

# GCSE Biology (Separate Science)

## Success Criteria: Variation and evolution



<i>I can...</i>	
<b>Describe</b> simply how the genome and its interaction with the environment influence the development of the phenotype of an organism.	
<b>State</b> that differences in the characteristics of individuals in a population is called variation.	
<b>Describe</b> how variation between individuals may be due to: <ul style="list-style-type: none"> <li>the genes they have inherited</li> <li>the conditions in which they have developed (environmental factors)</li> <li>a combination of both genes and environment.</li> </ul>	
<b>State</b> that there is usually extensive genetic variation within a population of a species.	
<b>Define</b> a species as a group of similar individuals that are able to reproduce and produce <u>fertile</u> offspring's.	
<b>Understand</b> that mutations (changes in DNA) occur randomly and continuously in a population.	
<b>Explain</b> that although mutations occur continuously, most have no impact to the phenotype (silent mutation), however, rarely a mutation will lead to a new phenotype.	
<b>Describe</b> evolution as a change in the inherited characteristics of a population over time	
<b>Explain</b> how evolution occurs using 'natural selection'. Random mutation = new allele (variation) which provides an advantageous characteristic Individual with the advantageous allele survives long enough to reproduce and passes on advantageous allele to offspring.	
<b>Explain</b> that if two populations of one species separately evolve that they become so different in phenotype and can no longer interbreed to produce fertile offspring they have formed two new species.	
<b>Explain</b> that all species of living things have evolved from simple life forms that first developed more than 3 billion years ago	
<b>Explain</b> how evolution occurs through natural selection of variants that give rise to phenotypes best suited to their environment.	
<b>Understand</b> that if one species becomes so different in phenotype that it can no longer interbreed to produce fertile offspring's that have formed a new species how new species form.	

# The theory of evolution and speciation

<p><i>I can...</i></p>	
<p><b>Understand</b> that Charles Darwin proposed the theory of evolution as a result of observations on a round the world expedition, backed by years of experimentation and discussion and linked to developing knowledge of geology and fossils.</p>	
<p><b>State</b> the three aspect of the theory of evolution:</p> <ul style="list-style-type: none"> <li>• Individual organisms within a particular species show a wide range of variation for a characteristic.</li> <li>• Individuals with characteristics most suited to the environment are more likely to survive to breed successfully.</li> <li>• The characteristics that have enabled these individuals to survive are then passed on to the next generation.</li> </ul>	
<p><b>Understand</b> that Darwin published his ideas in On the Origin of Species (1859). There was much controversy surrounding these revolutionary new ideas.</p>	
<p><b>Explain</b> that the theory of evolution by natural selection was only gradually accepted because:</p> <ul style="list-style-type: none"> <li>• It challenged the idea that God made all the animals and plants that live on Earth</li> <li>• There was insufficient evidence at the time the theory was published to convince many scientists</li> <li>• The mechanism of inheritance and variation was not known until 50 years after the theory was published.</li> </ul>	
<p><b>Understand</b> that other theories, including that of Jean-Baptiste Lamarck, are based mainly on the idea that changes that occur in an organism during its lifetime can be inherited. We now know that in the vast majority of cases this type of inheritance cannot occur.</p>	
<p><b>Appreciate</b> that the theory of evolution by natural selection developed over time and from information gathered by many scientists.</p>	
<p><b>Explain</b> that Alfred Russel Wallace independently proposed the theory of evolution by natural selection. He published joint writings with Darwin in 1858 which prompted Darwin to publish On the Origin of Species (1859) the following year.</p>	
<p><b>Explain</b> that Wallace worked worldwide gathering evidence for evolutionary theory. He is best known for his work on warning colouration in animals and his theory of speciation.</p> <p>Alfred Wallace did much pioneering work on speciation but more evidence over time has led to our current understanding of the theory of speciation</p>	

# Evidence for evolution, fossils, and extinction.

<i>I can...</i>	
<b>Explain</b> that the theory of evolution by natural selection is now widely accepted. Evidence for Darwin's theory is now available as it has been shown that characteristics are passed on to offspring in genes	
<b>Define</b> fossils as the 'remains' of organisms from millions of years ago, which are found in rocks.	
<b>Describe</b> how fossils are formed from parts of organisms that have not decayed because one or more of the conditions needed for decay are absent. Parts of the organism are then replaced by minerals as they decay. Fossils preserve traces of organisms, such as footprints, burrows and rootlet traces.	
<b>Use</b> information to describe how fossils help us to determine how much or how little different organisms have changed as life developed on Earth.	
<b>Explain</b> that many early forms of life were soft-bodied, which means that they have left few traces behind which means scientists cannot be certain about how life began on Earth.	
<b>Understand</b> evolutionary relationships when presented as evolutionary trees	
<b>State</b> that extinction occurs when there are no remaining individuals of a species still alive.	
<b>Describe</b> factors which may contribute to the extinction of a species eg. new disease, new predator, new competitor, loss of habitat etc	
<b>Describe</b> how bacterial antibiotic resistance occurs (random mutation)	
<b>Explain</b> how the rise in antibiotic resistance is evidence for evolution by natural selection (bacteria with the resistant gene survive, reproduce and pass on the advantageous allele)	
<b>Explain</b> why antibiotic resistance is concerning/dangerous for humans	
<b>Describe</b> steps taken to reduce antibiotic resistance: <ul style="list-style-type: none"> <li>• doctors should not prescribe antibiotics inappropriately, such as treating non-serious or viral infections,</li> <li>• patients should complete their course of antibiotics so all bacteria are killed and none survive to mutate and form resistant strains</li> <li>• the agricultural use of antibiotics should be restricted.</li> </ul>	

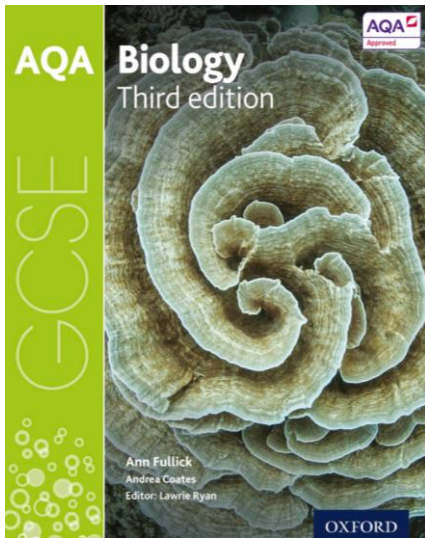
# Classification

<i>I can...</i>	
<b>State</b> that living things can be classified into groups depending on their structure and characteristics.	
<b>Define</b> artificial classification as grouping organisms based on one/few easily identifiable characteristic (eg. black colour – not useful for biological purposes, does not show evolutionary relationships)	
<b>Define</b> natural classification as grouping organisms based on many shared characteristics (eg. All mammals grouped together – warm blooded vertebrates, covered in hair, birth to live young etc. useful for biological purposes, shows evolutionary relationships)	
<b>Identify</b> the hierarchy of natural classification taxa (groups) first proposed by Carl Linnaeus kingdom, phylum, class, order, family, genus and species. (KIPCOFaGS)	
<b>Understand</b> the binomial naming system of organisms (binomial = two parts) using the genus followed by the species. Eg. Homo sapien (Homo = genus, sapien = species)	
<b>Describe</b> the impact of developments in biology on classification systems. Examples of developments are: microscopes, EM microscopes, understanding of biochemical processes, genetics and sequencing.	
<b>Understand</b> how scientific methods and theories develop over time. As our understanding of internal cell structures and biochemical processes advance, new models of classification can be proposed.	
<b>Explain</b> how due to evidence from chemical analysis there is now a 'three domain system' developed by Carl Woese. In this system organisms are divided into: <ul style="list-style-type: none"> <li>• archaea (primitive bacteria usually living in extreme environments)</li> <li>• bacteria (true bacteria)</li> <li>• eukaryota (which includes protists, fungi, plants and animals).</li> </ul>	
<b>Use</b> and interpret evolutionary trees to show how organisms are believed to be related.	

- 4.6.2.1 Variation
- 4.6.2.2. Evolution

**Additional support:** 

Access the appropriate textbook on kerboodle.com, create your own revision notes of the key points of the topic and attempt the summary questions.



Separate Biology GCSE textbook

**Variation and Evolution**

pages 218-222

**Theory of Evolution and Speciation**

Pages 236-242

**Evidence for Evolution**

Pages 242- 250

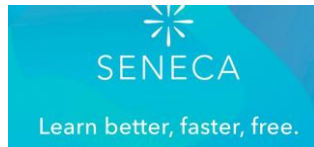
**Classification**

Pages 250-254

**Write your own summary notes** (bullet points of the key ideas /keywords list with definitions/ annotated diagrams/ mind-maps or flash cards) to go over the main content of the topic.

Attempt the textbook summary questions.

Utilise online revision resources to support your class notes, such as...



Attempt past paper questions using [www.physicsandmathstutor.com](http://www.physicsandmathstutor.com) and self-mark your answers using the official exam mark schemes.



**Extension work/extra challenge:**

Ask your teacher for extension tasks...

- Sexual Selection: How did the Peacock get his tail?
- Cultural evolution