

# Unit 4:

## Reproduction

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### 1. Reproduction function

### 2. Reproduction in animals

2.1. Asexual reproduction

2.2. Sexual reproduction

### 3. Reproduction in plants

3.1. Asexual reproduction

3.2. Sexual reproduction

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#### Think and answer

- a. Why do plants have flowers?
- b. What is the difference between asexual and sexual reproduction?
- c. Why is important for living beings reproduce?
- d. What is an ovoviviparous animal?

#### UNIT OBJECTIVES

In this unit you will learn:

- To learn what reproduction is and to understand its importance.
- To distinguish sexual and asexual reproduction.
- To list the advantages of sexual reproduction.
- To distinguish the types of asexual reproduction in animals and plants.
- To identify the stages of the life cycle of plants and animals.

## 1. Reproduction function.

Reproduction is the joint of processes that allows living beings produce offspring. It is the ability to create new individuals, **descendants**, similar or identical to the **progenitors**.

This vital function ensures the perpetuation of the species. New individuals replace the individuals which die.

### a) Types of reproduction

There are two types of reproduction:

#### - Asexual reproduction:

It requires only one progenitor. The descendants are identical to it.

It is carried out through specialised cells (*spores*) or not (*parts of the body*)

It is typical of bacteria, plants like ferns and some invertebrates, among others.

#### - Sexual reproduction:

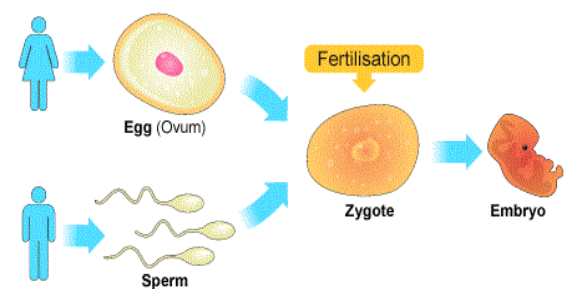
It requires two progenitors of different sex: male and female.

The descendants are similar but not identical to them, because they are a combination of genetic material contributed from both parents.

They produce a sexual cell called **gamete** (ovum and spermatozoon). Both gametes join together to make a **zygote**.

A new individual will grow from that zygote.

Plants and vertebrates belong to this group.



### b) Advantages and disadvantages of sexual and asexual reproduction



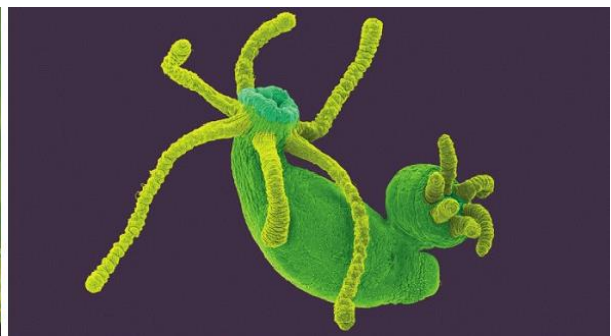
SEXUAL REPRODUCTION

#### Advantages

Genetic diversity among offspring increases the adaptation to changing environment and decreases the probability of extinction.

#### Disadvantages

Finding a partner and mating can be difficult and time-consuming.  
Reproduction is not assured.



ASEXUAL REPRODUCTION

#### Advantages

Reproduction is fast, economical and efficient.  
Reproduction is assured.

#### Disadvantages

Genetic non-diversity among offspring decreases the adaptation to a changing environment and increases the probability of extinction.

### READING ACTIVITIES

After reading the text, copy and answer the following questions into your notebook:

Remember: you must make complete sentences.

1.1. Why is reproduction important for living beings?

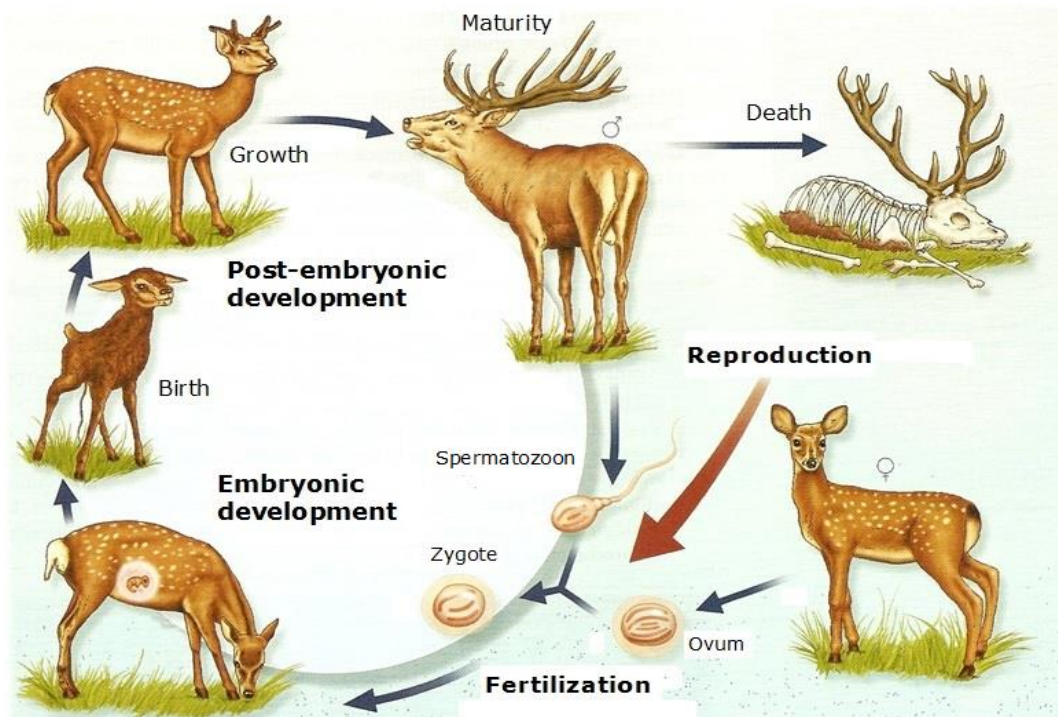
1.2. What are the differences between sexual and asexual reproduction?

## 2. Reproduction in Animals.

The **life cycle** is the joint of stages through undergo an organism during its life, from it starts as zygote until it becomes an adult able to reproduce.

In an animal's life cycle it is possible to distinguish several phases during which the organism changes:

- **Fertilization.** The gametes join together to form the zygote.
- **Embryonic development.** The zygote divides many times to form the embryo. This embryo grows and develops until the birth.
- **Post-embryonic development.** It goes from birth to the acquisition of the reproductive maturity. The organism (**young**) grows and matures to acquire the characteristics of the **adults**.
- **Reproduction.** The organism produces new individuals. This stage can be repeated several times during its life, until it finally dies.

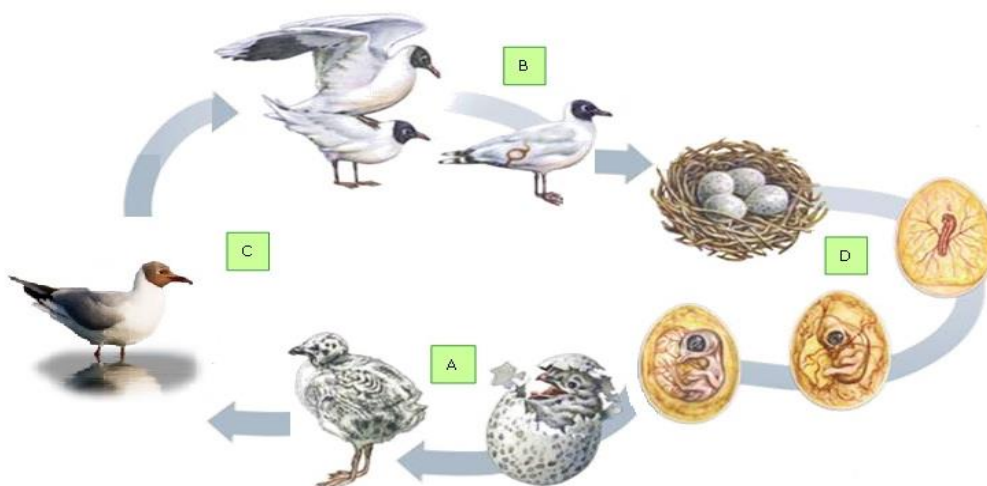


### READING ACTIVITIES

After reading the text, copy and answer the following questions into your notebook:

Remember: you must make complete sentences.

#### 2.1. Identify the phases of the gull's life cycle:



## 2.1. Asexual reproduction in Animals

Asexual reproduction is common in unicellular organisms and plants, but it only occurs in the most simple and least evolved animals.

The two main types of asexual reproduction in animals are:

### - Gemmation (or budding):

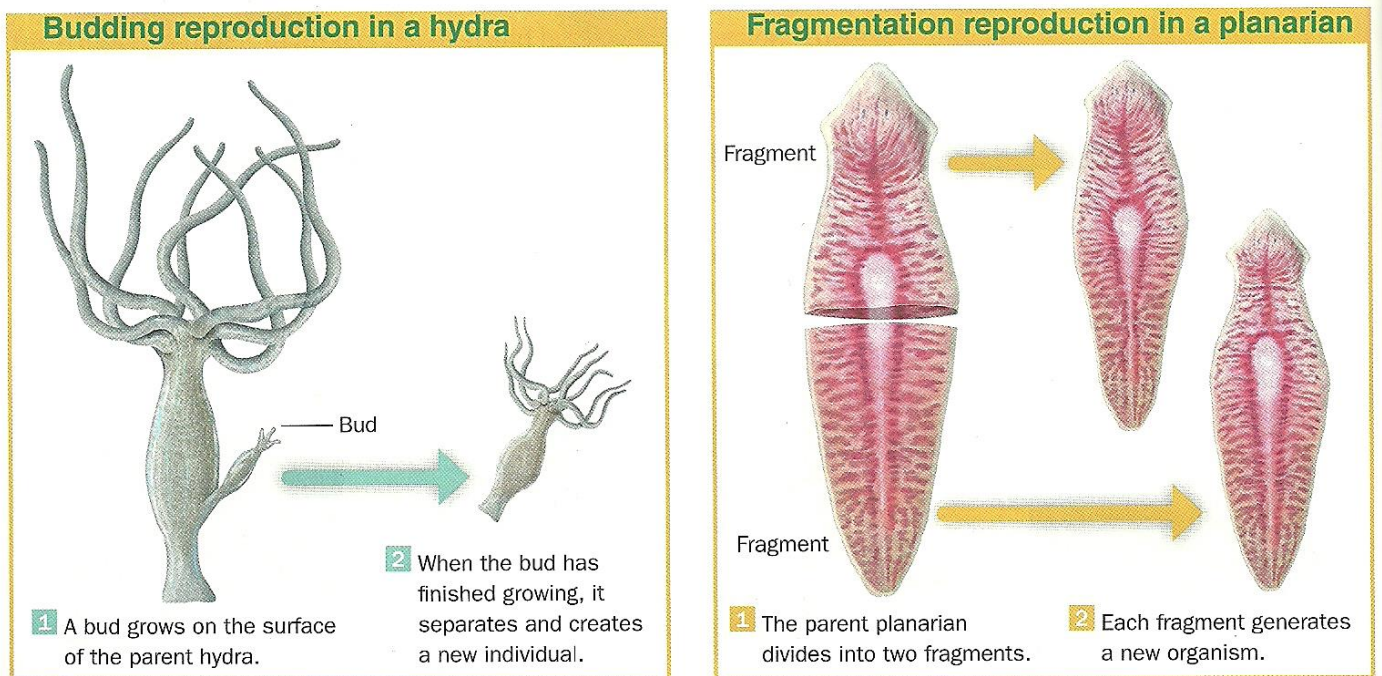
An outgrowth, bud, from the body of the parent, develops into a new individual.

Buds can:

- Separate from the parent, forming an independent individual (e.g. hydra)
- Remain attached to the parent, forming a colony (e.g. corals)

### - Fragmentation:

A new organism grows from a fragment of the parent. Each fragment develops into a mature, fully-grown individual (e.g. planarian)



Some animals can regenerate lost or damage body parts. This process is called **regeneration**. It is not a type of asexual reproduction. For example, lizards can regenerate their lost tails or starfish can regenerate their lost arms.

### READING ACTIVITIES

**After reading the text, copy and answer the following questions into your notebook:**

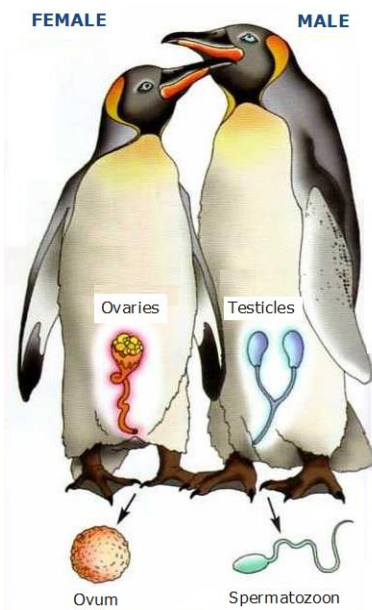
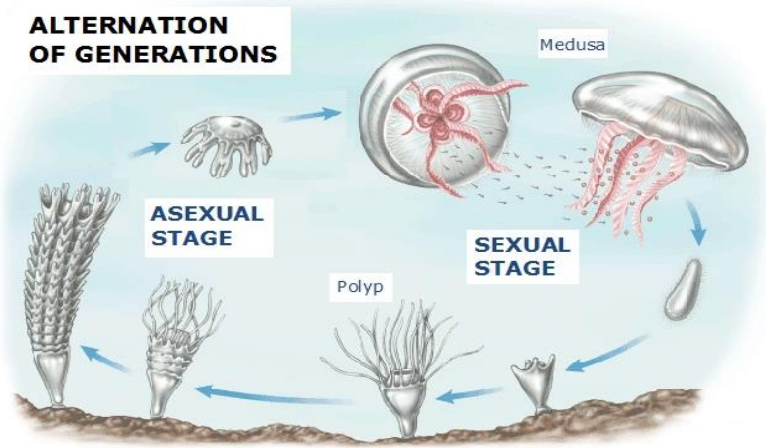
Remember: you must make complete sentences.

### 2.2. Why cannot regeneration be considered a type of asexual reproduction?

## 2.2. Sexual reproduction in Animals

Most part of animals reproduce sexually. However, some groups, such as some cnidarians have **alternation of generations**.

They have a complex life cycle which includes a **sexual stage** formed by individuals that reproduce sexually (medusa) and an **asexual stage** formed by individuals that reproduce asexually (polyps).



Sexual reproduction in animals usually requires two members of the opposite sex, a **male** and a **female**. Each sex has different reproductive organs (**gonads**) which produce **gametes**.

**- Male**

The male gamete is the **spermatozoon**. The male gonads are the **testicles**, which produce the spermatozoa. Spermatozoa are very small and mobile, because they have a flagellum in order to swim looking for the ovum.

**- Female**

The female gamete is the **ovum**. The female gonads are the **ovaries**, which produce the ova. Ova are immobile and very big, because they accumulate nutritive substances in order to feed the embryo in its initial stages.

Depending on the type of gonads present, animals can be:

**- Unisexual.**

Each individual has only one type of gonad. Most animals are unisexual and individuals are male or female. Sexes show usually differences in their appearance. This is called **sexual dimorphism**. The differences in size or colour or the presence of some structures, such as horns, allow animals to recognise potential partners.

**- Hermaphrodites.**

Each individual has both types of gonads. So that it is male and female at the same time.

Unisexual and hermaphrodite species		
Unisexual species	Unisexual species	Hermaphrodite species
No sexual dimorphism	Sexual dimorphism	
<p>Transparent goby</p>	<p>Female teal Male teal</p>	<p>Snail</p>

## a) Fertilisation

Fertilisation is the union of an ovum and a spermatozoon. When they fused, they form a **zygote** or fertilised egg cell.

In many animals fertilisation is preceded by **courtship**. It is special behavior, a sequence of actions that allows the male and the female come together before **mating**.

There are two types of fertilisation:

### - External fertilisation.

It occurs when the gametes join outside the female's body.

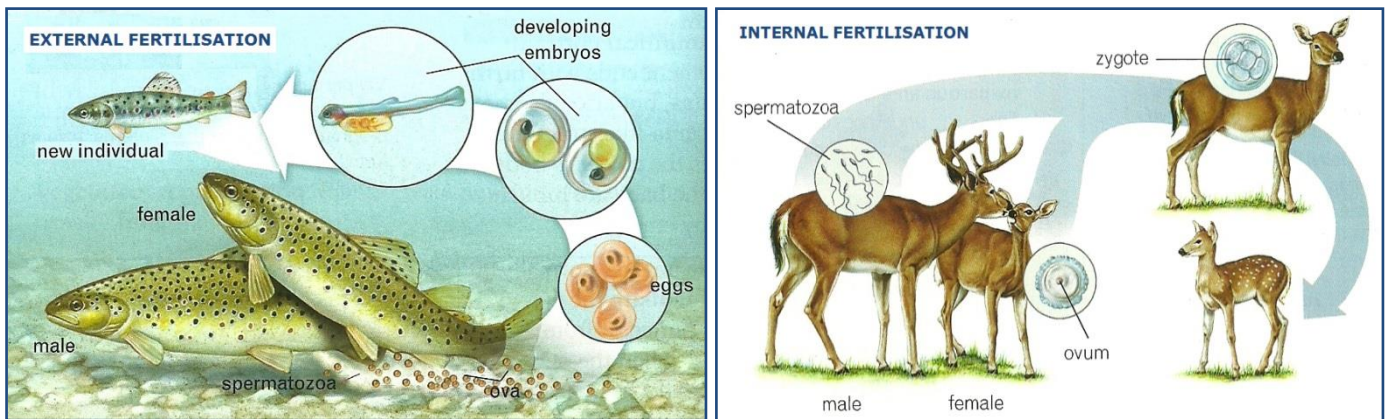
It is typical of aquatic animals and some terrestrial ones such as amphibians and some insects which spends a lot of time in water.

First, the female releases the unfertilised eggs (ova) into water and then the male releases sperm (full of spermatozoa) over them.

### - Internal fertilisation

It occurs when the gametes join inside the female's body.

It involves **copulation**, which is the transmission of sperm by copulative organs into the female reproductive system.



## b) Embryonic development

Embryonic development includes the processes from the formation of the zygote to the birth of the new individual.

After fertilization, the zygote undergoes through many cellular changes and becomes a developing organism, called an **embryo**.

Depending on where the embryonic development takes place, animals can be classified as **viviparous**, **oviparous** and **ovoviviparous**.

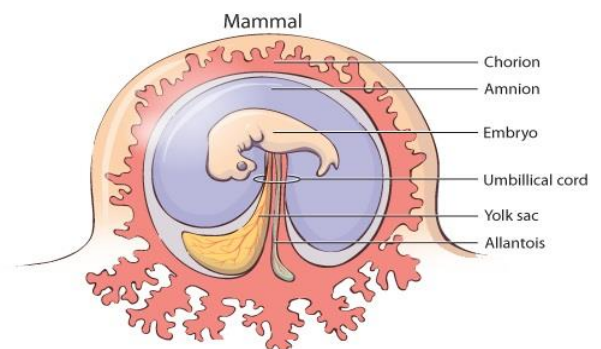
### - Viviparous

The embryo develops inside the female's body where it receives nourishment and protection. In this case, the embryo grows inside an organ in the abdomen called the **uterus** (womb).

There, a special organ called the **placenta** feeds the embryo, which is connected to it through the **umbilical cord**.

Birth occurs when the new being leaves the mother's body during **labour**.

*Mammals*, except *Monotremes*, are viviparous.



### - Oviparous

The embryo develops inside an **egg** outside of the female's body.

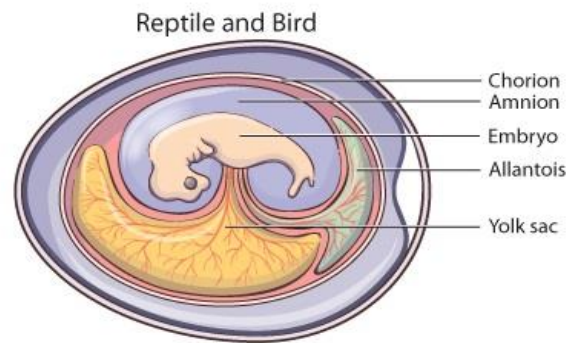
Most oviparous species lay eggs in nests and incubate them, in order to keep them warm and protected from predators.

Egg contains all the nutritive substances embryo needs to finish its development.

In this case, birth is called **hatching** and occurs when the egg hatches, that is when the new being breaks it and emerges.

There are two types of eggs:

- **Eggs without a hard shell**, such as those of *Amphibians* and *Fish*, which must be laid in water or in wet environment, so that they do not dry up.
- **Eggs with a hard shell and impermeable membranes** (Amniotic egg), such as those of *Birds* and *Reptiles*, can be laid on land as they do not dry up.



### - Ovoviviparous

The embryo develops inside an **egg** that remains inside of the female's body until it hatches. This is characteristic of *Reptiles* such as some snakes, *Amphibians* such as salamanders and *Fish* such as some sharks.

## c) Post-embryonic development

Post-embryonic development begins when the individual is born and it ends when it becomes adult and is able to reproduce.

In animals it can be:

### - Direct development.

The new-born individual is similar to the adult, but smaller.

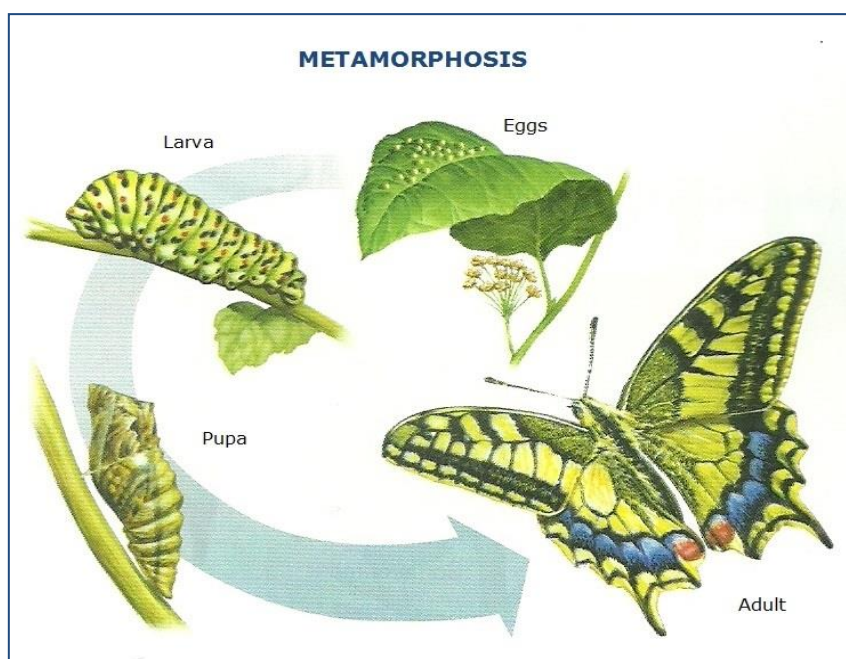
This postembryonic development consists on the growth of the body and maturity of the sexual organs.

It is typical of viviparous (*Mammals*) and oviparous animals with a large amount of nutritive substances in the egg (*Birds*, *Reptiles* and some *Insects*) that are born very developed.

### - Indirect development

The new-born individual (larva) is different to the adult. The transformation of the larva into an adult takes place through a series of transformations called **metamorphosis**.

It is typical of *Amphibians* and most part of *Invertebrates*.



**READING ACTIVITIES**

**After reading the text, copy and answer the following questions into your notebook:**

Remember: you must make complete sentences.

**2.3. Explain why:**

- Why is the fertilisation in terrestrial animals internal?
- Why is necessary sexual dimorphism in unisexual species?
- Why some animals (e.g. amphibians) only can lay eggs in wet or aquatic environments?
- Why some species (e.g. frogs) undergo metamorphosis?

**2.4. The following pictures represent the ladybug life cycle. Order them and relate each one with the descriptions below.**



- The larvae form a cocoon where it completes its development.
- After fertilisation, ladybug lays a large quantity of eggs.
- Once the transformation is completed, an adult individual emerges.
- Mating and fertilisation.
- The larvae that are born are quite different to the adults.
- When the embryo has completed its development, hatching takes place.
- The new individual is a mature adult able to reproduce.



## 3. Reproduction in Plants.

### 3.1. Asexual reproduction in plants

Asexual reproduction is more common in plants than in animals. It involves the formation of new individuals from the cells of a single parent.

There are three main types:

#### a) Spore formation:

It is typical of mosses and ferns.

A spore is a cell, surrounded by a hard protective covering. When it falls on the ground, grows into a new individual.



#### b) Vegetative reproduction:

New plants are formed from parts (buds) of the original plant. Plants can increase its distribution and when environmental conditions are too hard to survive, they stay alive in latent form, until these conditions return to be good.

These vegetative structures can be:

potato plant  
tuber

- **Tubers:**  
They can be roots or underground stems with a reserve of nutrients and buds. These tubers become new plants. E.g. Potato.

onion bulb

- **Bulbs:**  
They are underground stems with thick leaves containing nutrients. These nutrients feed the shoot which will become a new plant. E.g. Onion.

strawberry  
runner

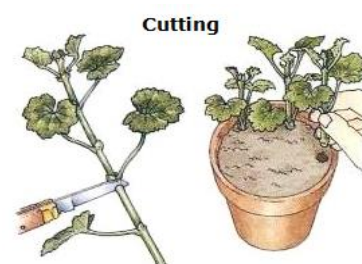
- **Stolons:**  
They are aerial stems which root when they touch the ground. If stolons are separated from the mother plant they become new plants. E.g. Strawberry.

Rhizome

- **Rhizomes:**  
They are underground stems that grows horizontally. E.g. Iris

#### c) Fragmentation

The new plant is created from a fragment of the mother plant.



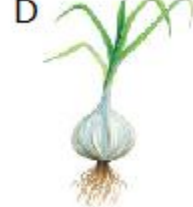
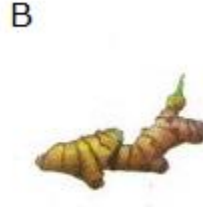
**READING ACTIVITIES**

**After reading the text, copy and answer the following questions into your notebook:**

Remember: you must make complete sentences.

**3.1. What advantages do plants obtain reproducing in a vegetative way?**

**3.2. Identify the vegetative structures that are represented in the pictures:**



### 3.2. Sexual reproduction in Plants

Plants have **alternation of generations**. In its **life cycle** it is possible to distinguish two stages:

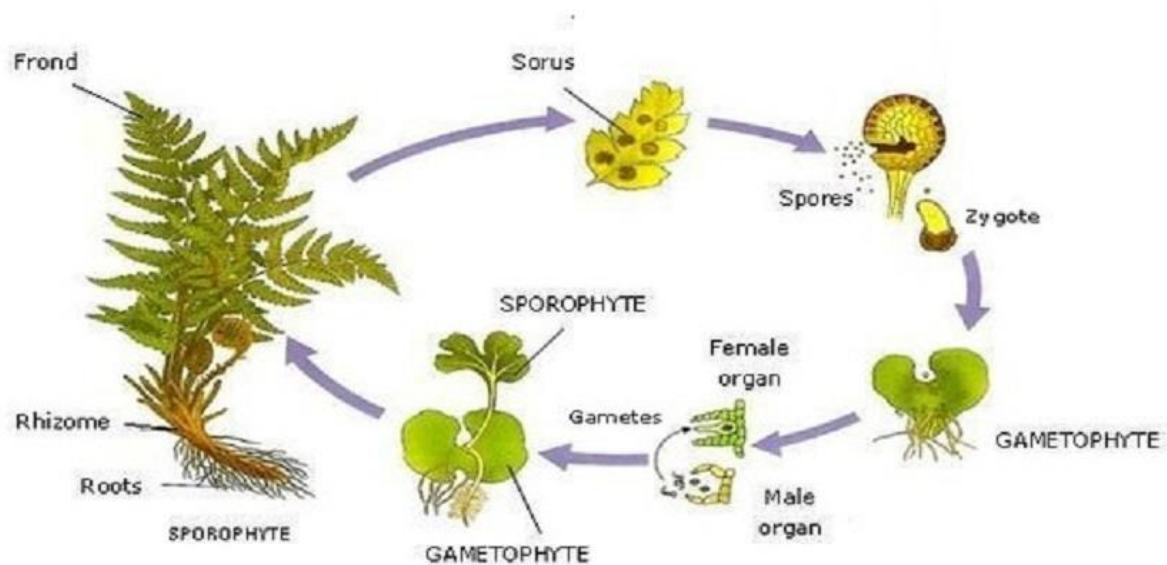
- **Sporophyte**. It is the plant that forms spores. It is the asexual stage.
- **Gametophyte**. It is the plant that forms gametes. It is the sexual stage.

The gametophyte forms gametes. These gametes join together to form a zygote. This zygote forms an embryo that develops into a sporophyte. The sporophyte forms spores which develop new gametophytes.

#### a) Seedless plants

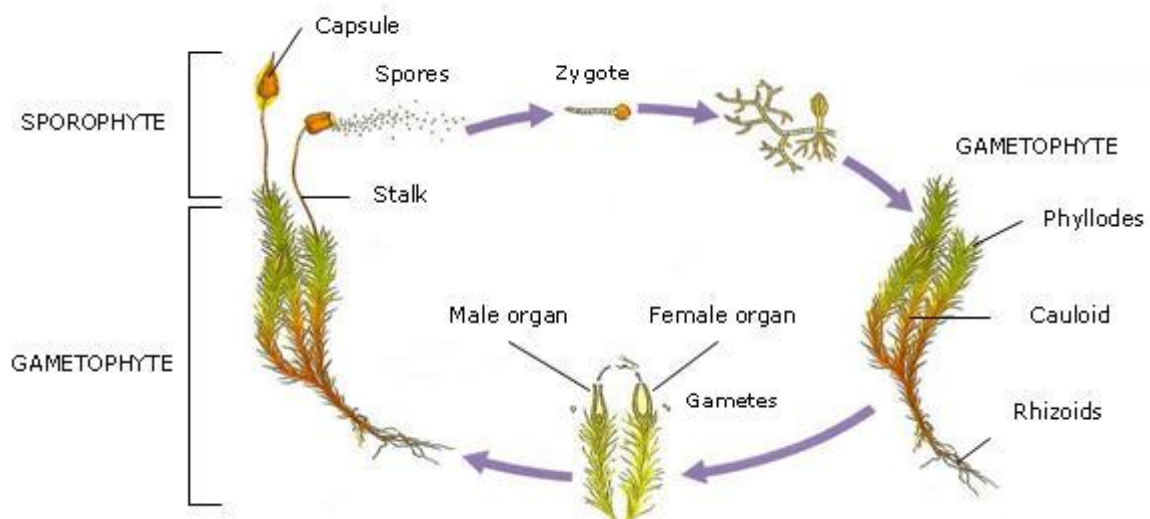
In **Pteridophytes** (ferns), gametophyte and sporophyte are different plants.

The sporophyte is the permanent part of the cycle. It is a vascular plant formed by roots, a rhizome (underground stem) and fronds (leaves). The **spores** are produced in **sporangia** called **sori** which are usually on the underside of fronds. When spores germinate a gametophyte is produced. It is very small plant with a very short life. It produces gametes (male and female). Gametes join together to form the zygote which becomes a new sporophyte.



In **Bryophytes** (mosses), sporophyte grows as part of the gametophyte.

The gametophyte is the permanent part of the cycle. It is a non-vascular plant formed by false roots, stem and leaves. Gametophyte produces gametes that join together to form a zygote. The zygote becomes a sporophyte. It grows on the top of the gametophyte. The **spores** are formed in a **sporangium** called **capsule**. When spores germinate produce new gametophytes.



## b) Seed plants

In *Spermatophytes* (seed plants), *Angiosperms* (flowering plants) and *Gymnosperms* (conifers), gametophyte is not an independent plant, but a reduced structure that forms inside the flower.

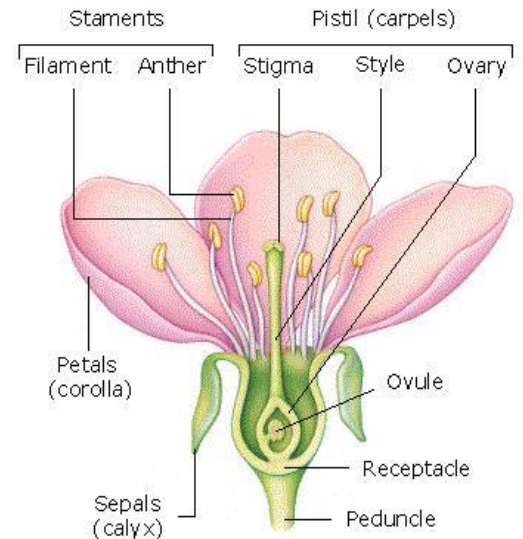
We can distinguish several phases in the life cycle of Spermatophytes:

### - Formation of gametes

The flower is a structure made up of modified leaves. It contains the reproductive organs of the plant where gametes are produced.

In a typical flower we can find:

- The **calyx**, which is the outer whorl. It is made up by **sepals**, small green leaves which function is to protect the fertile parts of the flower.
- The **corolla**, which is the next whorl, made of **petals**, coloured leaves which function is to attract animals for pollination.
- The **stamens**, which are the male reproductive organs. Each stamen is formed by a **filament** and an **anther** where **pollen grains** develop. Inside this pollen grains, males gametes are formed.
- The **pistil** which is the female reproductive organ. It is a structure formed by fused leaves (**carpels**) with three parts: the **ovary**, where **ovule** is formed, the **style** and the **stigma**. Female gametes formed inside the ovule.



The **receptacle** is the base where all the other parts are attached and the **peduncle** the small stalk that joins the flower to the plant.

Flowers can be:

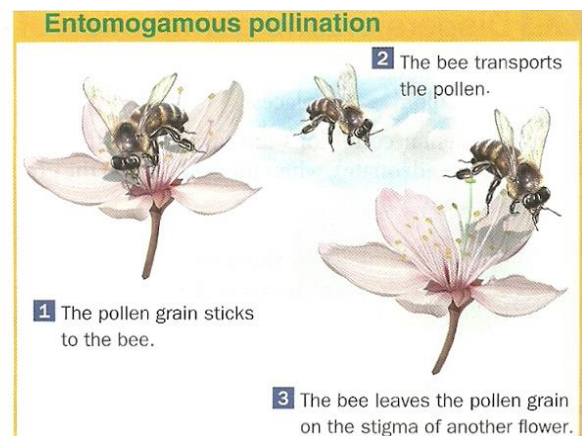
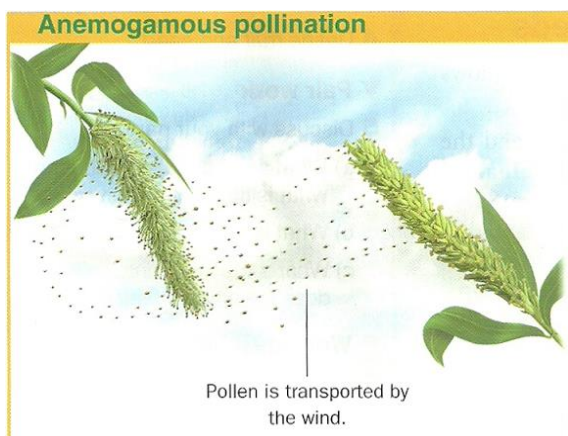
- **Complete** (it contains all the elements) or **incomplete** (it lacks of corolla or calyx).
- **Unisexual** (they only have stamens or carpels) or **hermaphrodites**.

### - Pollination

**Pollination** is the transfer of pollen grains from the anthers of a flower to the pistil of other flower of the same plant (self-pollination) or of other one (cross-pollination).

Pollen grains can be transported in two different ways:

- By **wind**. These plants have incomplete and small flowers and they produce a lot of pollen, in order to make easier its release and to assure that at least a part reaches its objective.
- By **insects**. These plants have big, coloured and fragrant flowers and usually produce a sweet substance called nectar, in order to attract insects. They do not need to produce a great amount of pollen because insects carry it directly to other flower.

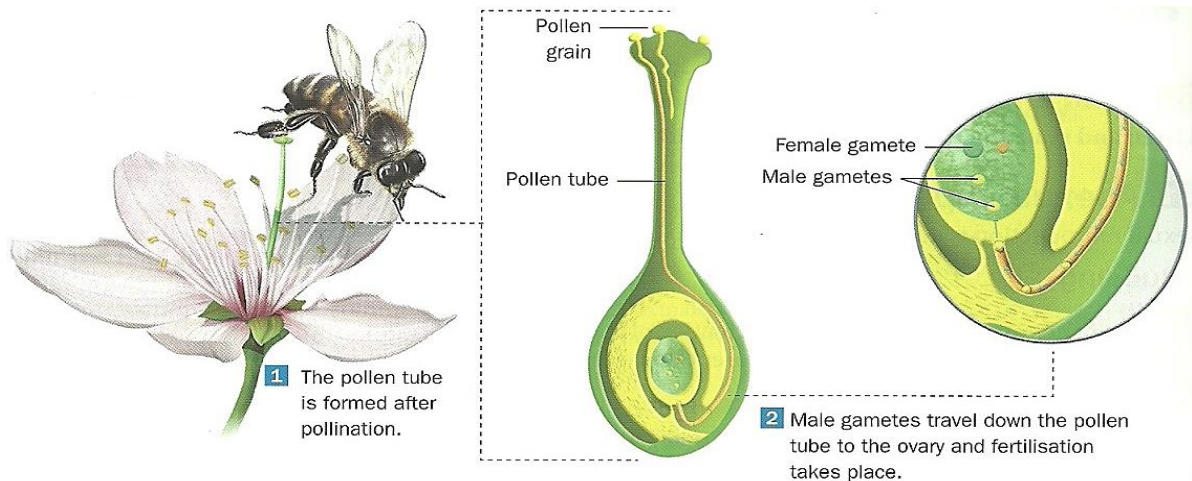


## - Fertilisation

**Fertilisation** consists of the union of the male gamete and the female gamete.

When the pollen grain reaches the stigma, it forms a pollen tube, which grows along the style until it reaches the ovary and the ovule inside.

The male gamete goes down inside its pollen tube. When it arrives to the ovule, join together with the female gamete and the zygote is formed.



## - Formation of the seed and the fruit

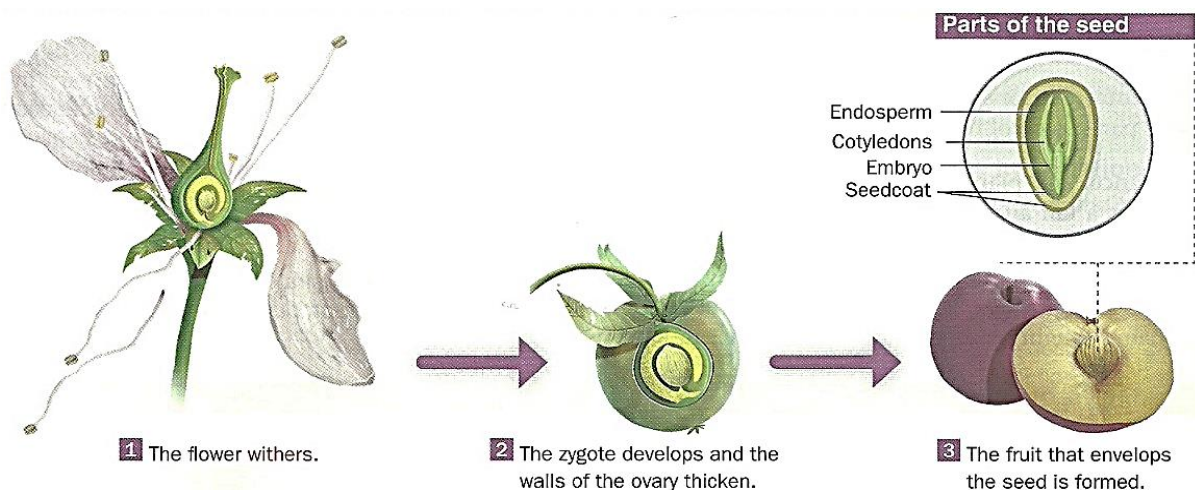
The **seed** is formed from the ovule tissues. The seed is composed by three parts:

- The **embryo** is produced by the zygote. It is a tiny plant formed by the radicle (embryonic root), the plumule (embryonic stem) and one or two cotyledons (embryonic leaves) that store nutrients.
- The **albumen** (or endosperm) is a nutritious substance that envelops and feed the embryo.
- The **seed coat** is a hard protective envelop.

The **fruit** is formed from the ovary tissues in *Angiosperms*. After fertilisation, the flower loses the sepals, petals, stamens, the style and the stigma. The walls of the ovary grow and develop with the seed inside.

The fruit function is to protect the seed and help in its dispersion. There are two types of fruits:

- **Fleshy fruit**, such as tomatoes or peaches, where the part around the seed is a juicy pulp.
- **Dry fruit**, such as sunflower seeds or nuts, where the seed has a stony fruit wall.



## - Dispersion and germination

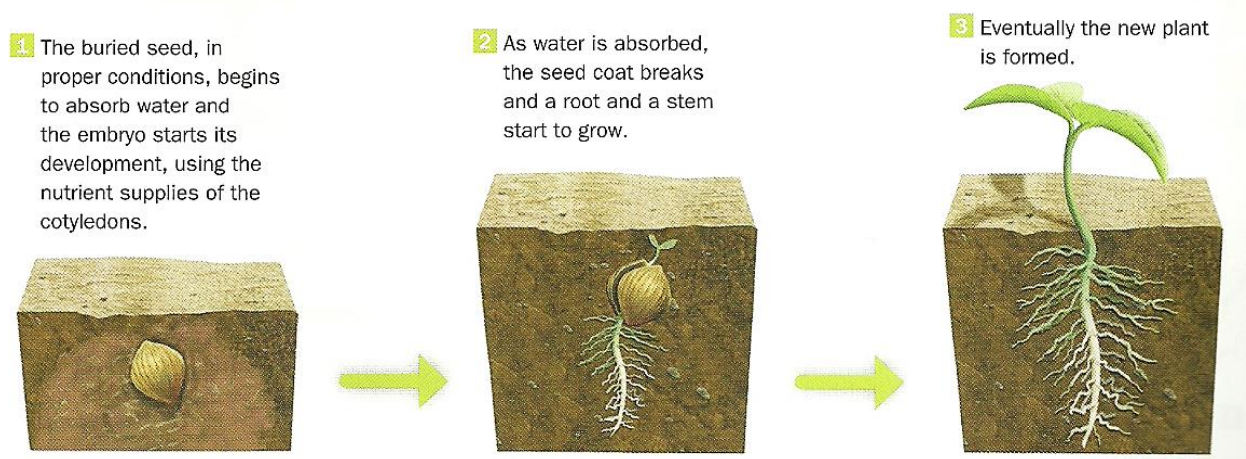
Dispersion of seeds and fruits can occur in the following ways:

- By **animals**:
  - Animals eat plants, but they can't digest the seeds. So these seeds are then released in the animal's faeces in different places.
  - Some fruits are not edible but they have hooks that stick to the fur of animals, so they are dispersed as animals move around.
- By **wind**: Some fruits and seeds are shaped like wings or windmills.
- By **water**: Some fruits and seeds have waterproof covers that allow them to float.

For germination to take place the seeds must disperse: they must land on suitable ground, at a distance from the mother plant and have enough space, light and nutrients.

**Germination** begins when the seed absorbs water, which causes its coat to break. The seed opens and the embryo begins to develop to create a new plant.

In the first stages the new plant feed on the supplies stored in the seed until it can carry out photosynthesis and begins to make its own nutrients.



### READING ACTIVITIES

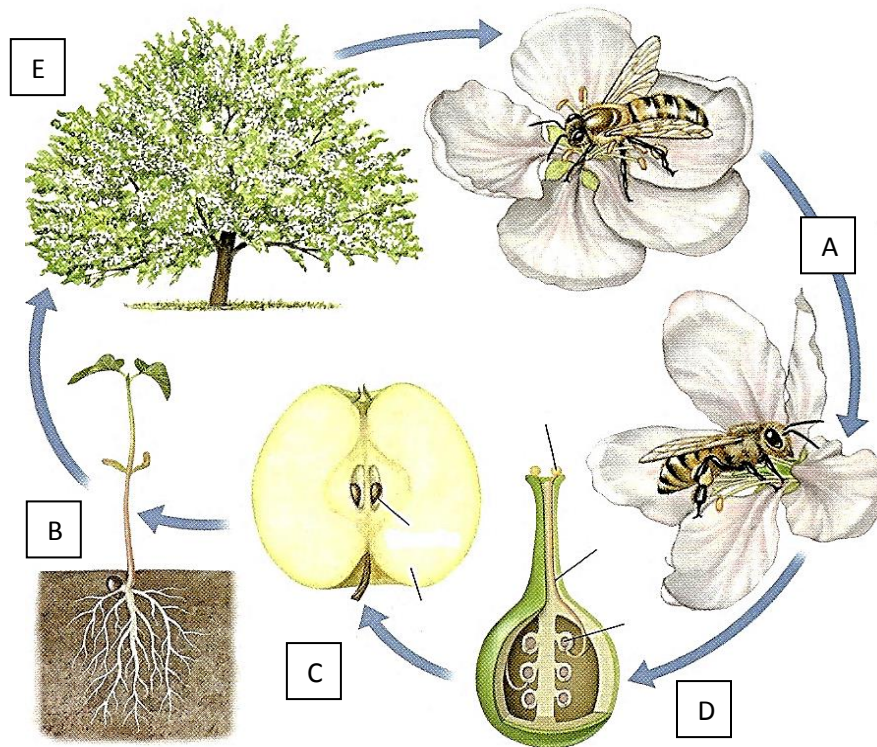
**After reading the text, copy and answer the following questions into your notebook:**

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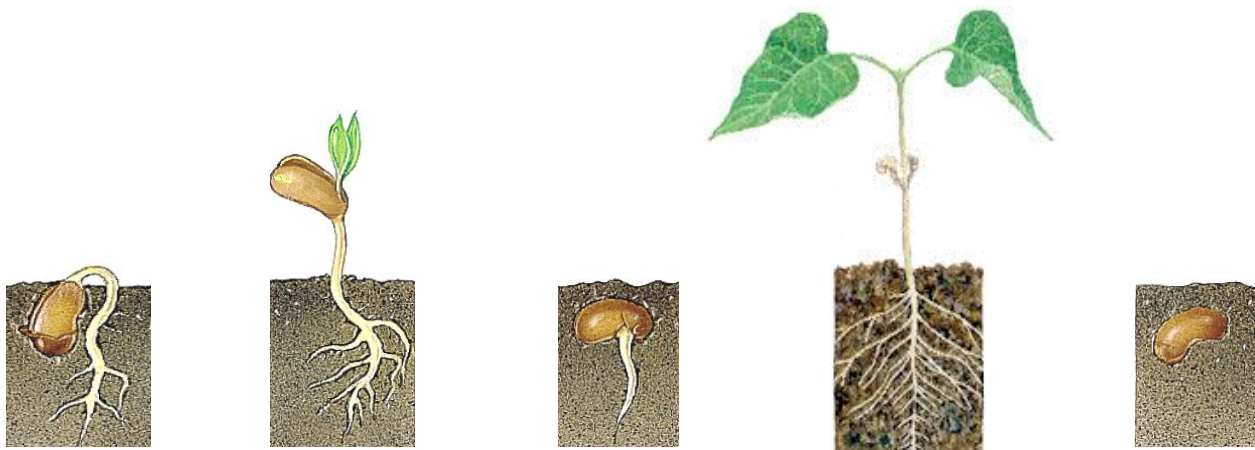
### 3.3. Indicate which of the following characteristics allow to plants pollinated by insects (I) and to plants pollinated by wind (W).

- a. They produce a lot of pollen
- b. They have flowers with coloured petals
- c. They produce nectar
- d. Their flowers have little or no scent at all
- e. They have big and bright coloured flowers
- f. They have very fragrant flowers
- g. They produce little pollen
- h. They don't produce nectar
- i. Flowers usually grow at the end of the branches
- j. Flowers are small and, often do not have petals

**3.4. Identify the phases of this Angiosperm's life cycle.**



**3.5. Cut out these pictures and glue them in the right order in your notebook. Complete the sentences and relate them with their correspondent image. What process is represented?**



- The ..... waits for favourable conditions to .....
- The ..... appears when there is enough moisture in the soil.
- The seed ..... falls and the young ..... come out of the soil.
- The ..... feed the plant while it hasn't got real leaves to perform .....
- Finally, the first real ..... appear and the cotyledons fall down.