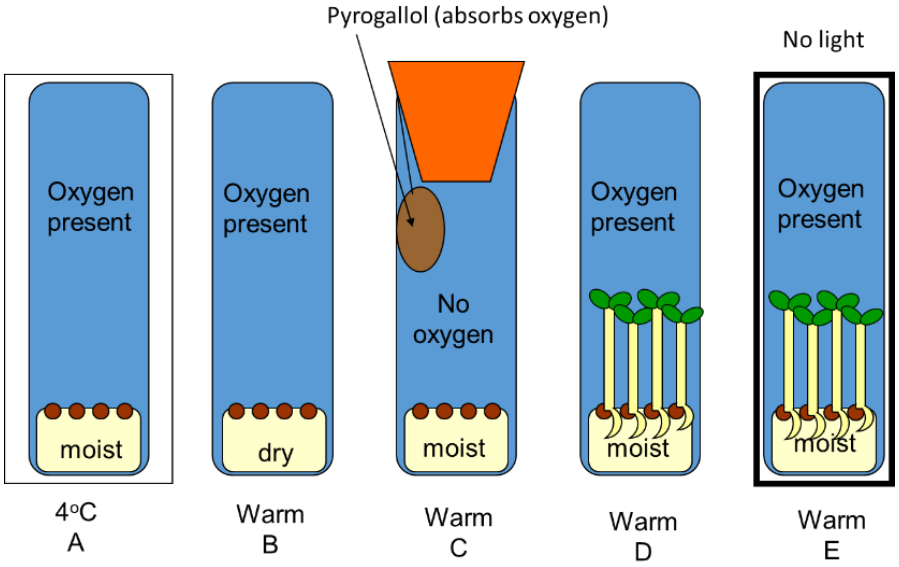
>fire to burn seed coat
>light
>soaking in water
>scratched seed coat
>being digested by animals

Before they germinate



Common garden bean

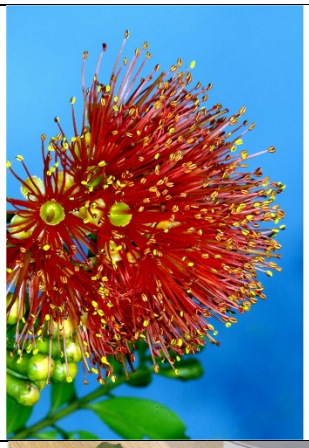
Germination Investigation



By altering the conditions in containers with seeds, we can see what conditions are required for germination. The range of conditions include light, water, oxygen and warmth. The seeds germinated when seeds have warmth, water and oxygen - whether there was light or not did not affect germination.

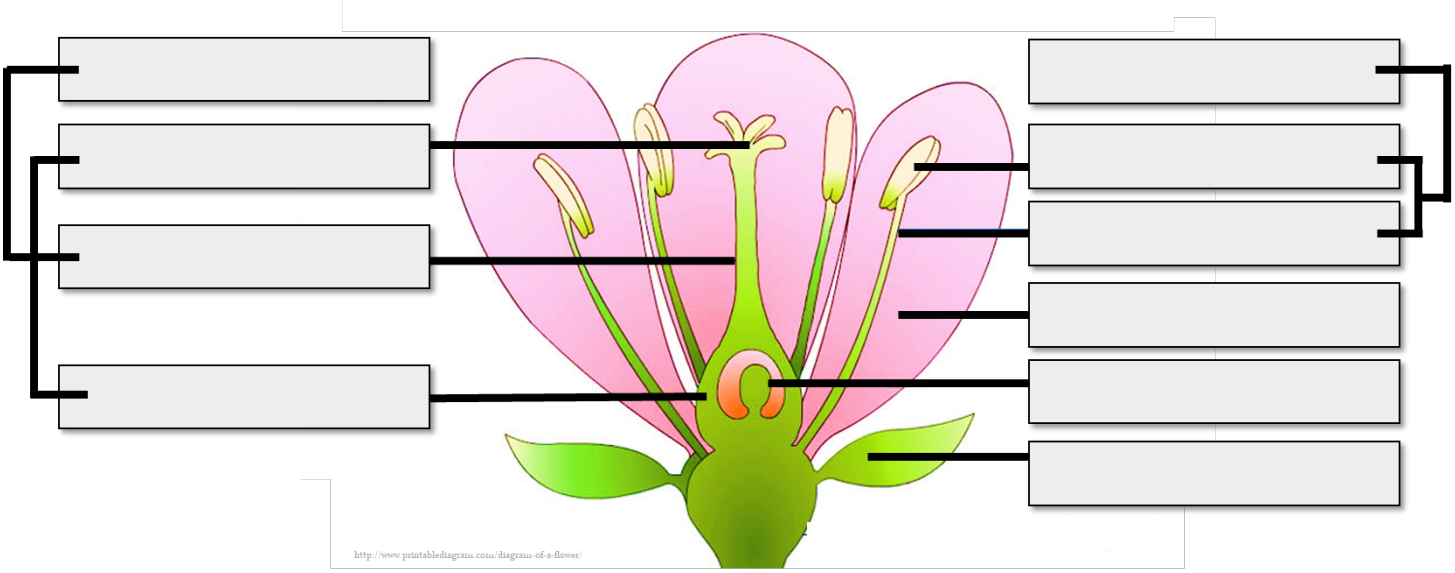
Māori scientific knowledge and understanding of their use of plants

Over a long period of time, Māori have built up their scientific knowledge and understanding of their use of plants for medicine (Rongoa), food, clothing and housing. Many of these uses are still practiced today.

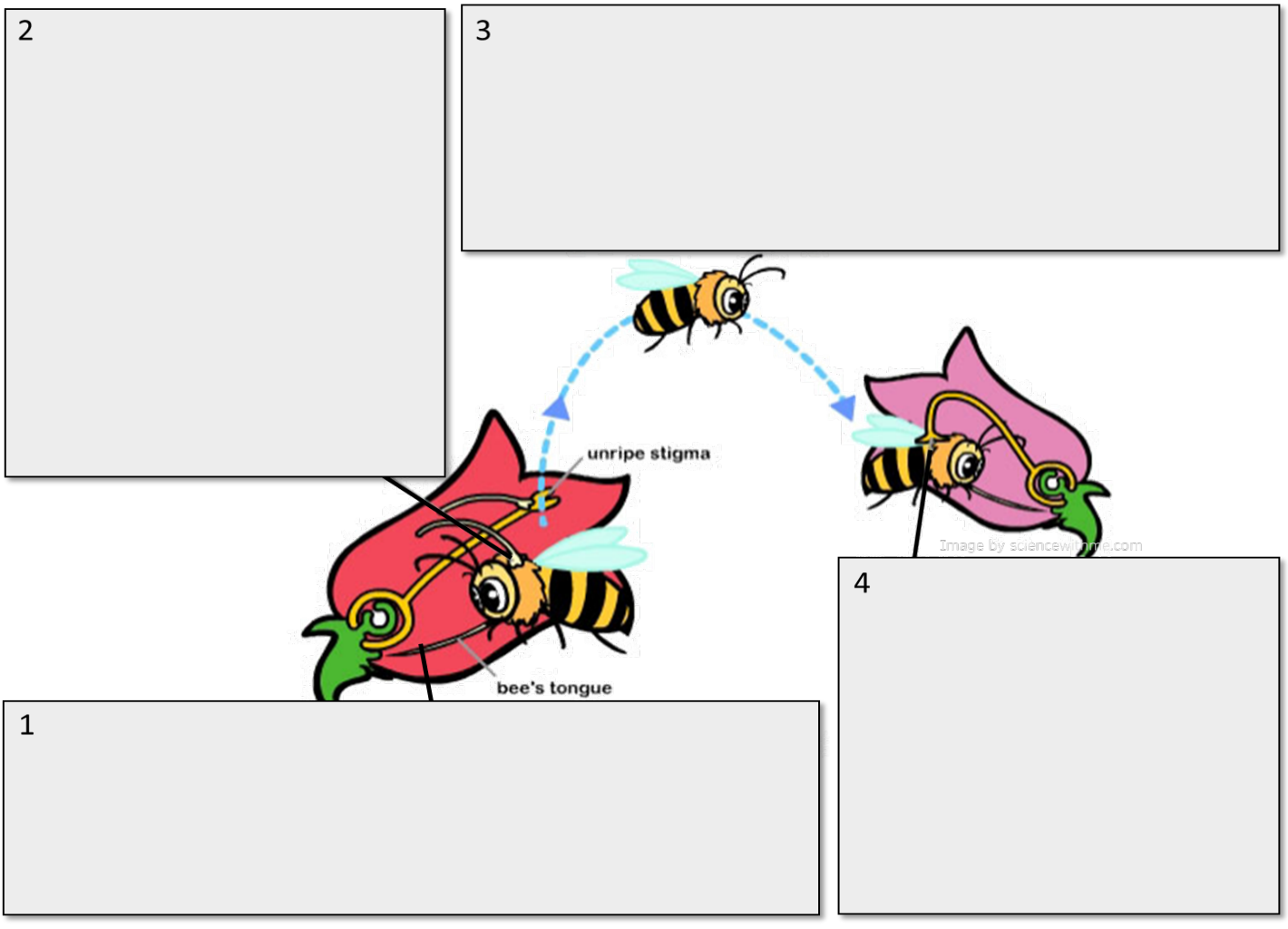
The rātā tree bark can be made into a lotion or poultice, and the flower nectar can used for sore throats.	  White and Red Rata from Maungatautari
Kawakawa can be made into a tea, poultice or chewed for toothache, sore stomach, and pains	 Te Ara - The Encyclopedia of New Zealand Photograph by Emily Tutaki  Kawakawa from Maungatautari

1. Complete the labelled diagram of a typical flower

petal	*filament*	*stamen*	*style*	*sepal*	*pistil (or carpel)*	*ovule*	*ovary*	*anther*	*stigma*



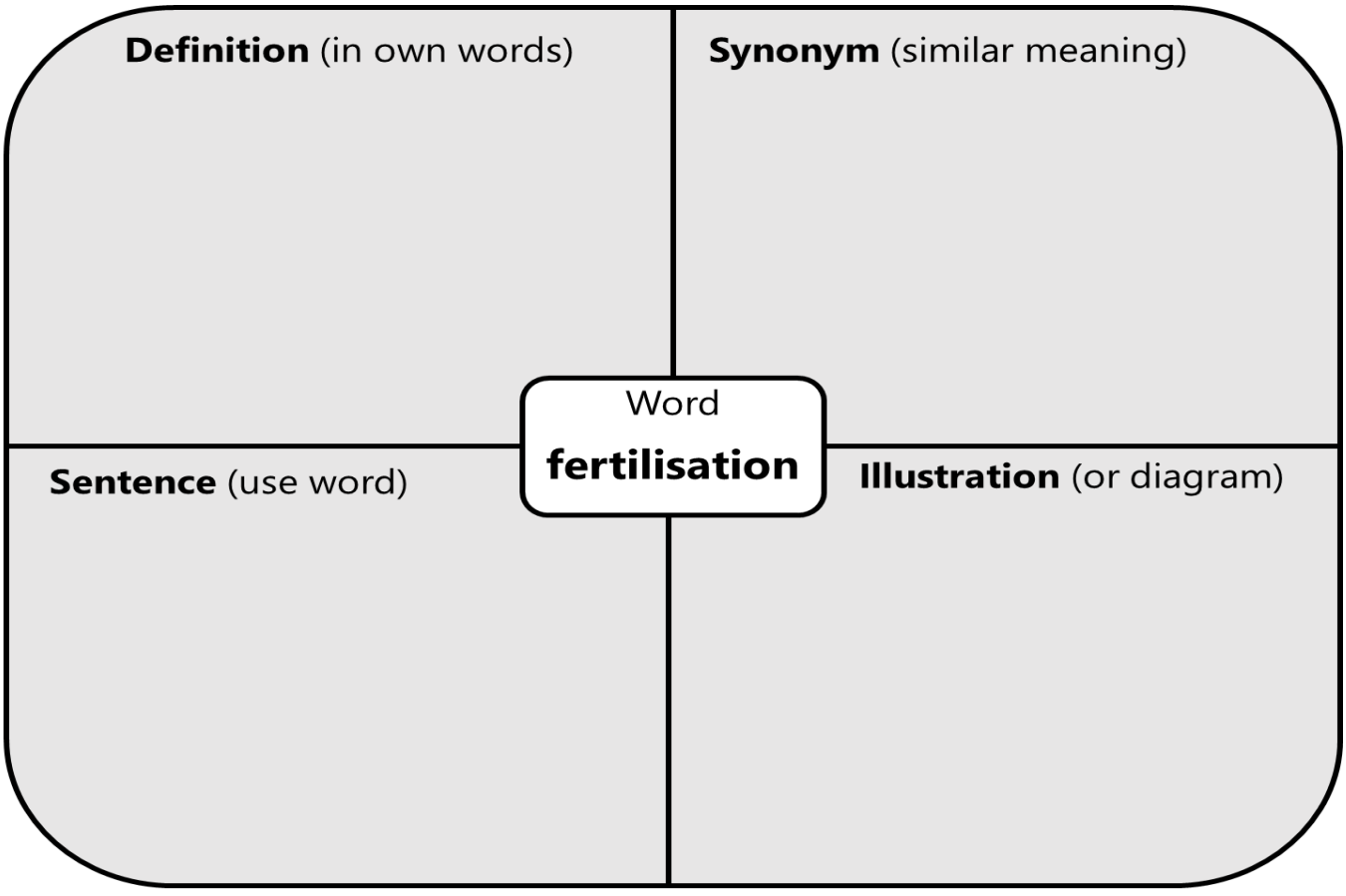
2. Add text to the diagram of pollination below to explain what is occurring at each stage



3. Complete missing information on the differences between wind and animal pollinated flowers

Feature	Wind pollinated	Insect pollinated
petals	Small dull coloured petals	
scent		Flowers have scent to attract insects
stamen		Stamen is strong and inside the flower
pollen	Pollen grains are light and numerous	
stigma		Stigma is also hairy and sticky and is inside the flower
nectar	No nectar or nectary	

4. Research the word **fertilisation**, and add your found information to the vocabulary square below



5. Seeds can be dispersed in many different ways. Match names of the plants (seeds) to their method of seed distribution. You may need to research some of the plants to find out!

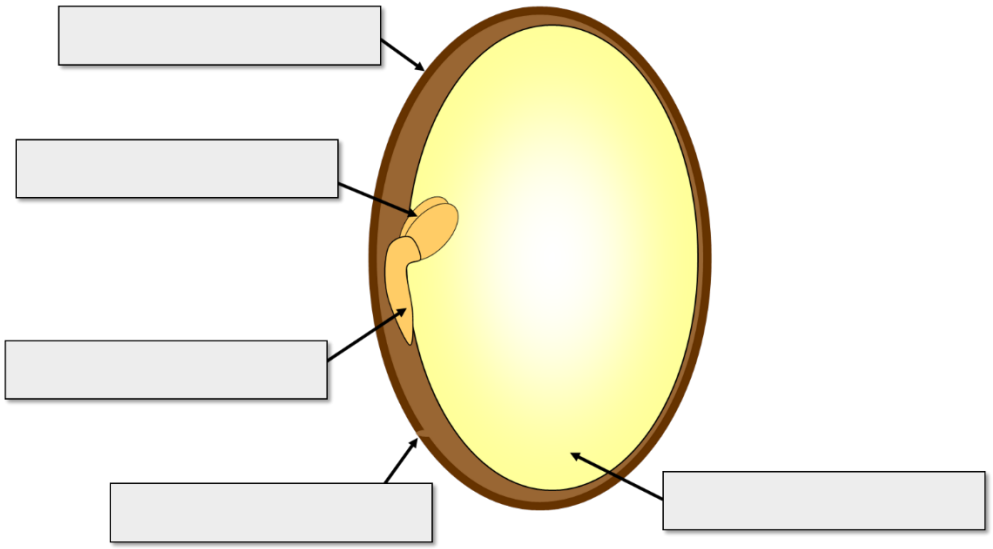
Animals	Expulsion
Wind	**Water**

6. Research a plant that is not listed above and has an interesting method of dispersing seeds.

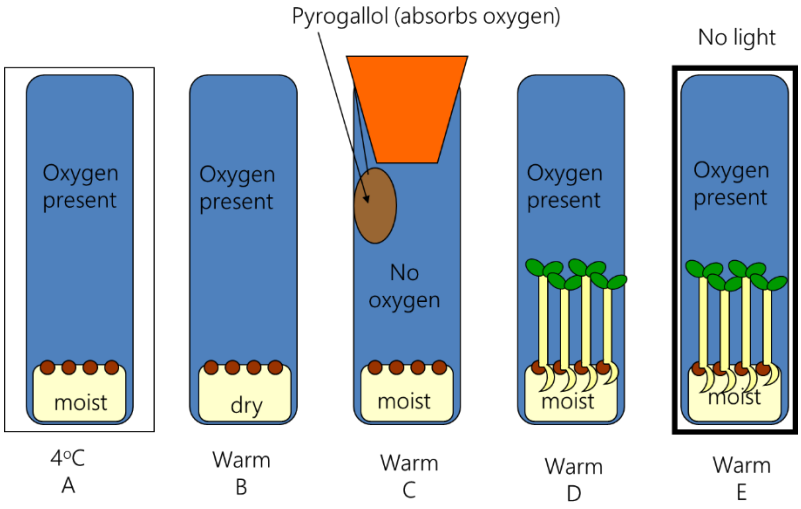
Name of plant:	drawing of seed
Method of seed dispersal	

7. complete the labelled diagram of a seed

plumule	*radicle*	*micropyle*	*testa*	*cotyledon*



8. Use the information from the diagram of an investigation below to describe the conditions needed for germination, and an **evidence-based statement** for why you think that.



Condition needed	Evidence based statement