

Edexcel Core Science Biology B1a

*Items in **bold** are for higher tier only*

Topic 1 — Environment

Environmental issues have become more important in people's lives and feature regularly in the media, even affecting local and national elections. This topic looks at human impact on the environment and how it can be measured. Ways in which plants and animals can be improved in order to feed the world are at the forefront of modern agriculture and students will consider the energetics of food production. As usual, new food production techniques raise new ethical, social and environmental questions.

Organisms are classified according to how closely they are related and students will learn to appreciate that 'rules' change as new evidence emerges. It is a competitive world, all organisms compete for resources and only those that are best adapted will survive in a changing environment. There is an opportunity to study populations using computer models and also to use secondary data to explore how human activity affects populations and the environment. Students will also discuss the evidence for natural selection, examining how Darwin's ideas were received by his contemporaries and comparing this with how current scientific theory is received by today's scientific community.

Have you ever wondered?

- How can the Sun's energy support all life on Earth?
- Why don't food chains go on forever?
- Which grows more quickly — grass or cow?
- How do different organisms make different changes to solve the same environmental problem?
- Does the number of foxes control the number of rabbits or does the number of rabbits control the number of foxes?
- Is evolution still taking place?
- What would happen to the human race if we were all the same?
- How does natural selection 'know' how to create a new species?
- Why are so many people worried about GM technology?
- Why did a cartoon of Charles Darwin drawn as an ape appear in a national newspaper when he proposed his theory of evolution?

Some facts:

- Animals and plants depend on each other.
- All organisms are adapted to their environment.
- There is often competition between organisms for resources.
- Natural selection is a long process over many generations.

Glossary

adaptation	quantitatively	organic	genetically
evolution	characteristic	selective breeding	modified
intra-species	food chain	competition	population
prey	natural selection	genetic engineering	environment
biomass	reproduction	organism	interdependence
extinct	classification	species	predator
mutation	fossil	ecosystem	

You should be able to:

- interpret food chains quantitatively using pyramids of biomass and consider why this is more accurate than a pyramid of numbers
- describe how organisms in an ecosystem compete with each other for resources
- explain why it is more cost effective, in terms of energy, to produce a field of wheat rather than a field of beef cows
- explain population data in terms of predator-prey interdependence and intra-species competition
- **use secondary data to explain how human activity can affect the environment, especially changes in population size and in economic and industrial conditions**
- demonstrate an understanding of how computer models can be used to study populations, and show an awareness of the advantages and disadvantages of these models compared with real data
- demonstrate an understanding of the principles of natural selection, to include:
 - how individuals within a species can have characteristics that promote more successful reproduction (survival of the fittest)
 - how, over generations, the effects of natural selection result in changes within species and the formation of new species from genetic variants or mutants that are better adapted to their environment
 - how species that are less well-adapted to a changing environment can become extinct
- explain how fossils provide evidence for evolution
- explain, compare and contrast selective breeding and genetic engineering in terms of changing the characteristics of a species
- **discuss why Charles Darwin experienced difficulty in getting his theory of evolution through natural selection accepted by the scientific community in the 19th century**
- explain the principles of classifying organisms and the difficulties encountered in attempting to do so, as illustrated by the five kingdoms, the use of phylum, class, order, family, genus, species and the main characteristics of the five vertebrate groups
- discuss the ethics and principles of organic farming and explain why organic products are more expensive than non-organic produce
- **demonstrate an understanding of how crop plants can be genetically modified and the reasons for doing so and the ethical concerns this raises.**

Topic 2 — Genes

We are living in an age of an explosion in the use and understanding of genetics. The Human Genome Project may now be followed by many new medical treatments.

The activities of any organism are determined by the genes they possess. Chemical reactions in the cell depend on the cell's proteins. The structure of these proteins is determined by the cell's DNA. Genes are passed from parent to child in predictable ways, but sometimes these mutate. Variation is produced by a combination of genes and environment. There is now even more genetic manipulation of living organisms for food production. Scientists are able to extract and modify genes in order to change the properties of crops and animals used as food. Scientists are also able to clone organisms and some scientists hope to produce cloned body parts for transplantation surgery. Studying this topic gives students opportunities to interpret data produced through breeding experiments. Students can use various kinds of resources to consider the benefits, drawbacks and risks of scientific opportunities in gene therapy, cloning and genetic modification. Students can also investigate how scientific decisions are made and how the ethical concerns of society can be considered, for example in relation to cloning.

Have you ever wondered?

- Why can we not just breed a racehorse that will win every race?
- Are clones really like they are in the movies?
- Is it possible that Old English Sheepdogs and Yorkshire Terriers both came originally from wolves?
- How can cows make drugs in their milk?
- When will I be able to get medicines especially made for just me?
- How can genetics be used to cure diseases?

Some facts:

- Characteristics of organisms are dependent on their genes.
- Sexual reproduction leads to variation.
- Genetic modifications are used for a range of purposes.
- There are many ethical considerations associated with advances in genetic modification.

Glossary

allele	reproduction	haploid	transplant
cystic fibrosis	DNA	sexual reproduction	chromosome
gene therapy	generation	cell	gamete
nucleus	cancer	fertilisation	Human Genome
antibody	dominant	heterozygous	Project
diploid	genotype	transgenic	variation
genetics	recessive	characteristic	clone gene
phenotype	carrier	forensic	inheritance
asexual	environment	homozygous	

You should be able to:

- describe genes as parts of chromosomes which are found within the nucleus and which control the cell's activity
- explain that the unit of inheritance is the gene which is a section of a long chain (DNA) molecule
- appreciate the emerging outcomes of the Human Genome Project (HGP) and discuss some of their implications, including the use of DNA evidence in forensic science and medicine

- **discuss how gene therapy could change the lives of two people, one suffering from cystic fibrosis and the other from breast cancer, if these diseases could be treated genetically**
- describe how asexual reproduction leads to genetically identical individuals called clones, including *Chlorophytum* (spider plant)
- explain how sexual reproduction, involving fertilisation, leads to variation in the new generation (including the use of a monohybrid cross diagram)
- **explain how some inherited characteristics can be modified by environmental conditions, including the influence of diet on human growth and mineral resources on plant growth**
- explain, how alternative forms (dominant and recessive alleles) of a gene cause variation in a characteristic
- demonstrate an understanding of how some alleles can cause diseases which can be inherited, for example, sickle cell anaemia, Huntington's disease and haemophilia
- **evaluate the potential for using transgenic animals, including the production of 'designer milk', for example milk containing human antibodies and low cholesterol milk**
- describe the social and ethical concerns of cloning mammals, including the possibility of the cloning of human body parts for transplant surgery
- **consider the contemporary scientific theory of 'designer babies' and explain why today's scientists are finding so much opposition to the use of this approach being publicly acceptable.**