

### Topic 3 - Passing It On

Characteristics are passed on from generation to generation through the reproductive process. Some characteristics, or traits, are inherited through genetic material. Living organisms display a wide variety of **reproductive strategies** for passing on their genetic information to their offspring.

#### Asexual Reproduction

Asexual reproduction involves only one parent who passes on the genetic information to their offspring. This sharing of genetic information makes the offspring identical to the parent. There are different types of asexual reproduction:

- **Binary Fission** - only single-celled organisms reproduce in this way. The cell duplicates its contents, including its nucleus and other organelles and then splits into two cells with each one being identical. (**bacteria, amoeba, algae**)



- **Asexual Spore Production** - spores are similar to seeds, but are produced by the division of cells on the parent, not by the union of two cells. One parent may produce many spores, each of which will grow into a new individual, identical to its parent. (**fungi, green algae, moulds, ferns**). Many spores are produced to ensure that at least some of the individual organisms will survive. Zoospores can also be produced by some fungi and green algae. They move using tail-like flagella.
- **Asexual Reproduction in Plants**  
A plant continues to grow throughout its life. The rapidly growing tips of roots and stems contain specialized reproductive cells called **meristem**. At a certain time these cells will specialize into cells that make up roots, stems and leaves. If parts of the plant are damaged, the meristem cells make repairs. Clones can be made from cuttings of a plant, because the meristem cells can specialize to reproduce the different parts needed to make a new plant. **Asexual reproduction** can produce many plants very quickly. This is an advantage in places where the environment doesn't change very much (**bacteria**). By building a large population of organisms very quickly the species is able to thrive. The great disadvantage is that when the environment changes, all of the organisms will die, if they do not have the ability to adapt to the change.
- **Budding** - the parent organism produces a bud (a smaller version of itself), which eventually detaches itself from the parent and becomes a self-sufficient individual - identical to the parent. Coral also reproduces in this way, but do not detach themselves (**hydra, yeast, coral, sea sponge**).

#### Sexual Reproduction

Sexual reproduction usually involves two individual organisms. The offspring that are produced from this union have a mix of characteristics, half from one parent and the other half from the other parent. Sexual reproduction does not always involve male and female parents, but can have specialized **gametes** (reproductive cells that have only one role - to join with another gamete during reproduction). Many organisms are capable of both sexual and asexual reproduction, like some moulds, such as **Rhizopus**, which produce spores. They can also produce **zygospores**, enabling them to reproduce sexually as well.

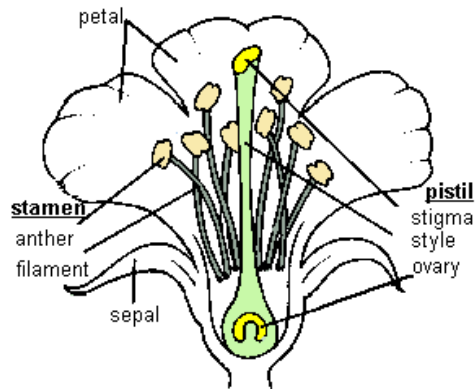
Sexual reproduction has the advantage of providing lots of variation within a species, helping it to survive when the environment changes. The main disadvantage is that this process takes a lot of energy. This means that they can only produce small populations.

### Bacterial Conjugation

Bacteria are able to transfer genetic material directly from one cell to another through a process called **bacterial conjugation**. It is a primitive form of sexual reproduction, since two parent cells are involved. The benefit is that new combinations of inherited characteristics may result. Although this process is not actually reproduction, because there is no increase in the number of cells, it does result in **genetic recombination**. The newly created cell can then divide by binary fission, to create identical cells with the new genetic material.

### Sexual Reproduction in Plants

Sexual reproduction in plants involves gametes as well, male gametes and female gametes joining, during **fertilization**, to produce a zygote and then an embryo. Most plants produce both male and female gametes, while some produce one or the other only.



**Pollen** contains the male **gametes** and is found on the **stamen**. **Ovules** contain the female gametes and are found in the **pistil**. **Pollination** occurs when pollen is transferred from the **anther** of the **stamen** to the **stigma** of the **pistil**. **Cross-pollination** occurs when **pollen** from one plant is carried to the **stigma** of another plant by wind, water or animals (bees or butterflies). **Cross-fertilization** occurs when a grain of the **pollen** forms a **long tube (pollen tube)**, which grows down the **style** into the **ovary**. The **gametes** unite to produce a **zygote**, which then develops into an **embryo**. This usually happens inside a **seed**, which protects the embryo and provides food (**cotyledon**) for the embryo when growing conditions are right. Plants which are produced, as a result of **cross-fertilization**, are not identical to either plant.

### Plants reproduce Sexually and Asexually

Sponges and hydra are organisms that can produce both sexually and asexually. Most plants that produce seeds can also reproduce asexually (cuttings, runners). Depending on the environmental conditions the amount of energy varies, enabling the plant organism to control its population.

**Vegetative Reproduction** - is the reproduction of a plant not involving a seed, including; cuttings, runners, suckers, tubers. (**coleus plant, spider plants, strawberries, aspen, potatoes**)

Mosses produce asexual spores in the early part of their life cycle and then egg and sperm cells are produced in a later part of the same cycle.

### Sexual Reproduction in Animals

Sexual reproduction in animals involves gametes. The male gametes are called **sperm cells**, and the female gametes are called **egg cells (ova)**. During mating, the sperm cell and the egg cell unite to form a fertilized combination of cells called a **zygote**. This zygote is the first of many cells of a new individual. This zygote will begin to divide into two cells and this continues to be repeated over and over resulting in the development of an **embryo**. This embryo develops into a multi-cellular organism inside the female (in most mammals) or, outside (in an egg shell) in other animals.