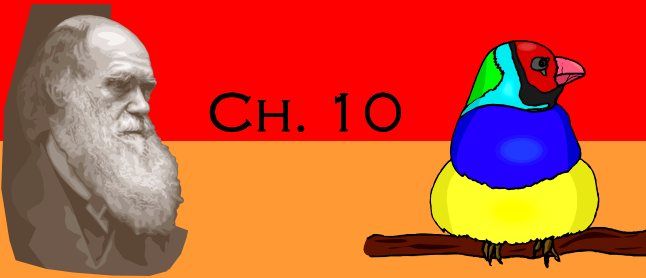


PRINCIPLES OF EVOLUTION

CH. 10



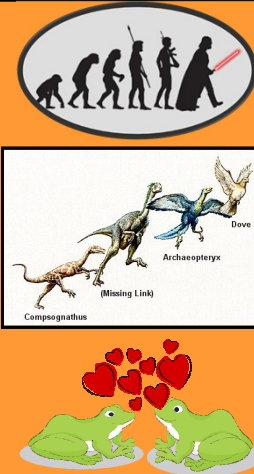
"Nothing in biology makes sense except in the light of evolution."

Theodosius Dobzhansky

10.1 Early Ideas About Evolution

The Puzzle of Life's Diversity


- o Evolution - modern organisms have descended from ancient organisms (change over time)
- o Theory - a well-supported, testable explanation of phenomena that have occurred in the natural world
- o Species: group of organisms that can reproduce and have fertile offspring



10.1 Early Ideas About Evolution

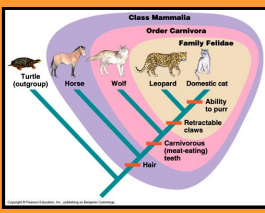
Early ideas about evolution 1700s...

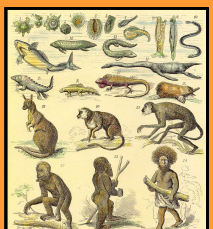
Linnaeus: classification system from kingdom to species



Buffon: species shared ancestors rather than arising separately

Erasmus Darwin: more-complex forms developed from less-complex forms






10.1 Early Ideas About Evolution

Lamarck's




- o He proposed the idea of "***inheritance of acquired characteristics***"-- by selective use or disuse of organs, organisms acquired or lost certain traits during their lifetime
- o Over time, this process led to change in a species



10.1 Early Ideas About Evolution

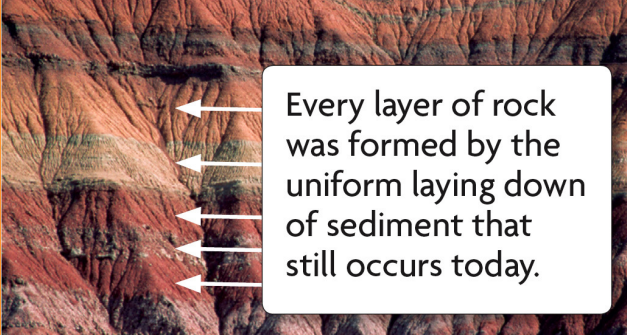
- There were three theories of geologic change.

1. Catastrophism--Cuvier
2. Gradualism--Hutton
3. Uniformitarianism--Lyell

They set the stage for Darwin's theory.




o Lyell's theory of **uniformitarianism** is the prevailing theory of geologic change and greatly influenced Charles Darwin.




Every layer of rock was formed by the uniform laying down of sediment that still occurs today.



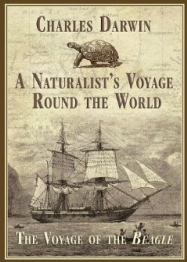
10.1 Early Ideas About Evolution

- o **Hutton & Lyell** helped scientists recognize that Earth is millions of years old
- o The processes that changed Earth in the past are the same processes that are changing Earth now


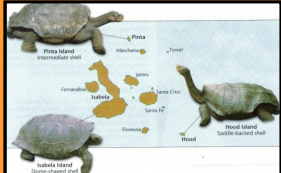
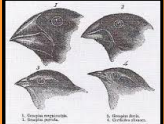

10.2 Darwin's Observations

- o **Charles Darwin** contributed most to our understanding of evolution
- o Voyage of the **Beagle** → 
 - o Made observations & collected evidence → way life changes over time

10.2 Darwin's Observations

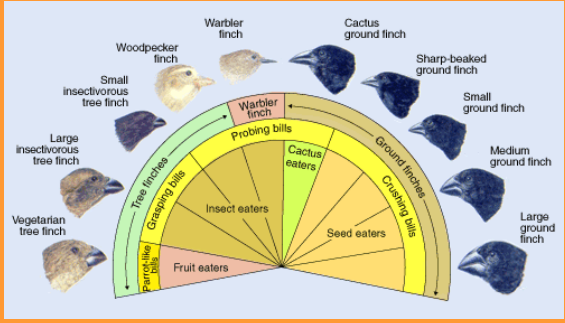
- Galapagos Islands influenced Darwin the most
 - Characteristics of animals & plants varied among the different islands
- Variation is a difference in a physical trait.
 - Tortoises that live in areas with tall plants have long necks and legs.
 - Finches that live in areas with hard-shelled nuts have strong beaks.

10.2 Darwin's Observations


Darwin's Finches

What is different about each finch?


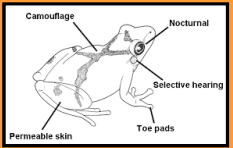



10.2 Darwin's Observations


- He realized that species adapt to their environment
- An **adaptation** is a feature that allow an organism to better survive in its environment.
 - Leads to **genetic change** in a population.



Fat respired for water






- Waxy covering
- Spines for leaves
- Long roots
- Roots near surface
- Die back during drought
- Fast growing seeds
- Can store water




10.2 Darwin's Observations


- Darwin collected fossils -the preserved remains of ancient organisms
 - Some resembled organisms that were still alive
 - Others looked unlike any creature ever seen




Glyptodont



Trilobites



Armadillo



T-rex

Using the images below, group the organisms according to shared traits. State what trait(s) they share.

Tree Sparrow

Killed Bill Toucan

Marlin

Lobster

Snow Crab

Ruby Throated Hummingbird

Palm Cockatoo

Honey Bee

Ant

10.3 Darwin's Theory of Natural Selection

Thomas Malthus
1798
Proposed

A growing human population would lead to insufficient food and living space

Famine and disease were forces that worked against this growth

10.3 Darwin's Theory of Natural Selection

If these factors can put pressure on a human population why can't the same thing happen to other living things?

If the offspring of all living things all survived, we would be overrun by them!!

10.3 Darwin's Theory of Natural Selection

Darwin Presents His Case

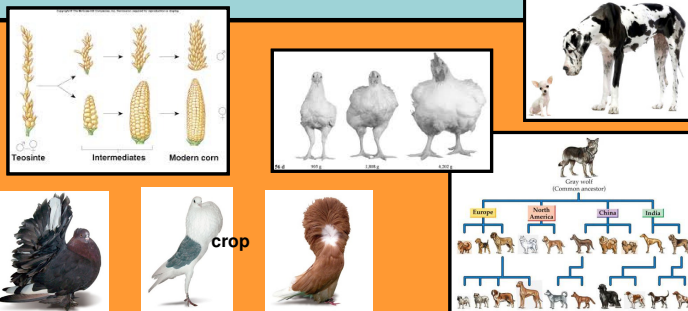
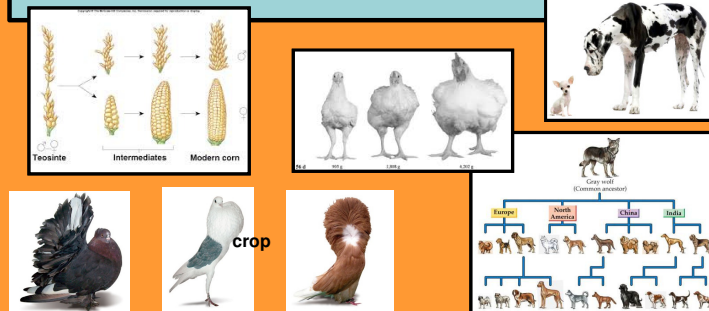
- o Darwin published the results of his work in a book, *On the Origin of Species*
- o In his book, he proposed a mechanism for evolution called **natural selection**
 - o Evolution has been taking place for millions of years, & continues in all living things

The Making of the Fittest: Rock Pocket Mice

10.3 Darwin's Theory of Natural Selection


Inherited Variation & Artificial Selection

- o **Artificial selection** - nature provided the variation, & humans selected those variations that they found useful
- o Through selectively breeding for different traits





10.3 Darwin's Theory of Natural Selection

- o **Struggle for existence** - the members of each species compete regularly to obtain food, living space, mates, & other necessities of life
 - Predators that are faster & better at catching prey are more likely to survive




10.3 Darwin's Theory of Natural Selection



- o **Fitness** - the ability of the organism to survive & reproduce in its specific environ.
 - Fitness is the result of adaptations (passed on from parent to offspring)

Ex: Jaguars with bigger teeth will have a higher fitness than those with smaller teeth. Why?



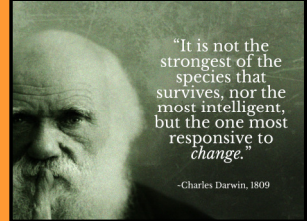


10.3 Darwin's Theory of Natural Selection

- o Individuals that are better suited to their environ., with adaptations that enable fitness, survive & reproduce most successfully - **Survival of the Fittest**

SURVIVAL OF THE FITTEST

Not him again....

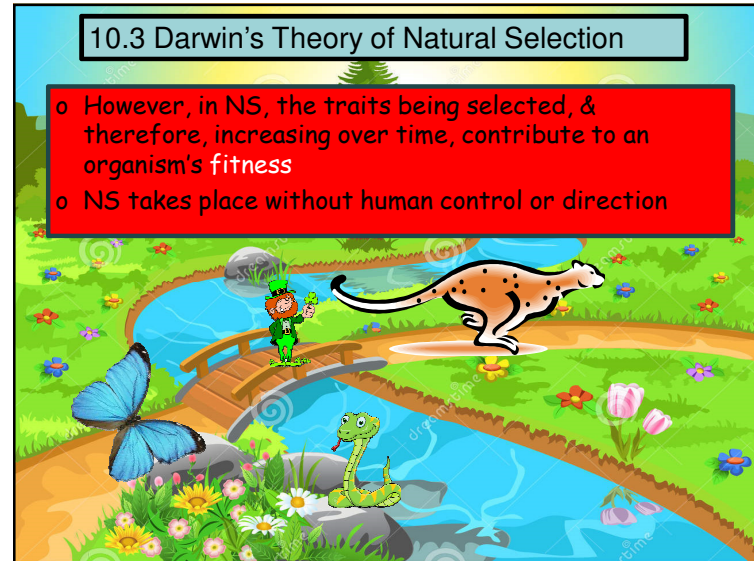
10.3 Darwin's Theory of Natural Selection

- o Since it is similar to artificial selection, Darwin referred to survival of the fittest as - **Natural Selection**
- o In both AS & NS, only certain individuals of a population produce new individuals



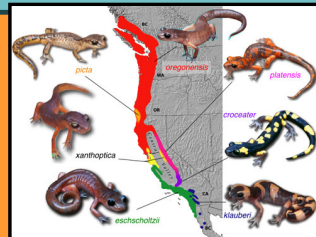
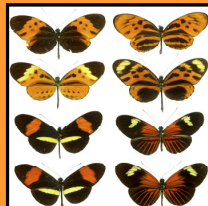
10.3 Darwin's Theory of Natural Selection

- o However, in NS, the traits being selected, & therefore, increasing over time, contribute to an organism's **fitness**
- o NS takes place without human control or direction



10.3 Darwin's Theory of Natural Selection

- NS results in changes in the inherited characteristics of a population, that increase a species' fitness in its environ.
- Over time, NS produces organisms that have different structures, & occupy different habitats



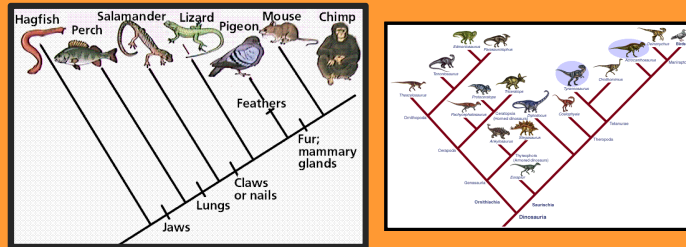
10.3 Darwin's Theory of Natural Selection

- o **Descent with Modification**-Each living species has descended, with changes, from other species over time
- o As a result, species today look different from their ancestors



10.3 Darwin's Theory of Natural Selection

- o Descent with modification also implies that all living organisms are related to each other
- o Common descent - all species (living & extinct) were derived from common ancestors



Ch. 10.4 Evidence of Evolution & 10.5 Evolutionary Biology Today



Evidence of Evolution

includes

Fossils Geography Anatomy Embryology



Ch.10.4-5 Evidence of Evolution

1. The Fossil Record:

- Darwin noticed that the sizes, shapes, & varieties of related organisms preserved in the fossil record, changed over time
- Paleontology is the study of the fossil record



Ch.10.4-5 Evidence of Evolution

2. **Biogeography**—the study of the distribution of organisms around the world

Which indicates

Common Ancestral species

Beaver Muskrat Capybara Coypu

All 4 organisms are similar - teeth, body structure, etc. but on different continents

Changed to have similar traits because the environments were similar

Common Ancestor Common Ancestor

Ch.10.4-5 Evidence of Evolution

3. **Anatomy Evidence**

Homologous body structures: structures that are the same(related) but have different functions.

Ch.10.4-5 Evidence of Evolution

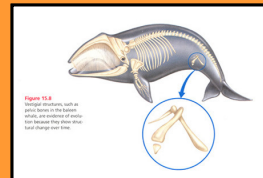
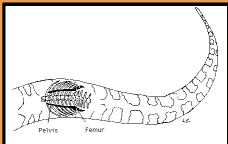
3. **Anatomy Evidence**

- o **Analogous body structures:** structures that perform a similar function but are not evidence of a common ancestor (not related)
- o Similar environment challenge

Ch.10.4-5 Evidence of Evolution

3. Anatomy Evidence

o **Vestigial structures** are remnants of organs or structures that had a function in an early ancestor.

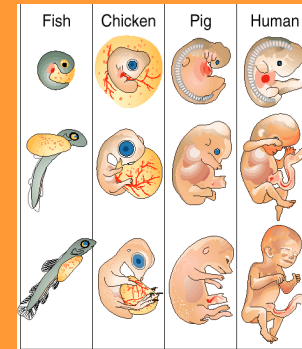


Ch.10.4-5 Evidence of Evolution

4. Embryology Evidence

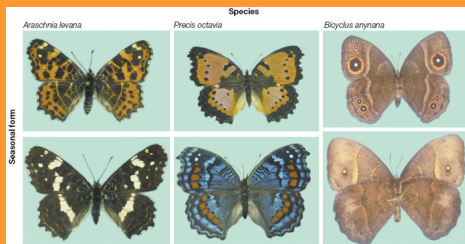
o **Similarities in Early Development:**

- The early stages or embryos, of many animals with backbones are very similar
- Embryology is the study of embryos.



Summary of Darwin's Theory

- o Individual organisms differ, & some of this variation is heritable
- o Organisms produce more offspring than can survive, & many that do survive do not reproduce



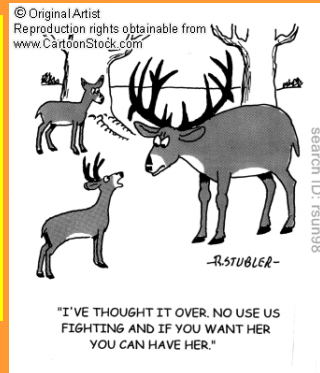
Summary of Darwin's Theory

- o Because more organisms are produced than can survive, they compete for limited resources
- o Individuals best suited to their environ., survive & reproduce most successfully



Summary of Darwin's Theory

- o These organisms pass their heritable traits to their offspring
- o This process of NS causes species to change over time



Summary of Darwin's Theory

- o Species alive today are descended with modification from ancestral species that lived in the distant past
- o This process, where diverse species evolved from common ancestors, unites all organisms on Earth into a single tree of life