**EVOLUTION**

- The development of complex forms of life from simple ancestors
- A change in the gene pool of a population over time
- Inheritable change in a group of organisms over time

- Inheritance of acquired characteristics

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**Aristotle’s View of Nature and the Christian Theory of Creation**
Species are eternally unchangeable.

Living species arose independently From inorganic matter and did not change.

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**Theory of Evolution**

Charles Darwin: *THE ORIGIN OF SPECIES*

- Theory of Descent with Modification
- Theory of Natural Selection
- Theory of Pangenesis (incorrect/discarded)

Chromosomal theory of heredity

Theory of inheritance

Genetic Theory of Evolution
Organisms in South America were different/exotic from those found in England.

Theory of Evolution
Charles Darwin and Alfred Wallace

Thomas Malthus: Tendency of population to increase in geometric proportion.

Theory of Natural Selection
Radioisotope Dating indicates that earth is 4.5 billion years old

<table>
<thead>
<tr>
<th>Radioisotope</th>
<th>Half-life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uranium-238</td>
<td>4.5 billion years</td>
</tr>
<tr>
<td>Lead</td>
<td></td>
</tr>
</tbody>
</table>

Uranium-238 decays to Lead

Uranium-238: Lead

Homologous Structures are Derived from a Common Ancestor

• Plants with betalains type red pigment are derived from a common ancestor
• Features of Plants that are also found in other organisms
  - Cells with nuclei
  - Chromosomes with histones
  - Genes containing non-coding regions called introns

Convergent characteristics in unrelated organisms

Cactus

Euphorbia
Biogeography: Study of Geographic distribution of animals

Island biogeography: Study of movement and evolution of organisms

World Distribution of Magnolias

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Adaptive radiation

- On many islands species arrive relatively frequently from a source area and fill the available niches.
- On very remote islands the rate of arrival of new species is so low that niches may be filled by a range of species evolving, within the island, or island group, from a single colonising species.
- This is adaptive radiation.

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Galapagos finches

The finches living on the Galapagos islands are a text-book example of adaptive radiation: the evolutionary diversification of a single lineage into a variety of species with different adaptive properties.
Variation in Fruit Morphology caused by Adaptive radiation in Hawaiian species of *Bidens*

**Variations in Fruit Morphology**
- *B. pilosa*
- *B. hiliobovida*
- *B. skottbergii*
- *B. crenophylla*

**Advancement in Molecular Biology and Evolution**

Cytochrome c oxidase
- An enzyme in electron transport chain (cellular respiration)
- It has been inherited by all the descendants from a single ancestor
- Related organisms have similar amino acids of this enzyme
- Genetic information is retrievable from DNA in fossils many thousands of years old

**Process of evolution can be observed in certain cases**
- Bacterial resistance to antibiotics
  - Example, Vancomycin resistant *Staphylococcus*
- Induced resistance to heat and chemicals in bacteria under laboratory conditions
Principles of Natural Selection

1. Organisms produce more offspring than survive
2. Competition for limited resources essential for life
3. Individuals in a population possess heritable variation
4. Individuals with favorable traits produce more offspring than their unfavorable counterpart

NATURAL SELECTION IS A PROCESS THAT RESULTS IN EVOLUTION

Three common kinds of natural selection

1. Stabilizing selection: Promotes common phenotype and reduces both extremes
2. Directional selection: Favors individuals at one extreme in the population
3. Diversifying selection: Occurs in environment that are suddenly or drastically changing