



**Biology Scheme of Learning**

**Year 11 – Term 2/Unit 14 Variation and Evolution**

**Intent – Rationale**

Variation and evolution includes some content for *GCSE Biology* students only, as well as some higher-tier content. All students should be able to discuss the causes of variation in terms of genetic, environmental, or a combination of both. They should link environmental variation with the effect of alcohol on a foetus in B7.5 *Alcohol and other carcinogens*.

In studying evolution by natural selection, students should understand the role of mutation in variation, understand the theory of evolution by survival of the fittest and natural selection, and be able to give examples. They should link this with previous studies on sexual reproduction and meiosis in B13.2 *Cell division in sexual reproduction*.

Students have studied the process of selective breeding. They should understand this as an example of artificial selection, and be aware of its limitations. In studying genetic engineering, all students should understand what is meant by the term, and be able to give examples of its use and consider the potential benefits and problems. They should link this with work on diabetes treatment using human insulin in B11.3 *Treating diabetes*, and with the treatment of cystic fibrosis in B13.9 *Inherited disorders*. Higher-tier students should be able to recall the steps involved in the process of genetic engineering.

Finally, *GCSE Biology* students have studied cloning as applied to both plants and animals. They should recall different ways of creating clones, and be able to describe why they are useful. They should link cloning plants with work in B11.10 *Using plant hormones*. They should understand the processes of embryo transplants and adult cell cloning in animals, and be able to discuss the choices that need to be made about all genetic technologies.

Sequencing – what prior learning does this topic build upon?	Sequencing – what subsequent learning does this topic feed into?
<p><b>Topic B7.3 Environment and adaptation</b>  <b>Topic B7.4 Variation and Classification</b>  <b>Topic B8.10 Inheritance and Evolution</b>  <b>GCSE B7.5 Alcohol and other carcinogens.</b>  <b>GCSE B13.2 Cell division in sexual reproduction.</b>  <b>GCSE B11.3 Treating diabetes.</b>  <b>GCSE B13.9 Inherited disorders.</b>  <b>GCSE B11.10 Using plant hormones</b></p>	<ul style="list-style-type: none"> <li>• A level Unit 8 DNA, genes and protein synthesis</li> <li>• A level Unit 9 Genetic diversity and adaptations</li> <li>• A level Unit 10 Biodiversity</li> <li>• A level Unit 17 Inherited Change</li> <li>• A level Unit 19 Populations and Evolution</li> <li>• A level Unit 20 Gene expression</li> <li>• A level Unit 21 Recombinant DNA technology</li> </ul>
What are the links with other subjects in the curriculum?	What are the links to SMSC, British Values and Careers?
<ul style="list-style-type: none"> <li>• EP ethical issues concerning selective breeding, cloning and genetic engineering.</li> </ul>	<ul style="list-style-type: none"> <li>• SMSC M1 M2 M3</li> <li>• BV 2,3,4 and 5</li> <li>• GB4 a) and e)</li> <li>• All of the above can be explored when discussing and the processes of selective breeding, cloning and genetic engineering.</li> </ul>
What are the opportunities for developing literacy skills and developing learner confidence and enjoyment in reading?	What are the opportunities for developing mathematical skills?



FROM THE LIBRARY

*Alcohol*-613.8

*Alcohol*-363.29

*How do Drink and Drugs Affect Me?*-615.78

*Understanding Eating Disorders*-616.8

The Issues Collection.

- Analysing data from Twin studies

**Biology Scheme of Learning**

**Year 11 – Term 2/Unit 14 Variation and Evolution**

**Intent – Concepts**

**What knowledge will students gain and what skills will they develop as a consequence of this topic?**

**Know**

Some examples of variation in plants and categorise these as being due to genetic causes, environmental causes, or both. Suggest reasons why identical twins will start to show variation as they get older.

Use data to explain why studying identical twins helps scientists investigate which traits have genetic causes.

Explain how a mutation may lead to a new phenotype. Describe the steps that take place during evolution by natural selection. Explain the process of selective breeding. Explain why humans have used selective breeding. Explain what inbreeding is, and why it is a problem in dog breeding.

Describe the steps used in genetic engineering to produce GM organisms. Describe the benefits for plant growers of reproduction using cuttings or tissue culture rather than seeds.

Describe how embryo transplants are undertaken, and why they produce clones. Explain why the animal produced using adult cell cloning is a clone.

List some benefits and drawbacks of adult cell cloning. Outline the potential benefits and risks of genetic engineering.

Describe economic and ethical concerns that people may have about cloning animals.

**Apply**

Analyse data from an activity modelling natural selection. Analyse data to describe why growing GM crops may be beneficial to a farmer.

Design a flow chart to describe the process of adult cell cloning.

Apply the theory of evolution by natural selection to suggest how a specific organism evolved.

**Extend**

Explain why some traits are only due to genetic causes. Explain why it is so hard to get valid results from identical-twin studies. Discuss some of the issues scientists face when conducting twin studies.

Explain why it is rare that a mutation leads to a new phenotype.

Compare and contrast natural and artificial selection. Explain in detail how the variation of alleles in a population is reduced through selective breeding. Explain in detail why the reduction of variation in a population through selective breeding is a problem.

Explain the process of genetic engineering using technical vocabulary (e.g., plasmid, vector, restriction enzymes, marker genes, recombinant DNA). Explain how genetic engineering could be used to cure people with inherited disorders, and discuss the limitations. Explain the benefits of embryo transplants over sexual reproduction for farmers. Compare and contrast tissue culture in plants and embryo transplantation in animals. Use advanced terminology to explain the process of adult cell cloning. Compare and contrast the processes of adult cell and embryo cloning. Evaluate the possible uses of adult cell cloning.



What subject specific language will be used and developed in this topic?		What opportunities are available for assessing the progress of students?
<b>cloning</b>	the production of identical offspring by asexual reproduction	<ul style="list-style-type: none"> <li>• Long Answer Question on Natural selection after L2</li> <li>• Long Answer Question on Genetic engineering after L4</li> <li>• End of Topic Test B14</li> </ul>
<b>environmental variation</b>	differences between individuals in a population due entirely to the environment you live in e.g. a scar from an accident.	
<b>gene therapy</b>	insertion of genes into a cell to replace defective genes.	
<b>genetic engineering</b>	the process by which scientists can manipulate and change the genotype of an organism.	
<b>genetic variation</b>	characteristics of an individual that are the result of the genes they have inherited from their parents.	
<b>genetically modified crops</b>	crops that have had their genes modified	
<b>mutation</b>	a change in the genetic material of an organism.	
<b>natural selection</b>	the process by which evolution takes place. Organisms produce more offspring than the environment can support. Only those most suited to their environment will survive to breed and pass on their useful characteristics to their offspring.	
<b>phenotype</b>	the physical appearance/biochemistry of an individual for a particular characteristic.	
<b>plasmid</b>	a small circular piece of DNA found in bacterial cells.	
<b>restriction enzymes</b>	enzymes that cut DNA molecules at a specific sequence of bases.	
<b>selective breeding</b>	speeds up natural selection by selecting animals or plants for breeding that have a required characteristic.	
<b>Survival of the fittest</b>	individuals with characteristics most suited to the environment are more likely to survive to breed successfully.	
<b>tissue culture</b>	a modern way of cloning plants that allows thousands of new plants to be created from one piece of plant tissue.	
<b>vector</b>	these are used to transfer genes from one organism to another.	





Intent – Concepts

Lesson title	Learning challenge I can/know	Higher level challenge I can	Suggested activities and resources
<b>B14 L1 Variation</b>	a) What makes you different from the rest of your family. b) Understand the importance of twin studies.	<ul style="list-style-type: none"> <li>Explain why some traits are only due to genetic causes.</li> <li>Explain why it is so hard to get valid results from identical-twin studies.</li> </ul> Discuss some of the issues scientists face when conducting twin studies.	
<b>B14 L2 Evolution by Natural Selection</b>	a) How natural selection works b) How evolution is driven by natural selection	<ul style="list-style-type: none"> <li>Explain why it is rare that a mutation leads to a new phenotype.</li> <li>Apply the theory of evolution by natural selection to suggest how a specific organism evolved.</li> </ul> Explain how a change in a model can make it useful for explaining something else.	
<b>B14 L3 Selective Breeding</b>	a) What selective breeding is and how it works b) Evaluate the risks and benefits of selective breeding	<ul style="list-style-type: none"> <li>Compare and contrast natural and artificial selection.</li> <li>Explain in detail how the variation of alleles in a population is reduced through selective breeding.</li> </ul> Explain in detail why the reduction of variation in a population through selective breeding is a problem.	
<b>B14 L4 Genetic Engineering</b>	a) The process of genetic engineering b) Evaluate the potential benefits and problems associated with genetic engineering in agriculture and medicine	<ul style="list-style-type: none"> <li>Explain the process of genetic engineering using technical vocabulary (e.g., plasmid, vector, restriction enzymes, marker genes, recombinant DNA).</li> </ul> Explain how genetic engineering could be used to cure people with inherited disorders, and discuss the limitations.	
<b>B14 L5 Cloning (Triple only)</b>	a) Describe the different ways of creating clones b) Explain why clones are useful	<ul style="list-style-type: none"> <li>Explain the benefits of embryo transplants over sexual reproduction for farmers.</li> </ul> Compare and contrast tissue culture in plants and embryo transplantation in animals.	
<b>B14 L6 Adult Cell Cloning (Triple only)</b>	a) Describe how adult cell cloning is carried out b) Explain the benefits and risks of adult cell cloning	<ul style="list-style-type: none"> <li>Use advanced terminology to explain the process of adult cell cloning.</li> <li>Compare and contrast the processes of adult cell and embryo cloning.</li> </ul> Evaluate the possible uses of adult cell cloning.	
<b>B14 L7 Ethics of Genetic Technologies</b>	Discuss the concerns and uncertainties about the new genetic technologies, such as cloning and genetic engineering.	<ul style="list-style-type: none"> <li>Outline the potential benefits and risks of genetic engineering.</li> </ul> Describe economic and ethical concerns that people may have about cloning animals.	
<b>B14 L8 TEST</b>			

