

4.3 DNA AND INHERITANCE

Overview

This topic covers the structure of DNA and how it acts as a code for the production of proteins and therefore produces the differences seen between different individuals. The application of genetic profiling as an application for looking at differences between individuals is studied. The mechanisms of inheritance are also covered, including the use of Punnett squares.

Working Scientifically

There are opportunities within this topic to discuss the methods by which scientific theories develop over time when teaching the structure of DNA. The discussion of genetic profiling also raises issues with regard to the ethical issues which may arise regarding the ownership of this information and also lead to a discussion regarding evaluating the personal and social implications of this. The topic of transfer of genes can also lead to the development of explanations of the technological applications of science.

Mathematical skills

There are a number of opportunities for the development of mathematical skills within this topic. These include being able to understand and use direct proportions and simple ratios in the study of genetic crosses, understanding and using the concept of probability in predicting the outcome of genetic crosses and extracting and interpreting information from charts, graphs and tables.

Learners should be able to demonstrate and apply their knowledge and understanding of:

- (a) the structure of DNA as two long chains of alternating sugar and phosphate molecules connected by bases; the chains are twisted to form a double helix; there are four types of base, A (**adenine**), T (**thymine**), C (**cytosine**) and G (**guanine**); the order of bases forms a code for making proteins; the code determines the order in which different amino acids are linked together to form different proteins
- (b) complementary base pairing between A and T, C and G **and the role of the triplet code during protein synthesis**
- (c) the process of 'genetic profiling' which involves cutting the DNA into short pieces which are then separated into bands
- (d) how 'genetic profiling' can be used to show the similarity between two DNA samples, the pattern of the bands produced can be compared to show the similarity between two DNA samples, for instance in criminal cases, paternity cases and in comparisons between species for classification purposes
- (e) the benefits of DNA profiling, for example to identify the presence of certain genes which may be associated with a particular disease
- (f) genes as sections of DNA molecules that determine inherited characteristics and that genes have different forms, called alleles, which are in pairs

- (g) the following terms: gamete, chromosome, gene, allele, dominant, recessive, homozygous, heterozygous, genotype, phenotype, F1, F2, selfing
- (h) single gene inheritance; be able to complete Punnett squares to show this; how to predict the outcomes of monohybrid crosses including ratios
- (i) the fact that most phenotypic features are the result of multiple genes rather than single gene inheritance
- (j) sex determination in humans: in human body cells, one of the pairs of chromosomes, XX or XY, carries the genes which determine sex, these separate and combine randomly at fertilisation
- (k) the artificial transfer of genes from one organism to another; the potential advantages, disadvantages and issues involved with this technology