



## You and your genes

### C2.1 What are genes?

**How do genes affect the way that humans (and other living things) develop?**

I should be able to:

- recall that instructions for how an organism develops are found in the nucleus of its cells;
- appreciate that genes are instructions for a cell that describe how to make proteins, which are important in the functioning of an organism;
- recall that genes are sections of very long DNA molecules that make up chromosomes in the nuclei of cells;
- recall that DNA has a double helix structure;
- recognise that both strands of the helix are made up of four different bases, which always pair up in the same way; explain how the order of bases in a gene is the code for building up amino acids in the correct order to make a particular protein.

### C2.2 How do my genes affect my looks, my abilities and my health?

**Why do people resemble their parents and yet differ from them and from their brothers and sisters?**

I should be able to:

- recall that sex cells have only one copy of each chromosome;
- relate the occurrence of chromosomes (and hence genes) in pairs to their origin from each parent's sex cells;
- recall that chromosomes in a pair carry the same genes in the same place, but that there are different versions of genes, called alleles, and a person may have two different alleles of any gene;
- interpret the inheritance of normal characteristics that are determined by a single gene with two alleles, in humans and other species, in terms of dominant and recessive alleles;
- explain why offspring may be similar to their parents in some respects because of the combination of maternal and paternal alleles in the fertilised egg;
- appreciate why different offspring from the same parents can differ from each other; explain how the inheritance of gender is related to the presence of sex chromosomes (X and Y).

**C2.3 How can I know whether or not my family may be affected by a genetic disease?**

**Who else should be allowed to know about my genes?**

**How can we use our knowledge of genes to predict disease?**

I should be able to:

- recall that a small number of disorders are caused by a particular allele of a single gene, limited to Huntington's disease, cystic fibrosis *and haemophilia*;
- describe the symptoms of Huntington's disease, cystic fibrosis *and haemophilia*;
- appreciate why a person with one recessive allele will not show the associated characteristic, but they are a carrier and can pass the allele to their children;
- interpret the inheritance of a disease or characteristic from family tree information;
- draw and interpret genetic diagrams, to show the risk of a child inheriting an a single gene disease, or being a carrier, for all combinations of parents;
- discuss the personal reasons which may arise from testing adults and fetuses for some of the alleles which cause genetic disease, for example:
  - whether or not to have children at all;
  - whether or not a pregnancy should be terminated.
- appreciate that information from genetic testing could also be used by others, e.g. employers and insurance companies.

When provided with additional information about the reliability and risks of genetic testing and / or about the uses which might be made of the resulting information, I should be able to :

- identify some of the ethical issues involved;
- outline different views that may be held;
- suggest arguments for and against these views

**C2.4 What is gene therapy?**

**Should genetic modification of sex cells or embryos be allowed? ~**

**How can we use our knowledge of genes to prevent disease?**

I should be able to:

- describe how genetic modification may make it possible to treat or prevent genetic disease by transferring appropriate alleles into affected body cells (gene therapy), where the changes produced are restricted to body cells;
- appreciate that this technology could be used to change the genes of human embryos (producing 'designer babies');
- identify the ethical issues involved in a given context;
- outline the different views that may be held;

Summary Notes/Revision Support: You and your genes:

- identify, and propose arguments based on the ideas that:
  - certain actions should not be taken because they are unnatural;
  - some actions are wrong in themselves and should never be taken;
  - an action is justified if its beneficial outcomes (for all the parties concerned) outweigh harmful ones

## **C2.5 What is cloning?**

**In what circumstances should cloning be allowed?**

**How is a clone formed and how can plant clones be useful?**

I should be able to:

- recall that bacteria, simple animals and most plants can reproduce from a single individual (asexually);
- recall that new individuals produced asexually have exactly the same genes in their cells as the parent (they are clones);
- appreciate that any differences between clones are likely to be due only to environmental factors;
- recall that the cells of multicellular organisms become specialised during the early development of the organism;
- appreciate that some plant cells remain unspecialised and can develop into any type of plant cell;
- relate the presence of these unspecialised cells to the production of clones of a plant with desirable features from cuttings;
- recognise that it is more difficult to produce animal (including human) clones;
- recall that clones of animals can, however, be produced:
  - when the cells of an organism are separated at a very early stage in the development of the fertilised egg; [This often happens naturally, resulting in identical twins.]
  - when the nucleus in a fertilised egg cell is replaced with the nucleus from an adult body cell.

In the discussion that cloning of human adults might soon be technically feasible,

I should be able to:

- identify the ethical issues involved;
- outline the different views that may be held;
- identify, and propose arguments based on the ideas that:
  - certain actions should not be taken because they are unnatural;
  - some actions are wrong in themselves and should never be taken;
  - an action is justified if its beneficial outcomes (for all the parties concerned) outweigh harmful ones