**Ch. 22: Descent with Modification: A Darwinian View of Life**

**Theme:** Evolutionary change is based on the interactions between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ & their \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which results in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (inherited characteristics) to increase \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Evolution =** change over time in the genetic composition of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**HISTORICAL PROCESS OF SCIENCE**

**Aristotle: (**384-322 B.C.)life-forms arranged on scale on increasing complexity (*scala naturae*) [simple 🡪 complex]

**Linnaeus:** (1707-1778)

* founder of taxonomy; \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Domain\* – Kingdom – Phylum – Class – Order – Family - Genus – Species

(broad) (specific)

* + (Dear King Philip Came Over For Good Spaghetti)
	+ **3 Domains = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,**
	+ Classification based on anatomy & morphology
	+ **Binomial Nomenclature** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = *Genus species* or Genus species
		- *Example: Human = Homo sapiens* or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- Language *= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**Cuvier:** (1769-1832)

* Paleontologist – studied \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Deeper strata (layers) - very different fossils from current life
* Opposed idea of evolution
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – catastrophe destroyed many living species, then repopulated by immigrant species

**Hutton / Lyell:** (late 1700s)

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** = geologic change results from slow & gradual, continuous process
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** = Earth’s processes same rate in past & present 🡪 therefore earth is ***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***
	+ Slow & subtle changes in organisms 🡪 big change

**Lamarck**: (1744-1829)

* Published theory of evolution (1809)
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: parts of body used 🡪 bigger, stronger

 (**Ex:** giraffe’s neck)

* Inheritance of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Characteristics: modifications (non-genetic changes) can be passed on
	+ ***Importance***: Recognized that species evolve, although explanation was flawed

**Malthus:** (1766-1834)

* More babies born than \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Consequences of overproducing within environment = war, famine, disease (limits of human pop.)
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Charles Darwin** (1809-1882)

* Who was he?
* Where did he travel?
* What was significant about the finches he observed?
* Who published a paper on natural selection before Darwin?
* What was Darwin’s famous publication in 1859 called?
* Darwin proposed that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for evolution. What does this mean?
* Darwin did not use the term “evolution.” Instead he used the phrase: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Some of Darwin’s key points were:
	+ ***Adaptations***: enhance an organism’s ability to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- **Ex:** Desert fox - large ears, arctic fox - small ears
	+ ***Overproduction*** of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ leads to ***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** for resources

|  |  |
| --- | --- |
| **Natural Selection** | **Artificial Selection** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ decides | “\_\_\_\_\_\_\_\_\_\_” decides |
| Works on individual | \_\_\_\_\_\_\_\_\_\_\_\_ breeding |
|  | Inbreeding occurs |
| **Ex:** beaks | **Ex:** Dalmatians |

Therefore, if humans can create substantial change over ***short*** time, nature can over ***long*** time.

**Key Ideas of Natural Selection:**

* Competition for limited resources results in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (best adapted survive better, others do not)
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: Individuals with more favorable \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ more likely to survive and produce more offspring, and pass traits to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* If environment changes or individuals move to new environment, new adaptations & new species may arise.
* ***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** evolve, not individuals.

**DISCUSS AND WRITE:**

1. How was Lamarck’s view of the mechanism of evolution different from Darwin’s?
2. How was Darwin’s theory influenced by other scientists?

**Ch. 22: Descent with Modification: Evidence for Evolution**

**Recap main ideas of natural selection:**

1. Evolution is change in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (population) over time.
2. There is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of offspring, which leads to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for resources.
3. Heritable \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ exist within a population.
4. These variations can result in differential \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ success.
5. Over \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(time), this can result in changes in the genetic composition of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Evidence of Evolution:**

1. **Direct Observations**
	1. Insect populations become \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to pesticides (DDT)
	2. Antibiotic-resistant \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (MRSA)
	3. Peppered moth (pollution in city vs. country)
2. **Fossil Record**
3. Fossils = remains or traces of organisms from past
4. Found in *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: study of fossils
6. Show evolutionary changes that occur over time and origin of major new groups of organisms
	1. Simple🡪 Complex
	2. Prokaryotes 🡪 Eukaryotes
	3. fish 🡪\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 reptiles 🡪\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 mammals
7. **Transitional forms** = \_\_\_\_\_\_\_\_\_\_ to modern species
8. **Homology**
9. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: characteristics in related species can have *underlying similarity* even though functions may differ (similar structure, but different function 🡪 suggests common ancestor/origin
10. Examples:
	1. **Homologous structures**: similar \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		1. (Ex: forelimbs of human/cat/whale/bat)



* 1. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_ homologies**: similar early development
		1. (Ex: vertebrate embryos with tail & pharyngeal pouches)
	2. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_ organs**: structures w/little or no use

(Ex: flightless bird wings, whale pelvic/leg bones, human appendix)

* 1. **Molecular homologies:**
		1. compare \_\_\_\_\_\_\_ & \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sequences
		2. Fewer differences = more recent common ancestor; greater # differences = less related

**Evolutionary Trees** (more on these later)



**Convergent Evolution**

* Distantly related organisms can resemble each other through the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ evolution of similar features in similar environments
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_structures**: similar function in similar environments but not common ancestry
	+ **Ex:** Torpedo shape of shark, penguin, & dolphin
1. **Biogeography**
	1. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** = geographic distribution of a species
	2. Species in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ geographic areas resemble each other
	3. *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*and *Pangaea* explains similarities on different continents
	4. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ species**: found at a certain geographic location and nowhere else
		1. **Ex:** Marine iguanas in the Galapagos