

## Asexual Reproduction

Asexual reproduction involves only one parent. All of the offspring are identical to the parent.

**Binary Fission** - The cell splits into two cells and each one is identical. (only single-celled organisms reproduce in this way; **bacteria, amoeba, algae**)

**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. (**hydra, yeast, coral**)

**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. (**fungi, green algae, moulds, ferns**)

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

## Sexual Reproduction in Plants

Sexual reproduction in plants 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, which grows down the **style** into the **ovary**. Gametes unite to produce a **zygote**, which then develops into an **embryo**. This usually happens inside a **seed**, protecting the embryo and providing 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.

## Sexual Reproduction in Animals

Sexual reproduction in animals involves **gametes** (reproductive cells that have only one role - to join with another gamete during reproduction). 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.

### Sexual & Asexual Organisms

**Sponges** 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.

## Advantages and Disadvantages of Asexual and Sexual Reproduction

Variation usually helps a species survive when the environment changes.

**Asexual reproduction** does not require any specialized cells to produce a new plant. It can therefore 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.

**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.

## DNA

DNA is the blueprint that is passed on from the parents to the offspring and is found in a molecule of the cell nuclei. This molecule, **deoxyribonucleic acid**, (DNA) is the inherited material responsible for variation. All living organisms contain DNA in their cells.

DNA is the inherited material responsible for variation. Characteristics are passed on from one generation to another within a species through the genetic code of the parents. This genetic code is called DNA.

Captive breeding programs enable scientists to control populations of species at risk of extinction. Using modern technology, geneticists and staff from zoos around the world can analyze the genetic code of the species they are trying to save and use it to introduce variation that will help the species survive when the environment changes.

## DNA and the Genetic Code

DNA was discovered prior to 1944. All DNA molecules contain exactly the same chemicals, but the way the chemicals combine determines the characteristics of the organism. **James Watson and Francis Crick** unraveled the structure of DNA, revealing the key to the multitude combinations of variation that are possible.

The DNA molecule is like a ladder twisted into a spiral (see image). The sides of the ladder are the same in all DNA molecules, but the rungs are what make the variations. Each rung pairs up two of the following chemicals: **guanine** (G), **cytosine** (C), **adenine** (A) and **thiamine** (T). The arrangement of these four chemicals creates the code that the cells are able to interpret.

## Chromosomes

DNA contains all the instructions, which create the organism's characteristics. The multitude of characteristics for each organism means that there is a lot of DNA in any one cell.

This DNA is arranged in the cell in compact packages, called chromosomes. Every human cell contains 46 chromosomes. In order to have a complete human organism, all 46 of the chromosomes must be present.

Not all organisms have the same number of chromosomes (Dogs have 78, cats have 38). Every cell of a human contains 23 pairs of chromosomes (dogs 39, cats 19). Not all of the chromosomes from species to species are the same, which accounts for the different characteristics between the species.

## Genes

A single **gene** is an uninterrupted segment of DNA, which contains the coded instructions for the organism. Researchers found out that (by working on the fruit fly):

- Genes are located in the chromosomes
- Each chromosome has numerous gene locations
- Genes come in pairs
- Both genes in a pair carry DNA instructions for the same thing
- Specific characteristic genes occupy matching locations on the two chromosomes
- DNA code may not be exactly the same in both locations

Offspring inherit genes from both parents. The genes exist in an array of possible forms that differ as to their exact DNA sequence. These variations in forms are called **alleles**. The ultimate combination of the chromosome pair is what makes the variation possible - combining the different variations of different characteristics to create a unique variation.

## Cell Division & Asexual Reproduction

Asexual reproduction involves only one parent. All of the offspring are genetically identical to the parent. In single celled organisms, **binary fission** enables the parent cell to split its contents equally between the two new cells. Prior to this division, the parent cell duplicates its DNA and when the split takes place each new cell receives a complete exact copy of the DNA, of the parent. In multi-cellular organisms the process that produces two new cells with the same number of chromosomes is called **Mitosis**.