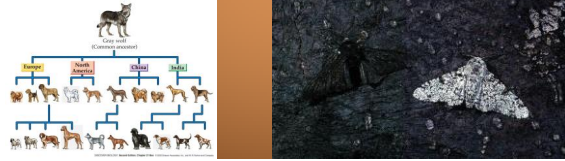


Evolution and Biodiversity

5.1- Evidence for Evolution

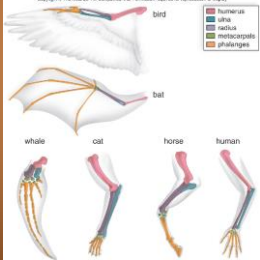


Essential idea:

- There is overwhelming evidence for the evolution of life on Earth.
 - Fossils
 - Biogeography- geographical distribution of species
 - Comparative Anatomy
 - Comparative Embryology
 - Molecular Biology

Nature of science:

- Looking for patterns, trends and discrepancies
 - there are common features in the bone structure of vertebrate limbs despite their varied use. (3.1)



Theory of knowledge:

- Evolutionary history is an especially challenging area of science because experiments cannot be performed to establish past events or their causes. There are nonetheless scientific methods of establishing beyond reasonable doubt what happened in some cases.
- How do these methods compare to those used by historians to reconstruct the past?

Evolutionary history of Equus (1)

Theory of knowledge:

Evidence for Evolution "It's only a theory!"

Find the **scientific** definitions of

FACT THEORY

TOK

i-Biology

Theory of knowledge:

Evidence for Evolution "It's only a theory!"

Find the **scientific** definitions of

FACT THEORY

"any observation that has been repeatedly confirmed and accepted as true; any scientific observation that has not (yet) been refuted"

TOK

i-Biology

Theory of knowledge:

Evidence for Evolution "It's only a theory!"

Find the **scientific** definitions of

FACT

"any observation that has been repeatedly confirmed and accepted as true; any scientific observation that has not (yet) been refuted"

THEORY

"A set of statements or principles devised to explain a group of facts or phenomena. Most theories that are accepted by scientists have been repeatedly tested by experiments and can be used to make predictions about natural phenomena."

TOK

i-Biology

Theory of knowledge:

Evidence for Evolution "It's only a theory!"

The **scientific method** is based on a system of **making hypotheses and testing them** through rigorous collection of **empirical evidence** (can be measured and recorded).

TOK

i-Biology

Theory of knowledge:

Evidence for Evolution "It's only a theory!"

The **scientific method** is based on a system of **making hypotheses and testing them** through rigorous collection of **empirical evidence** (can be measured and recorded), **peer-review of data**, statistical analysis, **replication** and finally acceptance.

theory

highest level of certainty in science

↑ accepted

corroborated unquestionably

↑ repeated

corroborated

TOK

i-Biology

Theory of knowledge:

Evidence for Evolution "It's ~~only~~ a theory!"

The **scientific method** is based on a system of **making hypotheses and testing them** through rigorous collection of **empirical evidence** (can be measured and recorded), **peer-review of data**, statistical analysis, **replication** and finally acceptance.

Real science is evidence-based. If a theory is proven wrong through good scientific evidence, the scientific community will re-think the theory. This is how science advances.

theory

highest level of certainty in science

↑ accepted

corroborated unquestionably

↑ repeated

corroborated

TOK

i-Biology

Theory of knowledge:

- The theory of evolution has stood up to generations of scientific research and testing.
- With each new piece of data collected, the theory gets stronger (and often more complicated).

Human Evolution

Because fossils are rare and often in poor shape, the field of human evolution is in a state of constant flux. This chart reflects current best estimates on what they think the range of these early hominid species looked like through to modern times. Major classification for some groups are tudy debated.

i-Biology

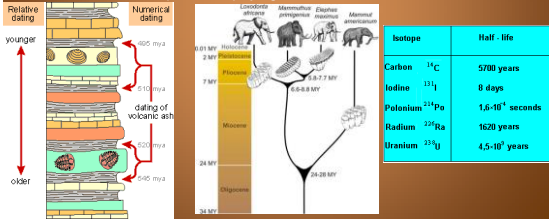
Understandings

- Evolution occurs when heritable characteristics of a species change.
 - Evolution is cumulative change over time.
 - Mechanism is natural selection.
 - Works at the population level.

i-Biology

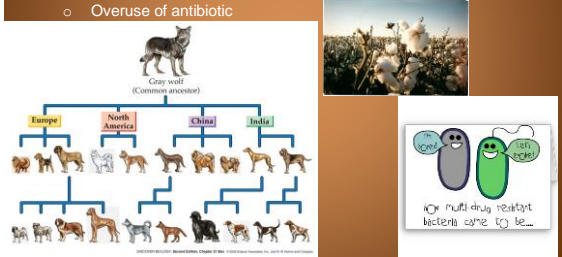
Understandings

- The fossil record provides evidence for evolution.
 - Fossils can be dated by a variety of methods that provide evidence for evolution.
 - Age of the rocks where a fossil is found (relative/absolute)
 - Rate of decay of isotopes including carbon-14
 - Relationships within phylogenetic trees



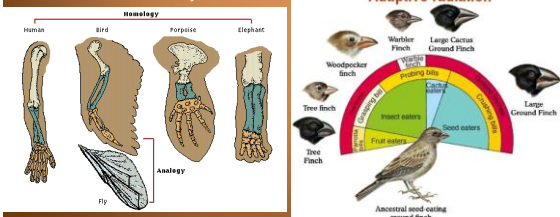
Understandings

- Selective breeding of domesticated animals shows that artificial selection can cause evolution.
 - Humans impact variation in other species.
 - Loss of genetic diversity within a crop species
 - Overuse of antibiotic



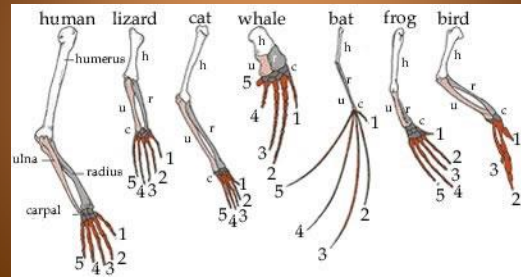
Understandings

- Evolution of homologous structures by adaptive radiation explains similarities in structure when there are differences in function.
 - Homologous Structures**
 - Similar features that originate in a shared ancestor
 - Structures may have different uses in adult, but come from same tissue in embryo.



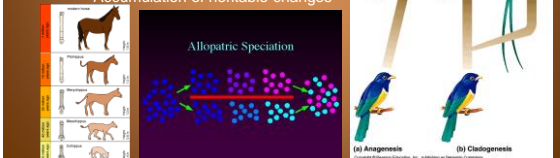
Applications

- Application: Comparison of the pentadactyl limb of mammals, birds, amphibians and reptiles with different methods of locomotion.



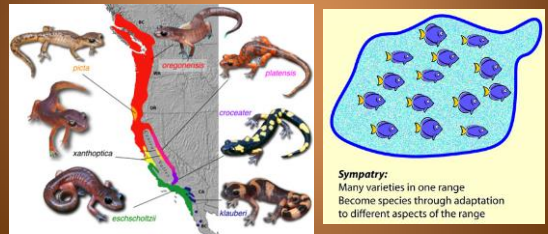
Understandings

- Populations of a species can gradually diverge into separate species by evolution.
 - Cladogenesis
 - Branching evolution
 - New species from a parent species that continues to exist
 - Allopatric Speciation (mechanism)
 - Anagenesis
 - Phyletic evolution
 - Accumulation of heritable changes



Understandings

- Continuous variation across the geographical range of related populations matches the concept of gradual divergence.
 - Sympatric Speciation



Applications

- Application: Development of melanistic insects in polluted areas.
 - Investigate the Peppered Moth ([Simulation for HW](#))

