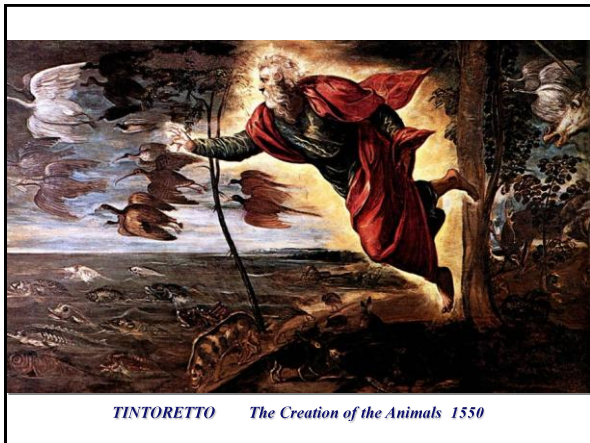


**Chapter 22**  
**Darwin and Evolution by Natural Selection**

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

-- Theodosius Dobzhansky  
 March 1973  
 Geneticist, Columbia University  
 (1900-1975)



**But the Fossil Record...**



**Succession of Types**

Armadillos are native to the Americas, with most species found in South America.

Glyptodont fossils are also unique to South America.

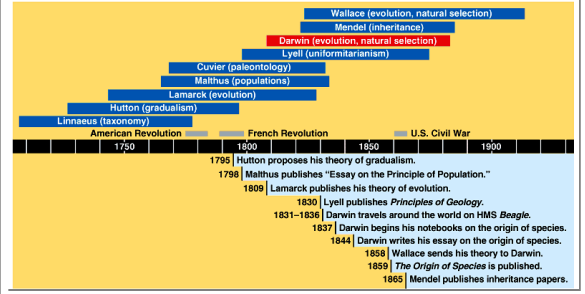
### LaMarck

- Organisms adapted to their environments
  - ◆ through **acquired** traits
  - ◆ change in their life time
    - **Use & Disuse**  
organisms lost parts because they did not use them — like the missing eyes & digestive system of the tapeworm
    - **Perfection with Use & Need**  
the constant use of an organ leads that organ to increase in size — like the muscles of a blacksmith or the large ears of a night-flying bat
  - ◆ transmit **acquired characteristics** to next generation



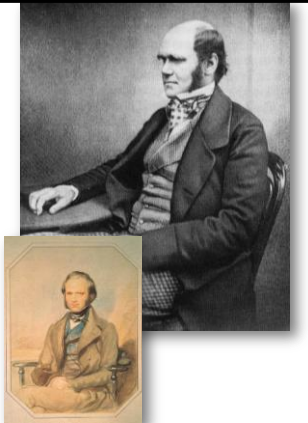
### In Historical Context...

- Darwin did not originate the idea of evolution
- Geologic theories of Earth's age & history cleared the path for evolutionary biologists



### Charles Darwin

- 1809-1882
- British naturalist
- Proposed the idea of evolution by **natural selection**
- Collected clear evidence to support his ideas



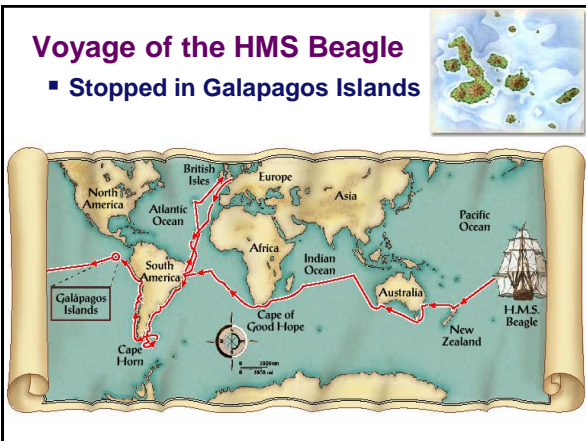
### Voyage of the HMS Beagle

- Travels around the world
  - ◆ 1831-1836
  - ◆ makes many observations of natural world
    - main mission of the *Beagle* was to chart South American coastline



### Voyage of the HMS Beagle

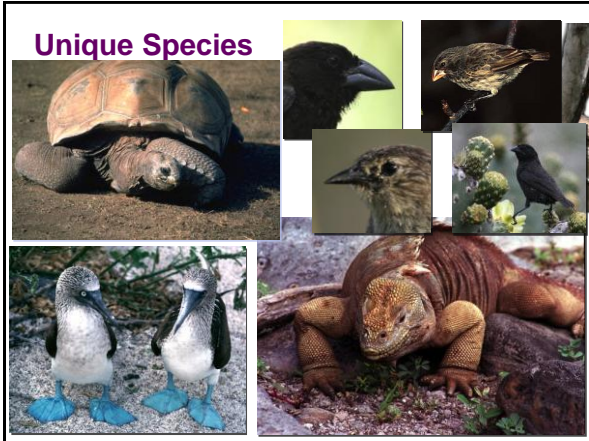
- Stopped in Galapagos Islands



### Galapagos

Of relatively recent volcanic origin most of animal species on the Galapagos live nowhere else in world, but **they resemble species living on South American mainland.**



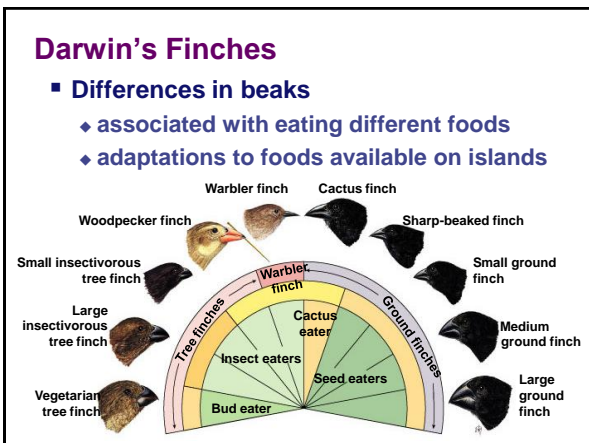
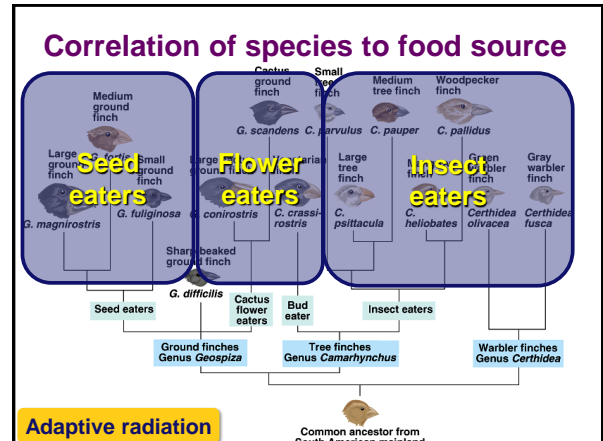


### The Birds...

- Galapagos birds
  - 22 of the 29 species of birds on the Galapagos are **endemic**
    - found only on these islands
  - collected specimens of all
- One particular group...
  - at first, he paid little attention to a series of small birds
  - some were woodpecker-like, some warbler-like, & some finch-like

### Darwin's Finches

- Darwin was amazed to find out they were **all finches**
  - 14 species
  - but only **one** species on South American mainland
    - 500 miles away
  - all the birds had to originally come from mainland species



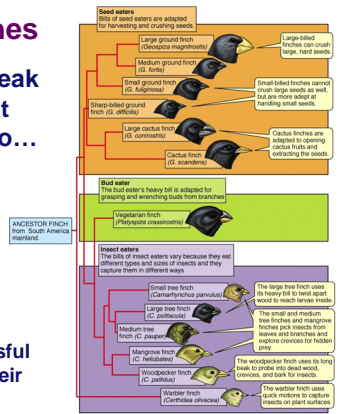
### Darwin's Finches

#### Darwin's conclusions

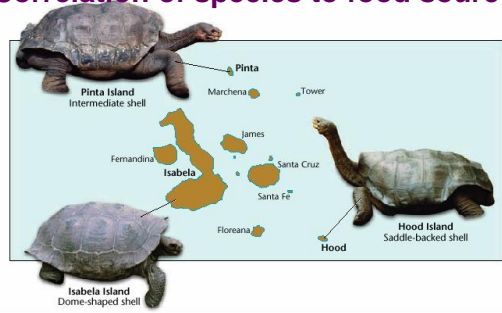
- small populations of original South American finches reached islands
  - variation in beaks enabled some to obtain food successfully in the different environments
- over many generations, the populations of finches changed anatomically & behaviorally
  - accumulation of advantageous traits
  - emergence of different species

### Darwin's Finches

- Finches with beak differences that allowed them to...
  - ◆ successfully compete
  - ◆ successfully feed
  - ◆ successfully reproduce
    - pass successful traits onto their offspring



### Correlation of species to food source



**Variation Among Tortoises** Darwin observed that the characteristics of many animals and plants varied noticeably among the different Galapagos Islands. Among the tortoises, the shape of the shell corresponds to different habitats. The Hood Island tortoise (right) has a long neck and a shell that is curved and open around the neck and legs, allowing the tortoise to reach the sparse vegetation on Hood Island. The tortoise from Isabela Island (lower left) has a dome-shaped shell and a shorter neck. Vegetation on this island is more abundant and closer to the ground. The tortoise from Pinta Island has a shell that is intermediate between these two forms.

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