

OCR 21st Century Core Science - Biology B1

You and your genes

B1.1 What are genes and how do they affect the way that organisms develop?

- recall that instructions for how an organism develops are found in the nucleus of its cells;
- understand that genes are instructions for a cell that describe how to make proteins, **which may be structural or enzymes;**
- understand that genes are sections of very long DNA molecules that make up chromosomes in the nuclei of cells.

B1.2 Why can people look like their parents, brothers and sisters, but not be identical to them?

- recall that sex cells have only a copy of one chromosome from each pair;
- understand that the occurrence of chromosomes (and hence genes) in pairs relates 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;
- understand that a person may have two alleles the same or two different alleles for any gene;
- interpret (through family trees or genetic diagrams) the inheritance of normal single gene characteristics with a dominant and recessive allele;
- understand that offspring may have some similarity to their parents because of the combination of maternal and paternal alleles in the fertilized egg;
- understand why different offspring from the same parents can differ from each other;
- recall that human males have sex chromosomes XY and females have sex chromosomes XX;
- **recall that sex of a human embryo is determined by a gene on the Y chromosome;**
- **understand the link between this gene and the development of sex organs into either ovaries or testes.**

B1.3 How can and should genetic information be used? How can we use our knowledge of genes to prevent disease?

- understand that most characteristics are determined by several genes working together, for example, height;
- understand that most characteristics are also affected by environmental factors, for example, lifestyle factors contributing to disease;
- recall that a small number of disorders are caused by alleles of a single gene, limited to Huntington's disorder and cystic fibrosis;
- recall the symptoms of Huntington's disorder and cystic fibrosis;
- understand why a person with one recessive allele will not show the associated characteristic, but is a carrier and can pass the allele to their children;
- interpret (through family trees or genetic diagrams) the inheritance of a single gene disorder, including the risk of a child being a carrier;
- understand the implications of testing adults and fetuses for alleles which cause genetic disease, for example:
 - whether or not to have children at all;
 - whether or not a pregnancy should be terminated.
- understand the implications of testing embryos for embryo selection (**pre-implantation genetic diagnosis**);
- **understand the implications of the use of genetic testing by others, (for example, for genetic screening programmes, by employers and insurance companies);**
- understand that gene therapy may make it possible to treat certain genetic diseases;
- in the context of genetic testing (when provided with additional information about the reliability and risks of genetic tests) or gene therapy, be able to:

- distinguish questions which could be addressed using a scientific approach, from questions which could not;
- say clearly what the issue is;
- summarise different views that may be held;
 - identify and develop arguments based on the ideas that:
 - the right decision is the one which leads to the best outcome for the majority of people involved;
- certain actions are never justified because they are unnatural or wrong;
- **in the context of use of genetic testing by others, can:**
 - **distinguish what can be done (technical feasibility), from what should be done (values);**
 - **explain why different courses of action may be taken in different social and environmental contexts.**

B1.4 What are stem cells, and why could they be useful in treating some diseases?

- recall that bacteria, plants and some animals can reproduce asexually to form clones (with identical genes to their parent);
- understand that any differences between clones are likely to be due only to environmental factors;
- understand how clones of animals occur:
 - naturally, when cells of an embryo separate (identical twins);
 - **artificially, when the nucleus from an adult body cell is transferred to an empty unfertilised egg cell;**
- recall that embryonic stem cells are unspecialised cells that can develop into any type of cell;
- understand that there is the potential to use stem cells to treat some illnesses;
- recall that the cells of multicellular organisms become specialised during the early development of the organism;
- in the context of cloning embryos to produce large numbers of stem cells to treat illnesses, can:
 - say clearly what the issue is;
 - summarise different views that may be held;
 - identify and develop arguments based on the ideas that:
 - the right decision is the one which leads to the best outcome for the majority of people involved;
 - certain actions are never justified because they are unnatural or wrong.