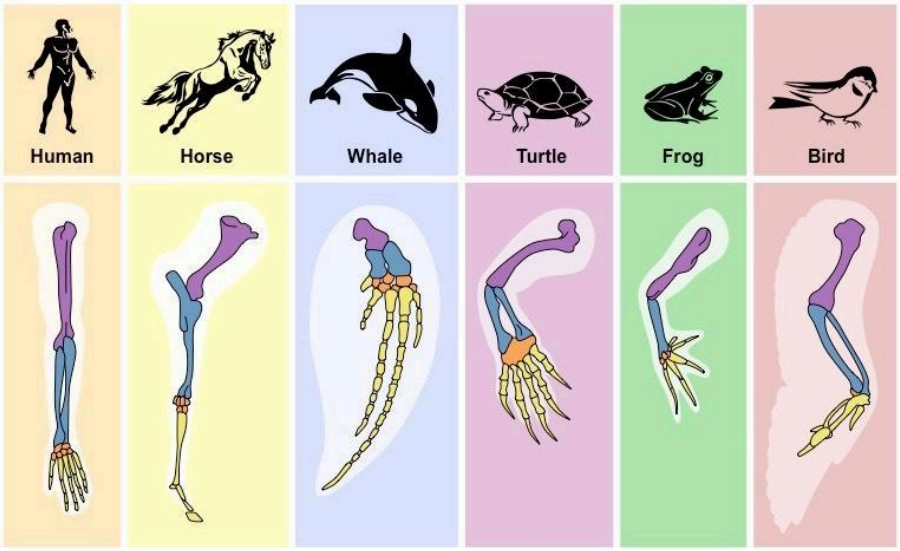
Year 13 HL

IB BIOLOGY

5.1 Evidence for Evolution



Name:

Teacher: Mr Trent

5.1 Evidence for Evolution

Essential idea: there is overwhelming evidence for the evolution of life on Earth.

Nature of science:

Looking for patterns, trends and discrepancies—there are common features in the bone structure of vertebrate limbs despite their varied use.

Understandings:

- Evolution occurs when heritable characteristics of a species change.
- The fossil record provides evidence for evolution.
- Selective breeding of domesticated animals shows that artificial selection can cause evolution.
- Evolution of homologous structures by adaptive radiation explains similarities in structure when there are differences in function.
- Populations of a species can gradually diverge into separate species by evolution.
- Continuous variation across the geographical range of related populations matches the concept of gradual divergence.

Applications and skills:

- Application: Development of melanistic insects in polluted areas.
- Application: Comparison of the pentadactyl limb of mammals, birds, amphibians and reptiles with different methods of locomotion.

Definition of Evolution

Define Evolution:

- A change in the *allele frequency* of a population's *gene pool* over successive *generations*

Evidence of Evolution

1. Fossil Record - Fossils can be dated by determining the age of the rock layer (strata) in which the fossil is found

2. Evidence of Common Ancestry

3. Comparative Anatomy (Homologous Structures vs Analogous Structures)

4. Vestigial Structures

5. Embryology

6. Similarity of Protein Structure

7. Similarity of different Genomes

8. Geographical Distribution

9. Behaviour

10. Selective Breeding (artificial selection)


Normal Cow


Belgian Blue

Give 2 plant and 2 animal examples of selective breeding and provide reasons why selective breeding was used.

Evidence of Evolution – The Peppered Moth

1. What were the natural variations within the original peppered moth population?

2. Which characteristic was favourable and why?

3. What change in the environment provided the selection pressure?

4. Which characteristic became favourable as a result?

5. Describe and explain how the allele frequency of the moth population changed over time.

Describe the story of the peppered moth using a images.

Development of melanistic insects in polluted areas

1. Why was the original form of the peppered moth pale and speckled? What advantages did this bring to the species whilst resting on tree trunks?

Peppered moths rest on silver birch tree trunks with their wings outstretched, this behaviour can make them easy prey for birds. Originally the peppered moth was only recorded in the paler speckled form, but during the industrial revolution in the UK (about 200 years ago) dark coloured peppered moths started to be recorded.

Whilst the numbers of the dark form of the peppered moth increased dramatically, the paler speckled form became scarce in some areas. However, in more recent times the numbers of the dark form have declined relative to the pale form.

2. What happened during the industrial revolution which allowed the darker moths to evolve and increase in numbers? What advantages did the darker moth now have?

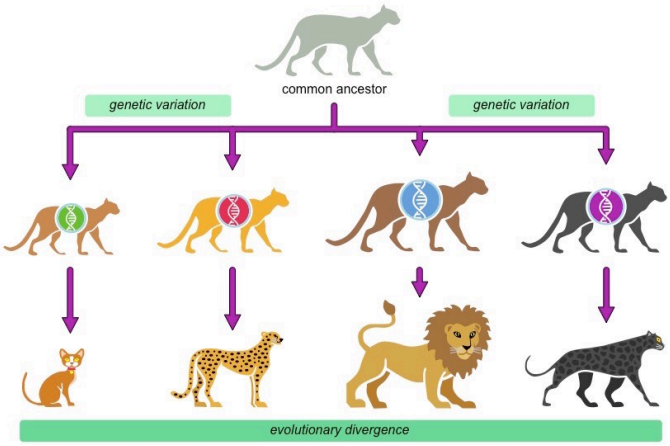
3. What happened in 1964 which resulted in the decline in the darker form of the peppered moth?

4. What types of factors have influenced the evolution of the peppered moth in the last 200 years? Why was the evolution of the species so fast?

Evolution

1. Populations of a species can gradually diverge into separate species by _____.
2. Within a population of any given species there will be genetic _____ (through meiosis, _____ reproduction or m_____).
3. Typically this variation will be continuous and follow a _____ distribution curve as the rate of change is gradual and cumulative
4. If two populations of a species become _____ **separated** then they will likely experience different ecological conditions
5. Over time, the two populations will _____to the different environmental conditions and gradually diverge from one another
6. The degree of divergence will depend on the extent of geographical separation and the amount of _____since separation occurred
7. Populations located in close proximity that separated recently will show _____ variation (less divergence)
8. Distant populations that separated a longer period of time ago will show _____variation (more divergence)
9. As the genetic divergence between the related populations increase, their genetic compatibility decreases
10. Eventually, the two populations will diverge to an extent where they can no longer _____ if returned to a shared environment
11. When two populations can no longer interbreed and produce _____, viable offspring they are considered to be separate species
12. This process is called _____

Variation
Interbreed
Speciation
Fertile
Evolution
Normal
Geographically
Adapt
Time
Less
More



What is speciation? How does it occur?

1. evolution.
2. variation
3. normal
4. geographically
5. adapt
6. time
7. less
8. more
9. As the genetic divergence between the related populations increase, their genetic compatibility decreases
10. interbreed
11. fertile
12. Speciation

1. Which of the following represent homologous features?

A. Wings in birds and insects

B. The appendix in humans and horses

C. Fins in fish and wings in birds

D. The striped coat of the zebra and the tiger

(1)

2. Which of the following are used as evidence for evolution?

I. Homologous structures

II. Selective breeding of domesticated animals

III. Overproduction of offspring

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

(1)

3. Explain why the development of melanistic insects in polluted areas can be used as evidence in support of the theory of evolution.

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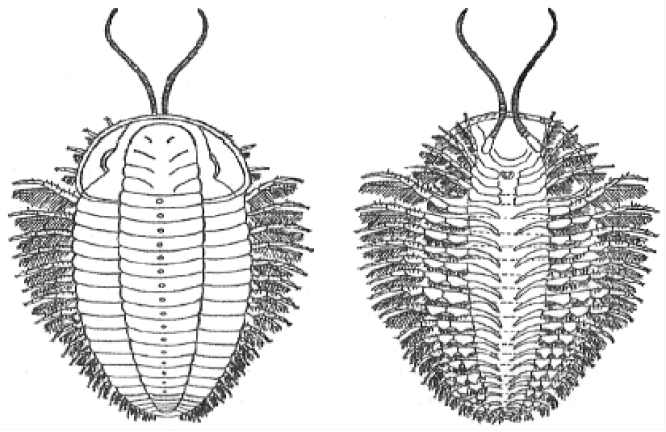
(3)

4. *Triarthus* was a trilobite that lived on Earth about 500 million years ago. The diagrams below show its structure, viewed from above and below. The structure was discovered by studying fossils of *Triarthus.*



[Source: R Fortrey, (2000), *Trilobite!*, page 62]

Outline the evidence for evolution provided by fossils.

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(2)

5. Outline the evidence for evolution provided by homologous structures.

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(5)

1. B

[1]

2. A

[1]

3. The melanin/black variety of moth arose as a result of a mutation (in the light form);
pollution surfaces camouflage the melanistic moths from predators better than the light form;
selection advantage for the melanin in the presence of pollution;
frequency of the melanin allele within the population increases in with pollution;

3 max

4. fossils show changes over time (in organisms);
fossilized organisms are different from existing ones;
(yet) share features with existing organisms / homologous structures;
suggest common ancestry;
show intermediate stages in evolution of groups / missing link fossils; 2 max

5. comparative anatomy of groups of animals or plants shows certain structural features are basically similar;
homologous structures are those that are similar in shape in different types of organisms;
structural similarities imply a common ancestry;
(homologous structures) used in different ways;
example is pentadactyl limb in vertebrates / modification of ovary wall or pericarp to aid seed dispersal / other suitable example;
adapted to different mode of locomotion in particular environment / example of two differences such as bat's wing and human hand;
illustrates adaptive radiation since basic plan adapted to different niches;
the more exclusive the shared homologies the closer two organisms are related;
certain homologous structures in some species with no apparent function such as human appendix (homologous with functional appendix in herbivores); 5max