Theories of Evolution

Classification and evolution

B1.7 Evolution

Accepting Darwin's ideas

Natural Selection

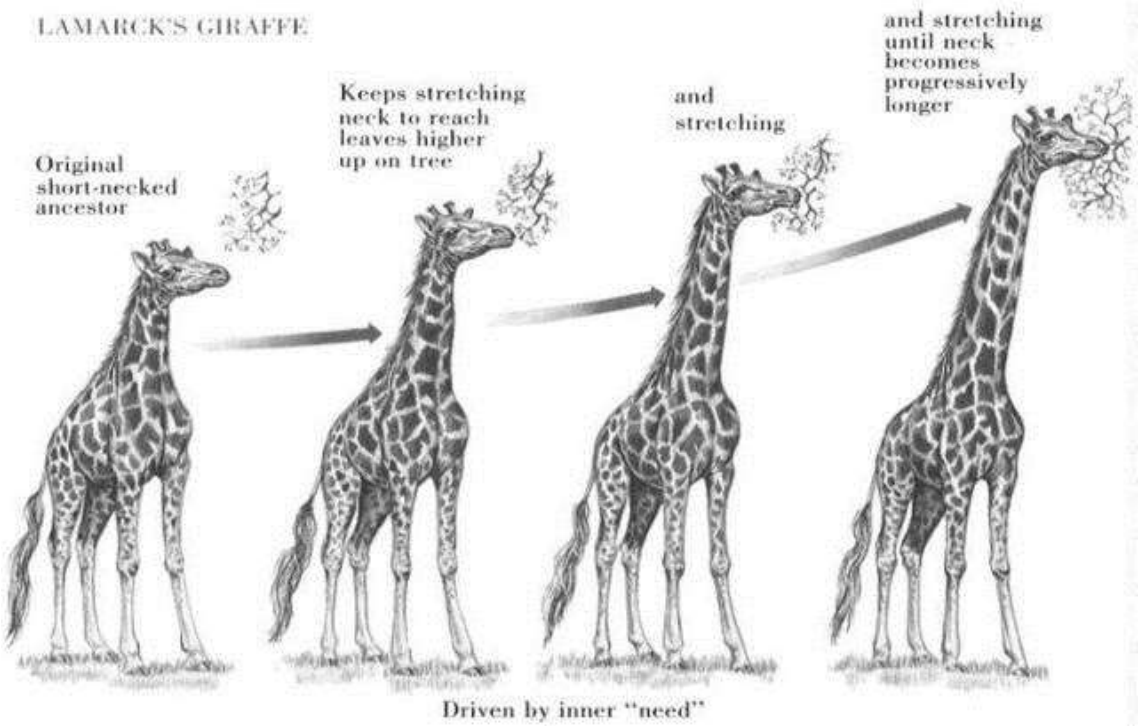
Theories of Evolution

All species of living things alive today have evolved from the first simple life forms

Jean-Baptiste Lamarck was a French biologist

His idea was that every animal evolved from primitive worms - The change was caused by the inheritance of acquired characteristics

Problems: No evidence - People didn't like to think they descended from worms - People could see clearly that changes were not passed onto their children (e.g. Big muscles)



Accepting Darwin's Ideas

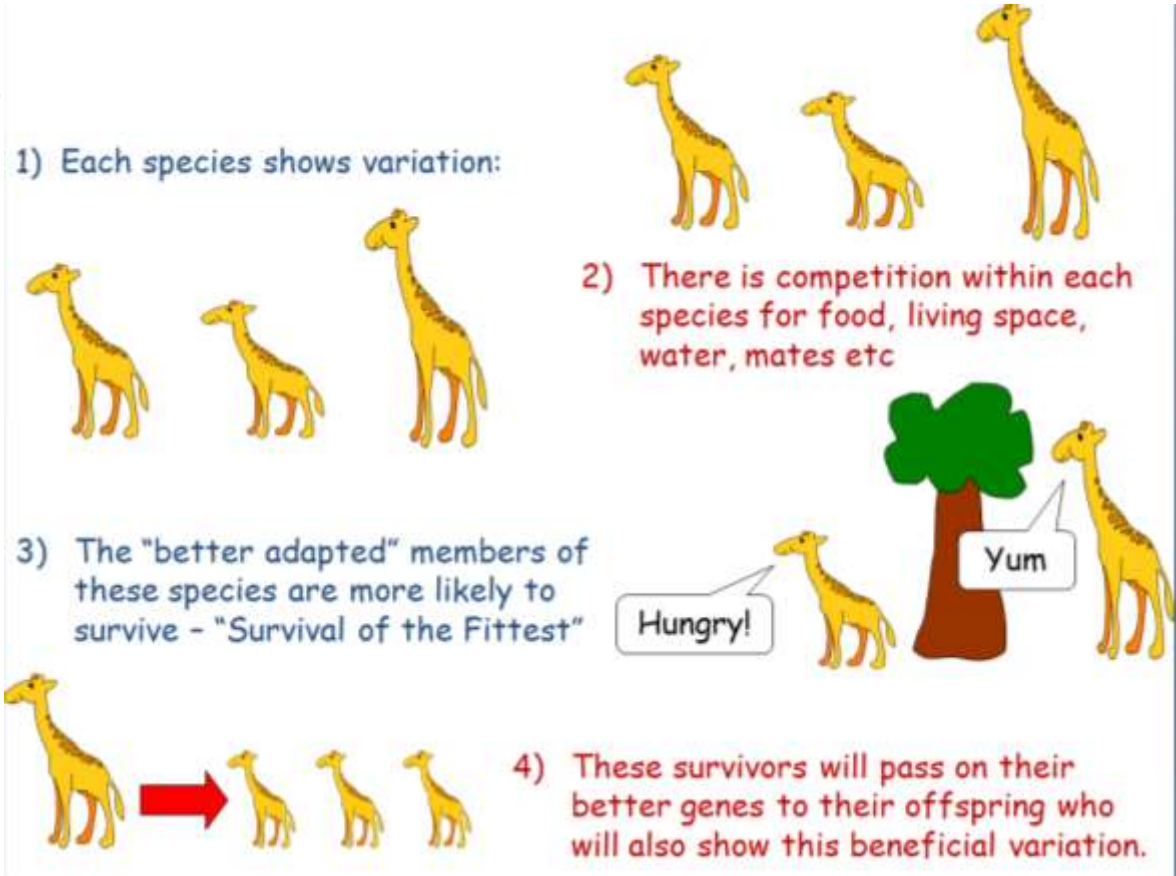
Darwin travelled the Galapagos Islands and noticed animals were adapted to their surroundings – his theory is that all living organisms have evolved from simpler life forms. This process has come about by **natural selection**

Building up the evidence:

- Animal and plant specimens
- Breeding experiments with pigeons
- Studied barnacles
- Network of friends also interested (scientists, pigeon breeders)

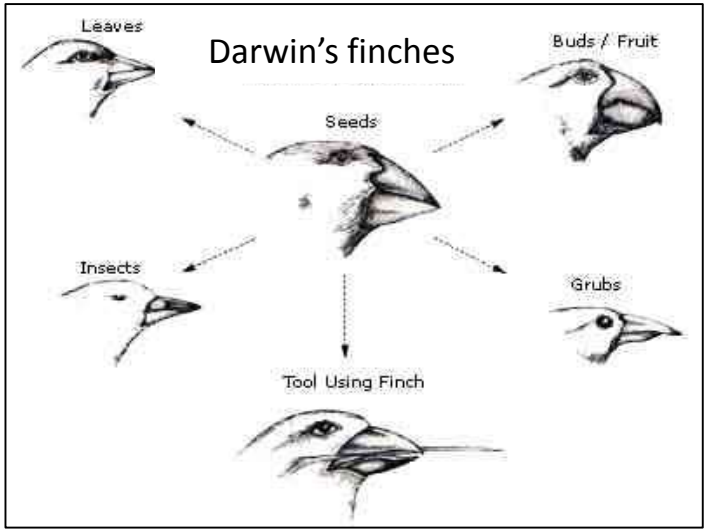
Why did people object?

Religious – god made the world
Not enough evidence
No way to explain inheritance – genetics not known about



Natural Selection

1. Variation
2. Competition
3. Survival of the fittest
4. Reproduction



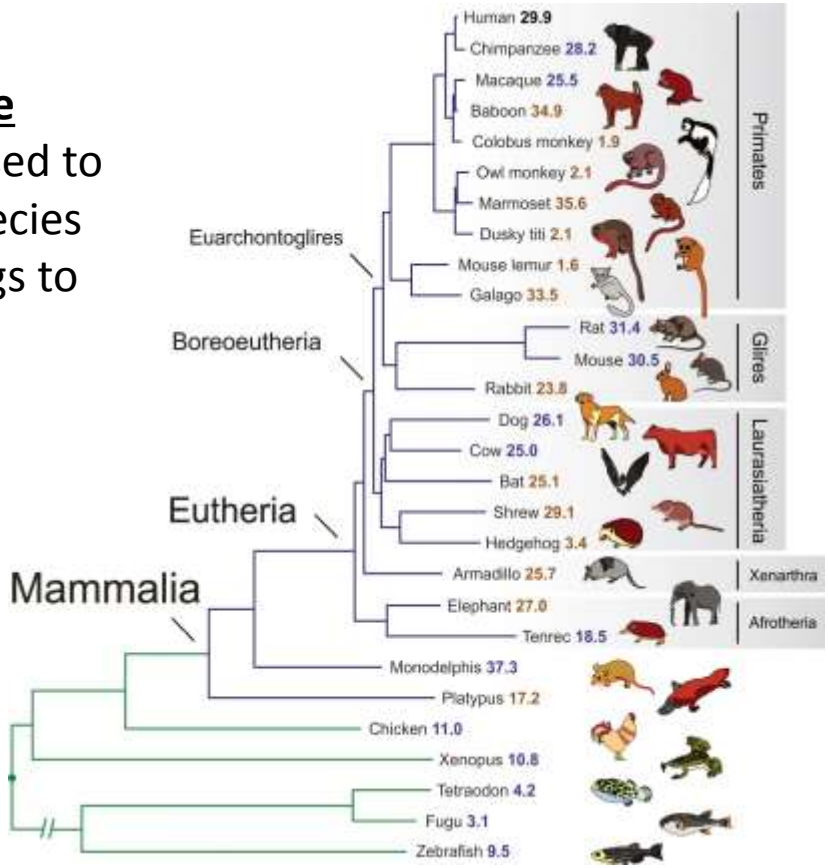
<u>Examples of evolution</u>:
Peppered moth,
Antibiotic resistance in bacteria,
Warfarin resistance in rats

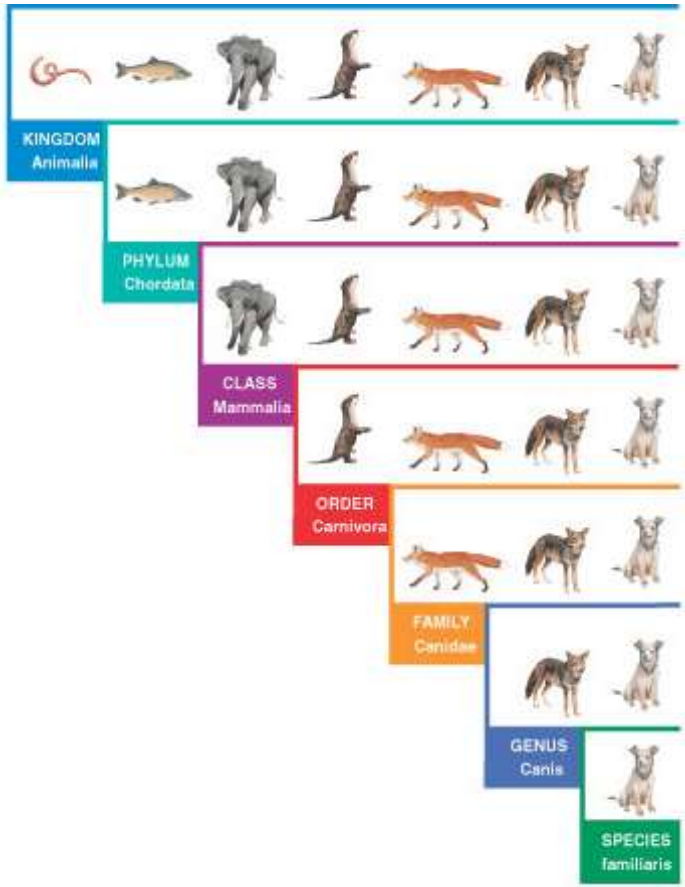
<u>Mutations</u>: New forms of **genes** resulting from changes to existing genes – random – mistakes made when **DNA** is copied in **cell division.** Mutations introduce more **variety**. May have no effect or harmful but if better **suited to the environment** and more likely to **survive** and **reproduce**

Classification and Evolution

Species: A group of similar organisms that are capable of interbreeding to produce fertile offspring

Evolutionary tree
DNA evidence used to decide which species an animal belongs to and work out evolutionary relationships





Exam questions:

7 The Galapagos Islands are in the Pacific Ocean, 1400 km from South America.
A type of bird called a ground finch lives on the islands.
The picture shows a ground finch.

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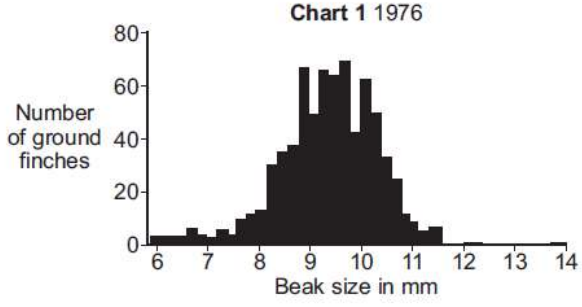
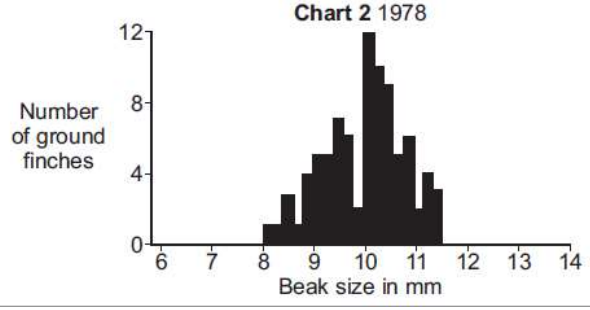
The size of the seeds the ground finch can eat depends upon the size of the beak.
To eat large seeds, a large beak is needed.
The bar charts show the sizes of the beaks of ground finches on **one** island, in 1976 and in 1978.





7 (a) The population of the ground finches and their beak sizes changed between 1976 and 1978.

Describe these changes.

(3 marks)

7 (b) In 1977 there was very little rain on the island. The lack of rain affected the seeds that the finches ate.
The table shows how the seeds were affected.

Year	Mean number of seeds per m^2	Mean mass of each seed in mg
1976	8.5	3.5
1978	2.8	4.2

Suggest an explanation for the changes in beak sizes between 1976 and 1978.

(4 marks)

7 (a)	in 1978 fewer finches **or** population smaller		1
	any **two** from: • no beaks less than 8mm • no beaks greater than 11.5 / 12mm • mean / average beak size higher	if these points not given allow smaller range of beak sizes for **1** mark	2
7 (b)	variation or range or mutation of beak sizes	do **not** accept idea that drought / seed size caused mutation	1
	birds with larg(er) beaks are better adapted for feeding	accept idea of competition for food / seeds amongst finches	1
	birds with larg(er) beaks survive	accept (only / more) birds with large beaks were better competitors	1
	birds with larg(er) beaks breed **or** gene / allele for large beak passed on	do **not** accept large beak passed on	1

5 The Blue-moon butterfly lives on a small island called Samoa, in the Pacific Ocean.

In 2006 Blue-moon butterflies almost became extinct.

Wolbachia bacteria killed males before they could hatch from eggs. Only females were resistant to the bacteria.

In 2006 the number of male Blue-moon butterflies had decreased to only 1 per cent of the population. Two years later, the number of males was equal to the number of females.

5 (a) Scientists believe that a change in a gene suddenly occurred to make some males resistant to the bacteria.

What scientific term describes a change in a gene?

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(1 mark)

5 (b) The numbers of male Blue-moon butterflies in the population increased quickly after the new form of the gene had appeared.

Suggest why.

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(4 marks)

5(a)	mutation	correct spelling only ignore other adjectives eg random / spontaneous	1
5(b)		ignore references to X / Y chromosomes	
	idea of mutant gene / new form / this allows hatching (of males)		1
	(individual with advantage) (more) survive / (more) live / (more) don't die	allow immunity rather than resistance throughout	1
	(so survivors) breed / reproduce		1
	mutation / gene passed (from survivors) to offspring / next generation	allow resistance / characteristic for gene 'gene passed on' is insufficient	1

7 Darwin suggested the theory of natural selection.

7 (a) Explain how natural selection occurs.

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(3 marks)

7 (b) Latitude is a measure of distance from the Earth's equator.

Scientists investigated the effect of latitude on:

- the time taken for new species to evolve
- the number of living species.

The table shows the scientists' results.

Latitude in degrees North of equator	Time taken for new species to evolve in millions of years	Relative number of living species
0 (at the equator)	3–4	100
25	2	80
50	1	30
75 (in the Arctic)	0.5	20

As latitude increases environmental conditions become more severe.

7 (b) (i) Describe the patterns shown by the data.

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(2 marks)

7 (b) (ii) Suggest explanations for the patterns you have described in part **(b)(i)**.

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(2 marks)

7(a)	variation (between organisms within species) those most suited / fittest survive genes / alleles passed on (to offspring / next generation)	allow described example allow mutation – but **not** if caused by change in conditions allow mutation passed on	1 1 1
7(b)(i)	any **two** from: • increase in latitude reduces number of (living) species • increase in latitude reduces time for evolution (of new species) • the less the time to evolve the fewer the number of (living) species	allow converse ignore references to severity of conditions	2
7(b)(ii)	any **two** from: • (increase in latitude reduces number of (living) species because) less food / habitats / more competition at high latitude • increase in latitude reduces time for evolution (of new species) because) severe conditions act more quickly / to a greater extent on the weakest • (the less the time to evolve the fewer the number of (living) species because) species that evolve slowly don't survive	do **not** accept intention or need to evolve allow only extremophiles / well-adapted species can survive	2