# Part B: Sexual Reproduction

Genetic material is made up of the molecule Deoxyribonucleic Acid (DNA). It is stored in the nucleus of the cell, packaged into structures known as chromosomes.

DNA is made of nucleotides. Each nucleotide is composed of a sugar and a base. The sugar molecules of the nucleotides are joined together in long chains. Each DNA molecule is made up of two strands of nucleotides twisted together to form a double helix.

The code or DNA sequence is determined by the sequence of base molecules on the nucleotides. DNA contains for different bases – Guanine (G), Cytosine (C), Thymine (T) and Adenine (A). If we find a Guanine on one strand of a DNA molecule we find a Cytosine at the corresponding position of the other strand. If we find a Thymine on one strand of a DNA molecule we find an Adenine at the corresponding position of the other strand.

The sequence of bases in our DNA dictates how are cells behave. The DNA itself does not directly control cell function. Instead, DNA codes for a messenger molecule that then results in different proteins being produced. Protein molecules are chains of amino acids. Three bases on a DNA strand creates a codon or code word which identifies with 1 of 21 potential amino acids.

DNA sequence → Protein Sequence → Protein Function

If we change the sequence of the DNA bases we can change the sequence of the amino acids joined together to made the protein. Changes to amino acid sequence can change the functionality of the protein.

DNA is stored in a tightly coiled structure in the form of chromosomes. Each chromosome is made up of two chromatids joined by a centromere.

The number of chromosomes we would expect to find in the nucleus of a cell is known as the chromosome compliment. Human body cells (somatic cells) normally contain 46 chromosomes. Somatic cells are said to be diploid. Somatic cells contain 23 pairs of homologous chromosomes – organised as two sets of 23 chromosomes. An individual inherits one set of 23 chromosomes from each parent.

(b) Sexual Reproduction

Each sex cell (sperm or egg) contains 23 chromosomes. These are said to be haploid.

The chromosome compliment of a cell is determined using a karyotype.

Sex cells are produced by an individual once they reach sexual maturity. The process of gamete formation is known as meiosis. Meiosis gives rise to the random assortment of chromosomes which results in variation amongst the offspring produced. During the process of meiosis the gamete mother cell undergoes division twice resulting in four potential gametes being produced.

1 x Diploid gamete mother cell (46 chromosomes) → 4 x Haploid gametes (23 chromosomes)

Male gametes (sperm) are produced in the testes. Female gametes (eggs) are produced in the ovaries. During sexual intercourse, a male may ejaculate in the vagina of a female. This releases sperm into the female reproductive tract. Sperm travel through the cervix into the uterus. From the uterus they enter the oviduct. If the sperm meet an ovulated egg, fertilisation may occur. Fertilisation occurs in the oviduct of the female.

At fertilisation a single sperm will fertilise a single egg. The two haploid cells fuse their nuclei together to form a diploid cell (the zygote). The zygote will begin dividing to produce an embryo. The embryo implants in the wall of the uterus and undergoes further divisions to produce an infant.

Due to the random assortment of chromosomes during meiosis AND the infinite number of sperm/egg combinations, sexual reproduction leads to variation within a species.

The sex of an offspring is determined by the sex chromosomes inherited from each parent. In humans, the mother gives each offspring an X chromosome. The father will give either an X chromosome or a Y chromosome.

Individuals inheriting XX sex chromosomes develop as females.
Individuals inheriting XY sex chromosomes develop as males.

(b) Sexual Reproduction

Plants can reproduce by sexual means, leading to variation within a species.

The main sexual organs of a plant can be found in the flower.

> The male parts of the flower are called the stamen. The stamen is made up of the anther and filament. Male sex cells are produced by the anther and packaged within the pollen grains.
>
> The female parts of the flower are called the pistil. The stigma, style and ovary make up the pistil. Female sex cells are produced by the ovary and packaged within the ovules.

Pollination is the process by which the male sex cells are transferred from the anther to the stigma. Once on the stigma, a pollen tube grows from the pollen grain down the style to the ovary. Once in the ovary, the male sex cell passes down the pollen tube. When it arrives at the ovary fertilisation occurs, the male sex cell fuses with the female sex cell forming a zygote. The zygote develops into a seed whilst the ovary develops into the fruit.