Darwin and Wallace and Natural Selection

Eg This is about Charles Darwin and Alfred Russel Wallace

England in early 19th century was beginning to move away from the established Natural Theology

this theory said there were 4 main aspects of creation and the natural world

a) there was a divine creator
b) species never changed.. the fixity of species. the clever french realised by now this was not true. Species did go extinct and had done in the past, but they didn't know mechanism
c) Short creation, world was approx 600 years old.. but science of geology rapidly overtook this view, earth dated to millions of years old.
d) As god created everything, everything was perfectly designed and fixed in a perfect form… because of this many scientists did not feel the need to know the how and why, you just collected and catalogued.

This was summarised by the philosopher William Daley in1802 natural theology

Charles Darwin read this book and at first didn't question its conclusions

Charles Darwin drifted through university first studying medicine (but didn't like blood) then Biology at Cambridge, but he was more interested in collecting beetles. Graduated at 22 not knowing what to do. Parents paid for him to go on HMS Beagle for 5 years to collect Specimens. This changed Darwin from a collector to a theorist.

Being on board a boat for 5 years he read lots especially about the new discoveries in geology eg works of Charles Lyell described how Fossils showed gradual change over a very long period time.

When in Chile experienced an earthquake and volcano erupting, realised how the earths geography could be changed

Collected many fossils eg giant sloth (megatherium)

these fossils resembled living species

The ship moved to the Islands about 1000km off the coast of Ecuador
the Galapagos islands

he found many strange and unique animals with seemed to have distant cousins on mainland South America

eg species of Iguanas, mocking birds, tortoises, thrushes and Finches

Locals could identify which Island they uniquely inhabited Eg by shape of tortoises shell

this eventually was used as one of the key points in theory of evolution Natural Selection

eg Speçialism of Giant Tortoise

When returned to England wrote up his Field notes bon the Plants and Animals he had foundering his 5 year voyage these were published in 5 volumes and he became a respected naturalist and pillar of scientific establishment. This was further enhanced by his wide distribution of specimens to university and museums

this enabled his specimens to be examined by other scientists confirming some of his conclusions eg Darwin's finches were different species not just varieties....

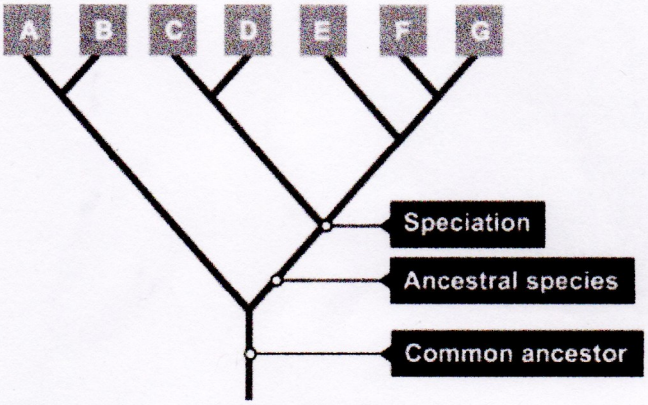
About this time he read a book by Thomas Malthus on population. Thomas Malthus had calculated that populations increase geometrically (exponentially) eg. 2 4 8 16 32 64 but food production only increases mathematically eg. 2 4 6 8 10 12 this means as populations increase the food supply cannot keep up with demand.... Result famine

This was the final clue Darwin needed to formulate his theory going the link between environment and Population Size. Living things compete over resources (food light space etc) only the most fit for a given region survive and pass on their genetic information (Darwin did not know how information was passed on)

- individual organisms within a particular species show a wide range of variation for a characteristic
- individuals with characteristics most suited to the environment are more likely to survive to breed successfully
- the characteristics that have enabled these individuals to survive are then passed on to the next generation

- over time these characteristics get established in the gene pool
- The population gradually changes until a new species is established

This theory is called natural selection.



Evolutionary trees

Evolutionary trees are used to represent the relationships between organisms. Branches show places where **speciation** has occurred, and a new species has evolved.

In this evolutionary tree, species A and B share a recent common ancestor. Species A is therefore most similar to species B.

Species F and G also share a recent, yet different, common ancestor, which itself shared a common ancestor with species E. All seven species share a common ancestor, probably from the distant past. The information is collected from a variety of sources, for example, fossil records and DNA sequences.

Compared to natural Theology

a) no creator

b) Species are not fixed

c) the process takes a very long time (not just 6000 years)

d) There is no design

But he did not publish his theory, he did confide in other scientists but realised it would be controversial and he wanted more evidence in addition to his voyage.

he then bred pigeons (by artificial selection) choosing traits that he wanted, he then spent 8 years studying barnacles.

In 1858 he received a letter from Wallace, he had independently discovered effectively the same mechanism for evolution. They decided to present a joint Paper to the Linnean society in London announcing the theory to the scientific establishment.

Darwin then wrote the book The origin of species and published in 1859 this became a best seller.

The main points in the book were

a) in any population you can see variation within the same species eg. birds some have short beaks others have long beaks

b) over a very long time natural selection modifies the population and the fittest survive and reproduce passing on these traits. eg if birds with long beaks find it easier to get food, in times of famine those with long beaks are more likely to survive and the birds with short beaks become much less common.. birds with the unfit trait eventually die out. the populations diverge and you get a new species

Wallace came from a poor family and left school at 16 had various jobs but eventually left England to be a professional animal and collector for wealthy clients and institutions. He read lots including darwins voyage of the beagle and Malthus

He went to the amazon and teamed up with another collector Henry Walter Bates.They collected large quantities of birds and monkeys and sent them back to England. However on the way back to europe his ship caught fire and sank. His large cargo of valuable specimens was lost, he survived but was bankrupt. In 1854 he went to southeast asia to earn money by collecting more specimens. he travel from island to island and noted how many of the animals were unique to each Island eg. in Indonesia and malaysia

This led him to realise that different environments produced perfectly adapted organisms. maybe this different environment produced the new species.. it was a self acting process.. the fittest would survive. He sent these Ideas to

darwin and they decided to publish jointly. He would stay in Asia and wrote the book the Malay Archipelago in 1869 He also developed the Wallace line

The divergence of Fauna between Asiatic (on the west and Australasian fauna. on the east)

The theory of natural selection was accepted very quickly amongst most educated people. Darwins and Wallace's writing and the depth of evidence made a compelling case. The term Survival of the Fittest was first used not by Darwin·By Herbert Spencer in1867, it was later included by Darwin in the 5th Edition of his book.

The theory was quickly applied more controversially to humans,

It was also applied to human civilisations (some people are more fit to govern) Known as Social Darwinism.. this eventually led to eugenics.

(1) Intro what we will talking about ->
Start with Evidence for Evolution
-> Guys slides.