

## EVOLUTION BY NATURAL SELECTION

13 AUGUST 2014

### Lesson Description

In this lesson we:

- Define *evolution* and *biological evolution*.
- State the difference between a *hypothesis* and a *theory*.
- Describe how each of the following provides evidence for evolution:
  - Fossil record
  - Modification by descent (homologous structures)
  - Biogeography
  - Genetics
- Define a species and a population.
- Describe how various factors contributes to variation amongst individuals of the same species
- Differentiate between continuous variation and discontinuous variation.
- Describe what is meant by each of the following 'Laws' used by Lamarck to explain evolution:
  - 'Law' of use and disuse
  - 'Law' of the inheritance of acquired characteristics
- Give reasons for Lamarck's theory being rejected.
- State the observations upon which Darwin based his theory
- Describe Darwin's theory of evolution by natural selection
- State what is meant by artificial selection
- List similarities between natural selection and artificial selection.
- Tabulate differences between natural selection and artificial selection.
- Describe how punctuated equilibrium explains the speed at which evolution takes place

### Summary

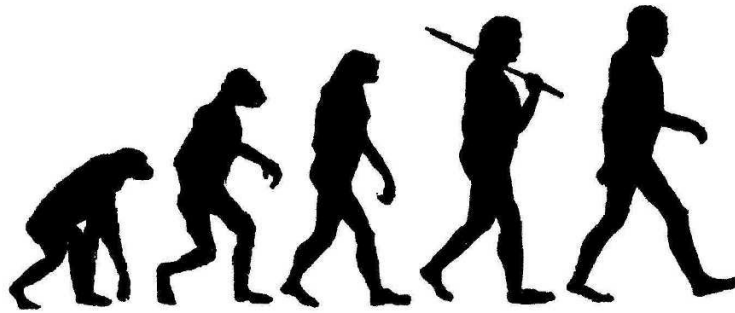
#### Evolution



- Basic premise = All living organisms share a common ancestor
- A gradual process in which something changes into a different and usually more complex or better form.

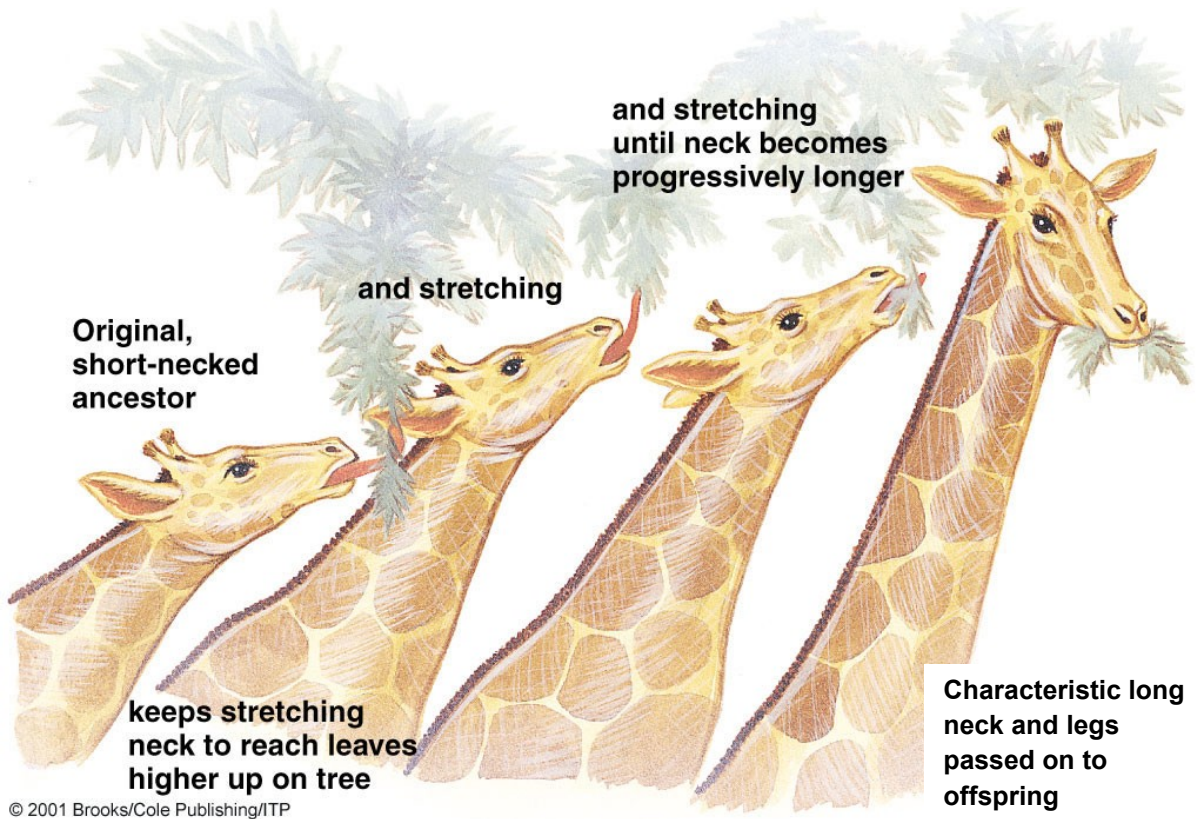
## Biological Evolution

- Descent with modification - changes in living organisms over time.



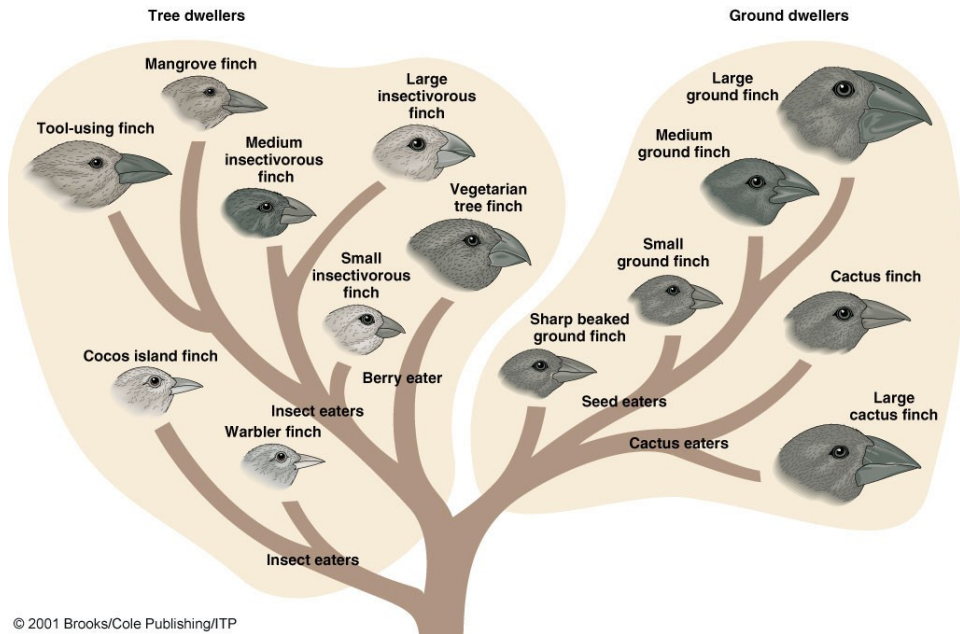
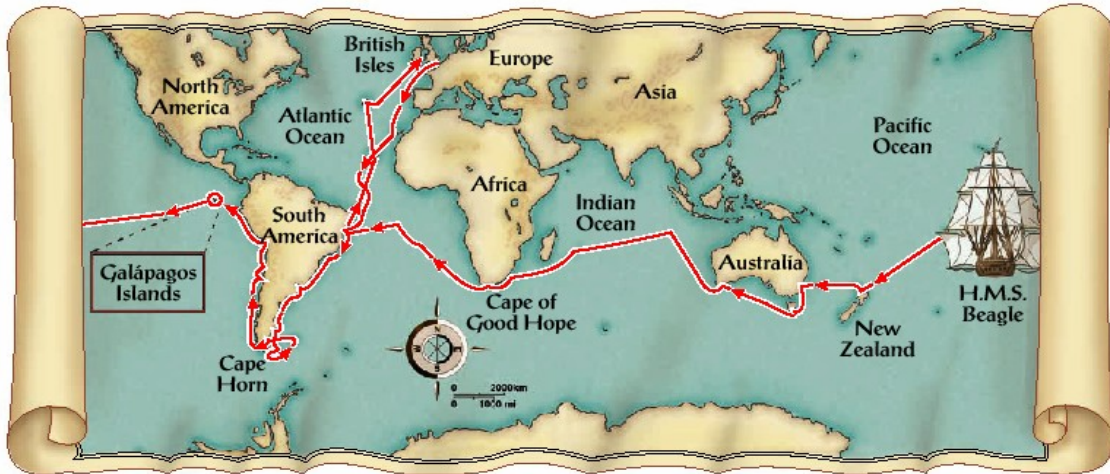
## Lamarck

- Use and Disuse
- Inheritance of acquired/modified characteristics



notes for...

Darwin



notes for...

**Theory of Natural Selection**

**Natural selection favors longer necks: better chance to get higher leaves**

**Original group exhibits variation in neck length**



**Favourable gene passed on to offspring**

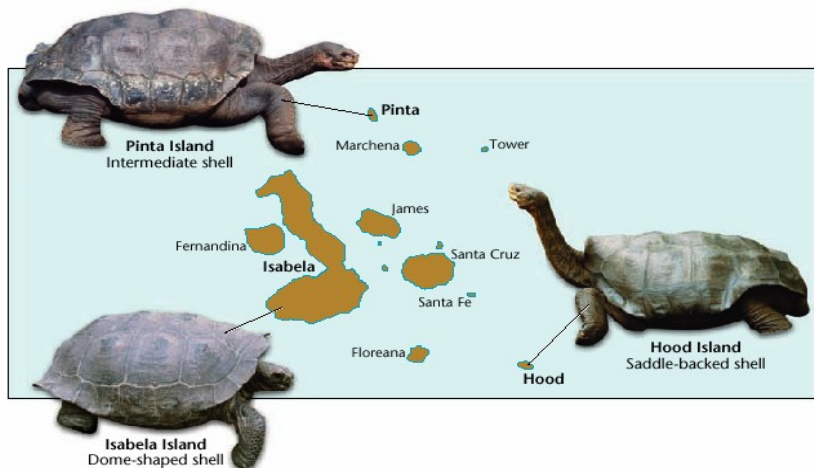


**Over several generations – shift in frequency of genes**

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- Many offspring
- Variation
- Competition
- Suitability
- reproduction
- Natural Selection
- Genotype & phenotype
- Subsequent generations

**Why Different?**

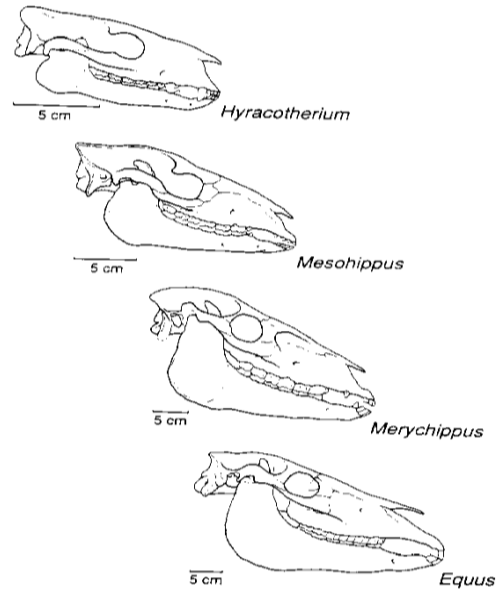


notes for...

**Evidence for Evolution**

1. Fossil/Paleontology

Name	<i>Hyracotherium</i>	<i>Mesohippus</i>	<i>Merychippus</i>	<i>Equus</i>
Geological Epoch	Early Eocene	Oligocene	Late Miocene	Pleistocene
Forefoot (front view)				
Forefoot (side view)				



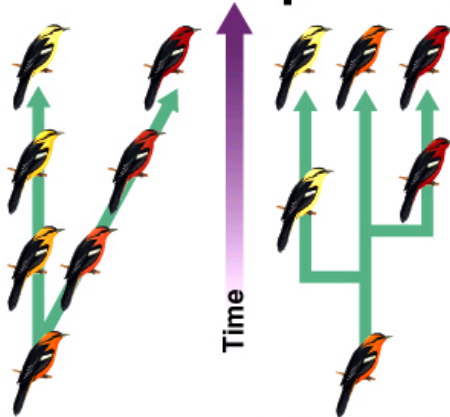
2. Comparative Anatomy
  - Homologous
  - Analogous
  - Vestigial structures
3. Biogeography
4. Molecular Biology and Genetics



notes for...

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# Phyletic gradualism versus punctuated equilibrium

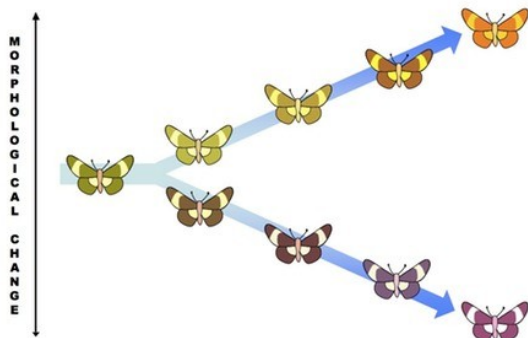
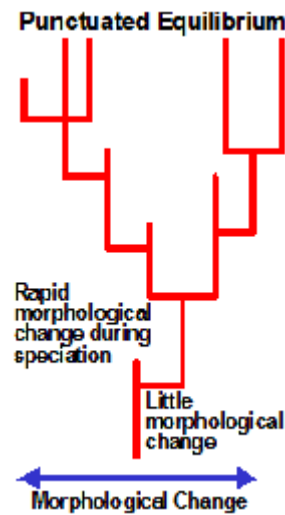
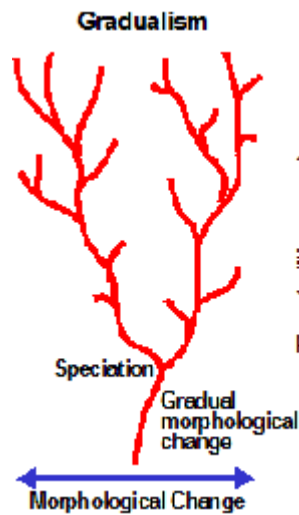


## a. Phyletic Gradualism

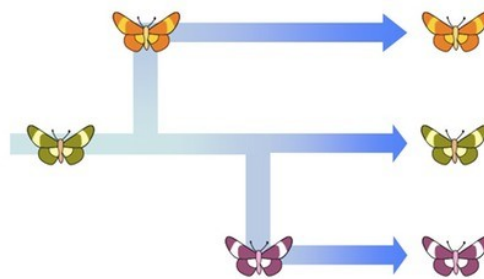
Speciation occurs gradually and stasis is apparent rather than real. Transitional links should be found. An ancestral species can be transformed into a new species.

## b. Punctuated Equilibrium

Speciation occurs rapidly and then a species experiences stasis. Transitional links will not necessarily be found. A subpopulation of the ancestral species becomes a new species.



Phyletic Gradualism



Punctuated Equilibrium



## Test Yourself

Select the most correct answer from the options given. Write down only the correct letter

### Question 1

Which of the following is NOT a component of the Theory of Evolution by Natural selection?

- A Competition for food and space
- B Variation among species
- C Inheritance of acquired characteristics
- D Survival and reproduction

### Question 2

A structure that seems to serve no purpose in an organism is called ....

- A homologous
- B vestigial
- C analogous
- D fossilized

### Question 3

In science, theories are:

- A an educated guess
- B a known fact
- C absolute and unchangeable
- D the best explanation for a set of data or observations

### Question 4

The finches on the Galapagos island were similar in form except for variations of their beaks. Darwin observed that these variations were useful for:

- A attracting a mate
- B defending territory
- C gathering food
- D building nests

### Question 5

Fossils can tell us:

- A the relative and absolute age of the species
- B only the relative age of a species
- C nothing of the age of a species
- D only the absolute age of a species

### Question 6

The breeding of dogs by humans to have a particular coat colour is an example of:

- A Natural selection
- B Artificial selection
- C Inheritance of acquired traits
- D Macroevolution

### Question 7

Which ONE of the following serves as evidence of cultural evolution in early *Homo* species?

- A Drawings and carvings on rocks
- B Animal remains close to a *Homo* skeleton
- C Male and female skeletons in the same area
- D More than one *Homo* skeleton in an area

### Question 8

The table below shows the number of differences in the amino acid sequence of the protein albumin in four species of primates

Species of primates	Monkey	Gibbon	Gorilla	Human
Human	32	14	8	0
Gorilla	32	14	0	
Gibbon	32	0		
Monkey	0			

Which two species are likely to have separated most recently according to the results on the table?

- A Humans and monkeys
- B Gorillas and gibbons
- C Gibbons and monkeys
- D Gorillas and humans

### Question 9

Indicate whether each of the statements in COLUMN I applies to **A only**, **B only**, **both A and B** or **none** of the items in COLUMN II..

	COLUMN I	COLUMN II
1	Describes evolution as consisting of long phases of little change alternating with short phases of rapid change	A: Punctuated equilibrium B: Darwinism
2	Evidence for evolution	A: Mitochondrial DNA B: Homology
3	The evidence that related species in similar biomes across the world developed from a common ancestor.	A: Biochemistry B: Biogeography
4.	Proposed the 'law' of use and disuse to support his theory of evolution	A: Lamarck B: Darwin



**Question 10**

Give the correct **biological term** for each of the following descriptions. Write only the **term** next to the relevant question number.

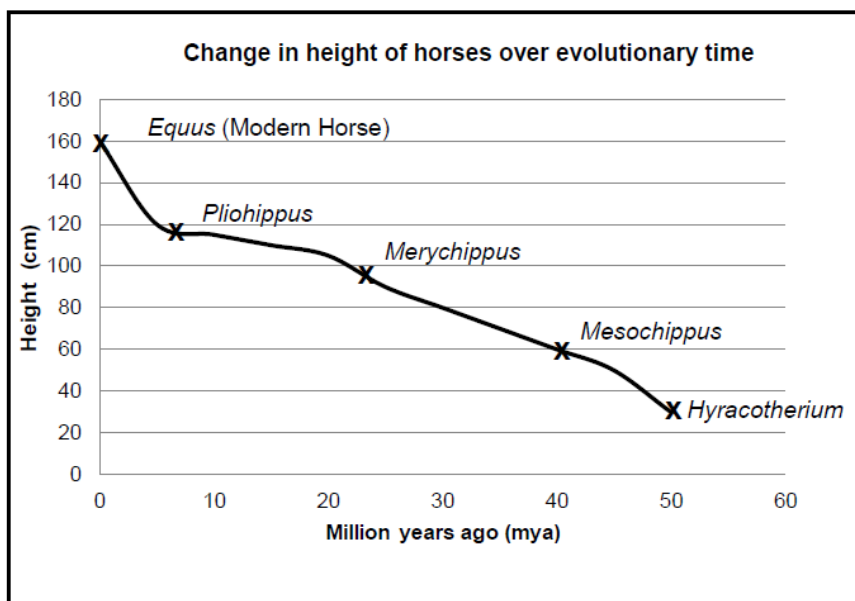
1. A diagram that shows possible evolutionary relationships between groups of organisms
2. The study of ancient humans and their cultures
3. Dating of fossils by comparing the age of one fossil to another
4. Lamarckian principle that suggests that if a structure is not used it may become smaller or disappear



**Improve your Skills**

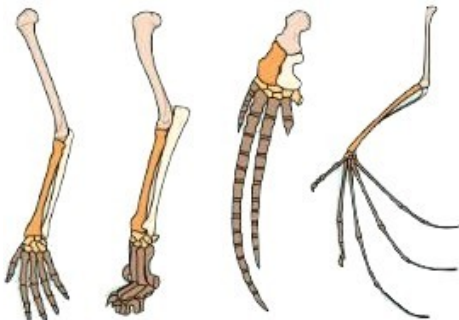
**Question 1**

The graph below shows the changes in the height of horses over evolutionary time.



[Adapted from *Biology*, Jones and Jones, 1993]

- 1.1 Distinguish between the terms evolution and biological evolution.
- 1.2 How would scientists have made observations about the different heights of these horses?
- 1.3 Calculate the difference between the height of *Equus* and *Mesochippus* according to the available data.
- 1.4 How would Lamarck have probably described the change of the height of horses over time?
- 1.5 Explain why we cannot be sure that the evolutionary information displayed in the graph are absolutely correct.
- 1.6 Study the following diagrams and answer the questions that follow:



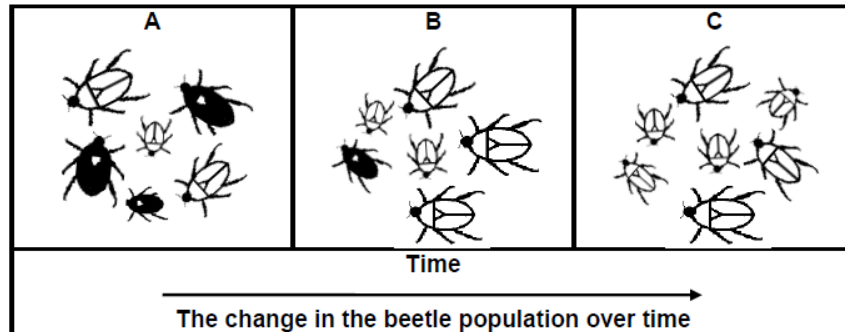
Explain why the above are considered to be homologous structures.

- 1.7 How do scientists use the above example as evidence for evolution.

**Question 2**

(Adapted from March 2013, Paper 2, Version 2, Question 2.1)

Study the three diagrams (A, B and C) below that show how a population of beetles changed over a long period of time.

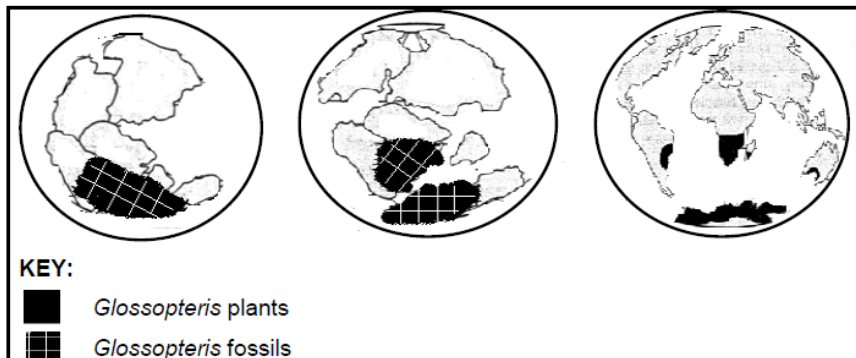


- 2.1 By comparing diagrams A and B, state the characteristic of the beetles that have enabled their offspring to survive.
- 2.2 Name the evolutionary mechanism that is illustrated in these diagrams.
- 2.3 Use the THREE diagrams above to explain the mechanism named in QUESTION 2.2.

**Question 3**

(Adapted from March 2013, Paper 2, Version 2, Question 3.1)

Refer to the diagrams below that show the distribution of the fossils of *Glossopteris* and the present-day *Glossopteris* plants and answer the questions that follow.



- 3.1 Between 500 and 300 million years ago the Earth was one supercontinent as shown in the first diagram. What is the name of this supercontinent?
- 3.2 How do scientists explain the present-day distribution of *Glossopteris* plants?

**Question 4**

Describe how each of the following contributes to genotypic variation within a species:

- 4.1 Meiosis (6)
- 4.2 Mutation (2)
- 4.3 Sexual reproduction (4)



**Links**

- Darwin and Lamarck: <https://www.youtube.com/watch?v=V8KlviCfGEM>
- Mindset Video Series: [https://www.youtube.com/watch?v=B4GFlvirB\\_w](https://www.youtube.com/watch?v=B4GFlvirB_w)