Theory of Evolution Teacher Sheet

Note:

Orange sections - teacher reading as narrator

Purple - children read (also on the Theory of Evolution Pupil Sheet)

Bold black - relevant slide of the Lesson Presentation

Theory of Evolution: The Ancients (BC)

Teacher: Humans, as far as we know, have always been curious about the world around them and tried to explain how life has come about.

In the past, there were many different ideas about life on earth in different parts of the world, in different cultures, societies and religions. Scientists have developed a particular approach that uses evidence to support ideas and theories.

Non-scientific ideas which have alluded to the evolution of living things have existed for thousands of years.

Anaximander of Miletus (c. 610 - 546 BC)

I believed that the first animals lived in water during a wet phase of the Earth's past. I thought that the first land dwelling ancestors of humans would have been born in the water and then spent some of their life on land. Furthermore, I argued that the first human would have been the child of a different type of animal.

Empedocles (c. 490 - 430 BC)

I thought that the first animals and plants were like disjointed parts of the ones we see now, some of which survived by joining in different combinations. Even though the ones that survived seem like they were created that way but it was actually accidental that they did.

Epicurus (341 - 270 BC)

I was a Greek philosopher and I was the author of an ethical philosophy of simple pleasure, friendship, and retirement.', which explained my understanding. I thought the goddess Gaia had spontaneously generated lots of different species in the past. I posited that only those that functioned the best survived and had offspring. However, I thought this was the result of abiogenetic events (where life arises from non-living things) for each species rather than just one event that led to lots of different species.

Zhang Zhou (c. 369 - 286 BC)

I was a Taoist philosopher. We believed that plants and animals did change and that the species were not fixed. We also speculated about how the environment affected the attributes of different living things. In general, Taoists thought that all living things, the Earth and the heavens were in a state of constant transformation rather than fixed.

Theory of Evolution: The Ancients (AD) to the Middle Ages

Augustine of Hippo (354 - 430)

I was a Catholic bishop and a theologian (someone who studies the idea of God and the nature of

religious ideas). I wrote a book called 'De Genesi ad litteram' which means 'On the Literal Meaning of Genesis'. Genesis is a chapter about how life began, which is part of both the Jewish Torah and the Christian Bible.

I thought that Genesis should not be taken literally. I believed that God created life but that living things had been transformed slowly over time. I also thought that certain creatures were not formed on the fifth and sixth day, rather insects, worms and spiders had originated later from rotting remains of animals.

Teacher: While Ancient Greek and Roman ideas died out in Europe during the Middle Ages, Arabian Scholars translated, studied and explored them further.

Al-Jahiz (776 - 868)

I noticed patterns in how animals preyed on those who were weaker than them but were in turn eaten by animals who were stronger. I argued that all animals struggled for existence, resources, to breed and avoid being eaten. Those that were successful were better able to survive.

Tusi (1201 - 1274)

I put forward a basic theory of evolution of species almost 600 years before Darwin! I believed that the universe consisted of equal and similar elements. Internal changes occurred and these elements developed faster and became different to each other. These changed over time to develop in minerals that developed into three types of living things – plants, animals and humans.

I believed that those organisms that could gain new features could gain an advantage over those that did not.

In terms of living things, I thought that some animals were more advanced than others and that humans developed from those advanced animals. I argued that humans came from apes that lived in Western Sudan (in Africa).

Teacher: Some of you may have heard of Tusi as he was responsible for the idea that planets orbited and rotated at the same time. He was a polymath (as are many of the key thinkers and scientists mentioned here). A polymath is a person who has studied and contributed to many different fields of learning. His evolutionary theory was highly accurate – especially in identifying the location of the apes that humans evolved from.

Ibn Khaldun (1332 - 1406)

I argued that humans developed from the world of monkeys by a process that led to numerous species. I thought that the cleverness and perception of monkeys was transformed into the human ability to think and reflect. I believed that all animals and plants were connected to others in this way. Living things were able to transform from one thing to another.

Theory of Evolution: Anticipating the Theory of Evolution

Teacher: The Renaissance was a period of time when thinkers in many European countries started to study the ideas of the Ancient Greeks and Romans again, along with those of the Islamic Scholars. This led to the development of science as a subject and further development of some of the earlier ideas that had been lost. There were many theories before Darwin's that anticipated the theory of evolution – that is they came close to the explanation but were not complete enough theories to explain how evolution worked.

Pierre Louis Maupertuis (1698 - 1759)

I was a French mathematician and philosopher. I thought that natural modifications occur when living things reproduce and this could result in new varieties of the living thing as well as lead to new species.

Georges-Louis Leclerc (1707 - 1788)

I believed that many of the species were actually just varieties of animals that had been modified from the original animal due to environmental factors. For example, I believed that lions, tigers, leopards and house cats all had a common ancestor. I also thought that all the mammals had descended from as few as 38 original animal types.

I studied and compared the skeletons of different animals, including humans and apes but did not believe that they did have a common ancestor.

Teacher: Leclerc's ideas did not constitute a theory of evolution but his writings did influence many others to continue exploring and investigating this area of study, where once it would have been accepted that all living things were fixed and unable to change.

Erasmus Darwin (1731 - 1802)

I am Charles Darwin's grandfather. I was a physiologist and physician. I wrote a book called 'Zoonomia' in which I said that 'one and the same kind of living filament is and has been the cause of all organic life'. That is to say that all living things have a common ancestor. I also believed that the strongest and most active animals would reproduce and as a result the species would be improved.

My book was very radical and controversial. I was banned by the Vatican as my views suggested that living things were not created by a god.

Lamarck (1744 - 1829)

I thought that transmutation of species did occur (transmutation was the word we used before it started to be called evolution). I thought that living things inherited traits that enabled them to adapt better to their environment. I did not have the evidence to really support my idea. Also, I did not think that all living things shared a common ancestor.

Thomas Robert Malthus (1766 - 1834)

I wrote about population (the number of people), not transmutation or evolution. However, my books were widely read and influenced scholars of other fields. This included the idea that if populations grew then they would struggle to survive as food would become scarcer. In this case, some would die of disease or hunger, which would lead to a decrease in the population. While I was talking about humans, this idea was applied to all living things by Darwin and Wallace.

Robert Edmond Grant (1793 - 1874)

I was very influenced by Lamarck's work on transmutation and evolutionism. I proposed that animals and plants had a common evolutionary start point from which they then diverged. I was one of Charles Darwin's professors at the University of Edinburgh. It is here that he started to read books about transmutation and learnt previous ideas about the evolution of life.

Robert Chambers (1802 - 1871)

I wrote a book anonymously (which means that no-one knew it was my book) called 'Vestiges of the Natural History of Creation', in which I proposed that the Solar System and Earth evolved, as well as living things on Earth. I had investigated fossils and believed that all living things branched off to become different species, including humans. While a lot of people debated my ideas, there were many who disagreed with them.

Teacher: In the end it was Charles Darwin and Alfred Wallace who pieced together a whole theory of evolution that could explain how and why evolution occurred. It is this coherent theory that led to the field of genetics that is studied in the present day. So how did they come to their conclusions?

Theory of Evolution: Darwin and the HMS Beagle

Charles Darwin (1809 - 1882)

Charles Darwin - young

From a young age I was fascinated by living things and studied them. I trained to be a doctor but could not deal with all the blood!! So I studied plants and animals instead. When I was 22 years old I was able to go on the most fascinating journey to the Galapagos Islands, which took 5 years! It was in the Galapagos Islands that I studied different animals and started to come up with my greatest theory: the theory of evolution. It was the different types of finches that got me thinking. Let's go through this step by step. **(Read Galapagos Finches slides on Lesson Presentation).**

Worries, Wallace and the World

Charles Darwin - old

I knew my ideas were controversial and I took a long time to mull them over. For 15 years I wrote about my journey on the HMS Beagle, what I had found and other books. While my friends knew I had my own ideas about transmutation, they did not realise the full extent. However, in 1856 everything changed. A certain Alfred Wallace published a paper called 'On the Law which has Regulated the Introduction of New Species'. My friend, Sir Charles Lyell, thought I should publish my own ideas as Wallace's were similar. At first I wasn't concerned but I had partly completed my book about evolution. In 1858, I was forced into action.

Alfred Wallace (1823 - 1913)

Knowing that Darwin was interested in ideas about transmutation, I sent him an article I had written in which I described natural selection and how it caused varieties of the same species. My evidence was from observations in South America and Asia. While our ideas were similar, Darwin emphasised competition for food more while I emphasised how environmental changes could lead to natural selection. However, I had not intended to publish my work straight away.

Charles Darwin - old

I had put off finishing my book and really struggled with it because I knew that I was opposing the idea that many religious people believed: that God had created all living things just as they were now. My grandfather's negative experience when he suggested the idea of transmutation also made me question whether I wanted to publish my ideas. When I received Wallace's paper some of my friends said to publish straight away so that I would be known as the first person to propose natural selection but I didn't think that was fair. So I decided that we would announce the theory and that we should both be attributed with its discovery.

Teacher: Charles Darwin, more than Wallace, is linked to the idea of evolution. They both came to the same conclusion separately but at a similar time. Darwin is the better known of the two due to his book, **On the Origin of Species by Means of Natural Selection**, in which he gave a detailed account of this theory. He also made the connection that all living things must have had a common ancestor in the past that they adapted and evolved from. His subsequent book, **The Descent of Man** (1871), gave a detailed account of how he thought humans had evolved from apes. It is also the first time he used the word evolution!