National Genetics and Genomics Education Centre

DNA

DNA (deoxyribonucleic acid) is one of the many chemicals found in our bodies. Like other chemicals (fats, proteins, sugars...) the DNA molecules in our cells are far too small to be seen under the microscope, but can be studied using the methods of chemistry. DNA is interesting because of what it does, but to understand what it does we need to know a little about its chemical structure. Chemical studies during the 1930s to 1950s showed that a DNA molecule consists of an immensely long chain of subunits called **nucleotides**. There are just four different sorts of nucleotide, called for short A, G, C and T. Two chains of nucleotides are wound round one another to make the famous DNA double helix, described by Francis Crick and James Watson in 1953 (*Fig. 1 DNA base pairs*).

DNA has two key properties:

1. It is the repository of genetic information. A cabbage seed "knows" how to grow into a cabbage, rather than a carrot or a frog, because of the information contained in its DNA. The information in a DNA molecule is encoded in the sequence of the A, G, C and T nucleotides along the chain, just as the information in this factsheet is encoded in the sequence of the 26 letters (plus spaces and some punctuation marks) that make it up. A cell needs all sorts of complicated machinery to read and act on the information, but the information itself is contained in the DNA sequence.
2. A DNA molecule can be exactly copied. The two strands of the double helix fit together like the two halves of a zip. If one strand has a certain sequence of A's, G's, C's and T's, the other strand has to have an exactly complementary sequence where A pairs with T and C pairs with G. Then, if the two strands are separated, a cell can use each as a template to assemble a complementary strand by lining up separate A, G, C and T units and zipping them together. By this means the DNA that was present in the original cabbage seed is copied into every cell of the cabbage. Equally, every cell of a person (with a few minor exceptions) contains an exact copy of all the DNA that was present in the original fertilised egg. That is why one can test somebody's DNA using a blood sample, a mouthwash, a skin biopsy, or any other source of cells. They all contain the same sequence of A, G, C and T units.

Compared to the sequence of letters in this factsheet, DNA sequences are exceedingly long. A human cell contains 46 double helical DNA molecules (found in the 46 chromosomes) that, between them, contain 6,000,000,000 A's, G's, C's and T's.

The DNA sequence of every normal cell of a person is the same (with a few minor exceptions), but the DNA sequences of two individuals are not identical. Some of those differences are what cause each of us to be recognisably individual, while others are important determinants of health and disease.

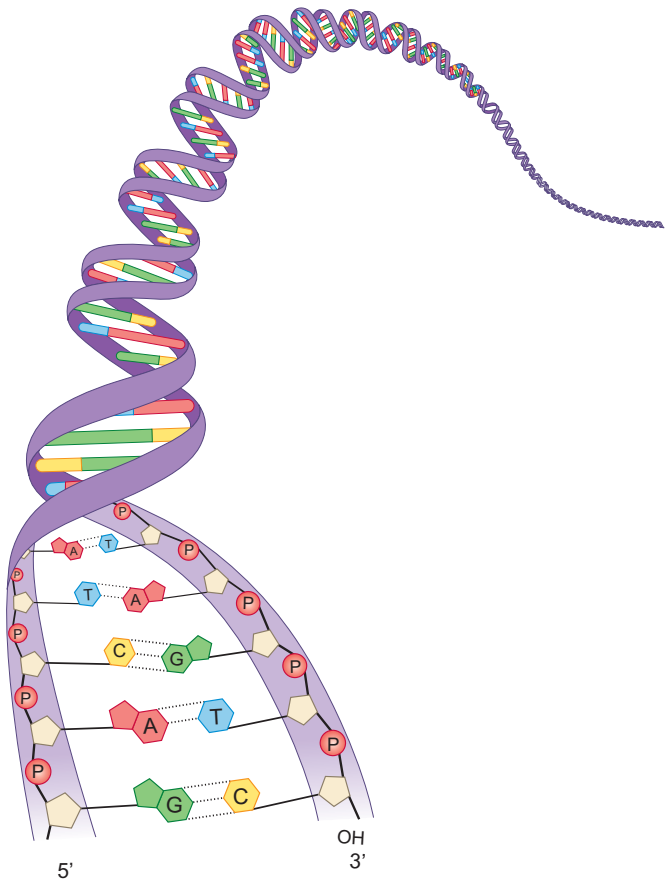

Fig. 1 DNA base pairs

Related factsheets in the series

- Variations in DNA and their effects