UNIT 4. REPRODUCTION
1. LIFE CYCLE

- The life cycle of an organism is the stages which it passes through during its life.

- Living beings go through several different stages during its life:
  - First it is born
  - Next it develops and grows to become an adult
  - Then it reproduces to produce offspring
1. WHAT IS REPRODUCTION?

- Reproduction is the biological process by which new individual organisms (offspring) are produced.

- It ensures the perpetuation of the species.

- Progenitors are able to multiply and generate new living beings, descendants.
1. WHAT IS REPRODUCTION?

There are **two** main types of reproduction:

- **Asexual reproduction**: a single individual is able to separate a part of its body and this develops into a new being. The descendants are genetically identical to the progenitors. To reproduce the living being need the right environmental conditions and enough food. The advantage is that one parent can produce a lot of offspring, so the population can increase rapidly. Asexual reproduction happen in algae, protozoa, fungi and some plants and animals.
1. WHAT IS REPRODUCTION?

- **Sexual reproduction**: two individuals (male + female) are necessary. Each one makes different special cells: the gametes, which join together and become a single cell a zygote, by means of fertilisation. The descendants have a combination of genetic material contributed from both parents. To reproduce two organisms need to find each other. Also, one type of gamete needs to be able to move easily, and the gametes need to be in a liquid for carry out fertilisation and a lot of resources are needed to produce gametes and develop the embryo. The advantage is that organisms are more diverse, so they are better at adapting to changes in their environment. Sexual reproduction happens in plants and most animals.
2. ASEXUAL REPRODUCTION IN ANIMALS

- It only occurs in the most simple and least evolved animals.

- **Types:**

<table>
<thead>
<tr>
<th>GEMMATION</th>
<th>FRAGMENTATION</th>
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<tbody>
<tr>
<td>- An outgrowth, bud, from the body of the parent, develops into a new individual.</td>
<td>- A new organism grows from a fragment of the parent. Each fragment develops into a fully grown individual.</td>
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<td>- Hydra, coral (colony)</td>
<td>- Planaria worm, starfish</td>
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http://www.edistribucion.es/anayaeducacion/8430042/UNIT_4/unit_04_video_05.html
2. ASEXUAL REPRODUCTION IN ANIMALS

- GEMMATION
- FRAGMENTATION
3. SEXUAL REPRODUCTION IN ANIMALS.

Sexual reproduction in animals usually requires two members of the opposite sex, a male and a female.

- Each member has different reproductive organs called gonads. The male gonads are the testicles and the female gonads are the ovaries.
- These organs make reproductive cells called gametes. The male gamete is called spermatozoon (they are very small and they can move easily) and the female gamete is called egg or ovum (they are much bigger than sperm because they contain nutrients).
3. SEXUAL REPRODUCTION IN ANIMALS.

- Depending on the type of gonad present, animal can be:
  - **Unisexual**: Each individual has only one type of gonad. Most animals are unisexual.
  - **Hermaphrodite**: Each individual has both male and female gonads. Examples of hermaphrodites: snails and slugs, as well as some types of worms, molluscs, crustaceans and fish. *(Normally they don’t fertilise themselves, they still need two parents to produce offspring. One parent acts as the male and the other acts as the female)*
3. SEXUAL REPRODUCTION IN ANIMALS.

- **UNISEXUAL:**

- In certain species of animals, the two sexes differ only in their sexual organs. Examples are rabbits, cats, dogs, etc.

- In other species, in addition to having different reproductive organs, females and males are very different in their appearance: these species exhibit **sexual dimorphism**. Examples of species that display sexual dimorphism are lizards, lions, many birds, human beings, etc.
4. WHAT IS FERTILISATION?

- **Fertilisation** is the union of an ovum and a spermatozoon. When the eggs and spermatozoon join, they form a fertilised egg called a zygote. Initially, the zygote is just one cell, but then the cell divides by mitosis. The cells continue dividing, so there are more and more cells.

- There are two types of fertilisation:
  - **External fertilisation** is the union of the gametes which occurs outside the female’s body. First, the female releases the unfertilised eggs. Then, the male releases sperm to fertilise them. The fertilised eggs then develop into embryos, and finally, into adult individuals. With external fertilisation, each egg has low chance of being fertilised, so the animals need to release large amounts of eggs and sperm. It is typical of aquatic animals, and some terrestrial ones such as amphibians and some insects.
  
  - **Internal fertilisation** is the union of the gametes which occurs inside the body of the female. It involves copulation which is the transmission of spermatozoon of the male into female. It is typical of most terrestrial animals and some fish.

http://www.edistribucion.es/anayaeducacion/8430042/UNIT_4/unit_04_video_06.html
4. WHAT IS FERTILISATION?

Life cycle with external fertilisation
- Female
- Male
- Ova
- Spermatozoa
- Developing embryos

Fusion of the gametes occurs outside the female body.

Life cycle with internal fertilisation
- Female
- Male
- Ova
- Spermatozoa
- Zygote

Fusion of the gametes occurs inside the female body.
5. EMBRYONIC DEVELOPMENT

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

- After fertilisation, the zygote undergoes many cellular changes and becomes a developing organism, called an embryo.

- Depending on where embryonic development take place, animals can be classified as:
  - **Viviparous:** The embryo develops inside the female body. The embryo grows inside of uterus. The placenta feeds the embryo through the umbilical cord. Embryonic development ends with birth. Is typical of mammals with placentas, but also of some fish, reptiles and amphibians with placenta-like structures.

  - **Oviparous:** The embryo develops inside an egg (that contains nutrient to feed the embryo). To start with, the egg is inside the mother, then the mother lays the egg, so the embryo finishes developing outside the mother. Embryonic development ends when the eggs hatches (the baby breaks out of the eggs). This is typical of birds, reptiles and fish.

  - **Ooviviparous:** The embryo develops inside an egg which remains inside the female’s body until it hatches. The eggs hatch inside the mother, and then the mother gives birth to live offspring. The egg contains nutrients to feed the embryo. This is typical of some sharks, rays, snakes and lizards.
6. POST-EMBRYONIC DEVELOPMENT

- It is the growth of the organism until it reaches the adult state, in which it acquires the ability to reproduce.

- There are two types:
  - **Direct development:** The new-born individual is similar to the adult, only smaller. Its development consists of: growth and maturity of the organs. Animals that receive a lot of nutrient before they are born develop in this way. Examples: mammals, birds, and most types of fish and reptiles.

  - **Indirect development:** Some animals develop less before they are born, because they don’t receive as many nutrient. The offspring has to go through various changes in order to become an adult. These changes are called metamorphoses. Examples: many insects, amphibians and molluscs. There are two types of metamorphosis:

    - **Incomplete metamorphosis:** the offspring that hatch from the eggs are called nymphs. They already look like small adults, but in order to grow they have to moult (change their exoskeleton) several times.

    - **Complete metamorphosis:** The offspring look completely different from the adult. They are called larvae. They have to go through bigger changes to become adults, in which the larva loses some organs and generates others.
6. POST-EMBRYONIC DEVELOPMENT

- INCOMPLETE METAMORPHOSIS
6. POST-EMBRYONIC DEVELOPMENT

- COMPLETE METAMORPHOSIS

http://www.edistribucion.es/anayaeducacion/8430042/UNIT_4/unit_04_video_08.html

http://www.edistribucion.es/anayaeducacion/8430042/UNIT_4/unit_04_video_07.html
7. ASEXUAL REPRODUCTION IN PLANTS

- It involves the formation of new individuals from the cells of a single parent.

- There are two main types:
  - Spore formation: The nucleus of the parent cell divides repeatedly into a number of daughter cells, called spores. These spores become new individuals without attaching themselves to other cells. Ferns and mosses reproduce by spores.
7. ASEXUAL REPRODUCTION IN PLANTS

- **Vegetative reproduction**: Plants create new individuals from a particular organ, usually from the stem. Types:

  - **Bulb**: is a stem with thick leaves that grows underground. Example: onions, tulips, garlic...
  - **Tuber**: is an enlarged stem or toot that grows underground. The tuber contains a store of nutrients that the new plant can use. Example: potatoes
  - **Stolons or runners**: are stem that grow horizontally above the ground. A new plant can grow from the runner. Example: strawberries, clover, spider plant...
8. SEXUAL REPRODUCTION IN PLANTS

- **Sexual reproduction**: It is typical of plants with seeds. The reproductive organs are inside the flower, where gametes are produced.

- **The flower structure consists of the following parts:**
  - **Calyx**: is formed of the green sepals which protect the flower.
  - **Corolla**: is formed of the brightly coloured petals. The petals attract insects to facilitate pollination.
  - **Stamen**: is the male reproductive organ of flower. It consists of filament and anthers (where the pollen is stored)
  - **Pistil**: is the female reproductive organ of the flower. It consists of stigma, style and ovary (where the ova are stored)
8. SEXUAL REPRODUCTION IN PLANTS

- The flower structure:

http://www.youtube.com/watch?v=X7zW5W6XGeg
8. SEXUAL REPRODUCTION IN PLANTS

- Sexual reproduction in flowering plant has several stages: pollination, fertilization, seed dispersal and germination

- **Pollination**

Pollination means *transferring the pollen from the anther to the stigma*:

- **self-pollination** is transferring the pollen to the stigma of the *same plant*
- **cross-pollination** is transferring the pollen to the stigma of *another plant*

Pollination is done by *insects* or by the *wind*.

- **Insect pollination**
  - Bees and other insects carry pollen from the anther to the stigma. Plants that use *insects* for pollination:
    - have flowers with a *strong smell* and *brightly coloured petals* to attract insects
    - produce *sweet nectar*, which insects eat
    - have *sticky stigmas* to take the pollen off the insect

- **Wind pollination**
  - The wind carries pollen from the anther to the stigma. Plants that use the *wind* for pollination:
    - have *smaller, dull-coloured flowers* with *no smell*
    - have *long filaments* so that the pollen blows away easily
    - produce *a lot of pollen*, because only a small amount will reach another plant
8. SEXUAL REPRODUCTION IN PLANTS

- **Fertilisation**

Fertilisation happens when *male pollen and female ovules join together*:

1. The pollen lands on the stigma.
2. A pollen tube grows down the style into the ovary.
3. The pollen nucleus moves down the tube and joins with the ovule nucleus.
4. The ovary turns into a fruit and the ovule grows into a seed.

Some fruits are soft and juicy, like peaches and apples. Others are hard and dry, like nuts and legumes (beans).

**Types of Fruit**

- **Dry Fruit**
  - Wheat
  - Almonds
  - Doubtful knight’s spur
  - Buttercups

- **Fleshy Fruit**
  - Tomatoes
  - Grapes
  - Melon
  - Cherries
  - Oranges
8. SEXUAL REPRODUCTION IN PLANTS

Seed dispersal

If all of the seeds tried to grow in the same place, there would not be enough space, nutrients or water for them. They therefore need to be spread over a bigger area. This is called dispersal.

There are two main ways of dispersing the seeds:
1. The seeds are carried by the wind.
2. Animals eat the seeds. They move to a different place, and eventually the seeds come out in their faeces. Animals can also carry seeds on their fur.
8. SEXUAL REPRODUCTION IN PLANTS

- **Germination**

If the conditions are right, the seed starts to **grow and develop into a new plant**. This is called **germination**. Seeds need three things in order to germinate:

- water
- warmth
- oxygen

If the seed does not have these three things, it might stay **dormant** (without germinating) until the conditions improve.

The seed has a hard case called a **seed coat**. Inside is the **embryo** and the **endosperm**, which contains nutrients. The seed **starts to grow** using the nutrients in the endosperm. The **root develops first** and takes in water. After this, the **shoot starts to grow** and produce leaves.
8. SEXUAL REPRODUCTION IN PLANTS

TO SUM UP:

1. The pollen grains land on the pistil helps by wind, insects...(Self -pollination or cross-pollination)
2. Then pollen tubes develop until they reach the ovary, where fertilisation occurs.
3. Inside the ovary the male (pollen) and female (ovum) gametes fuse to form the zygote.
4. The zygote grows into an embryo.
5. The ripened ovule becomes a seed. The seed contains the embryo and food for the new plant (endosperm). The seed feeds the plant until it grows green leaves responsible for photosynthesis.
6. The ripened ovary becomes the fruit (dry fruit or fleshy fruit). It is responsible for protecting and dispersing the seed.
7. Seed germination to develop a new plant.
8. SEXUAL REPRODUCTION IN PLANTS

TO SUM UP:

1. Pollen grains land and a pollen tube develops.
2. The ovule (female gamete) is fertilised and a zygote is formed.
3. The ovary becomes the fruit and the ovule becomes a seed.
4. The seed germinates and an embryo develops.