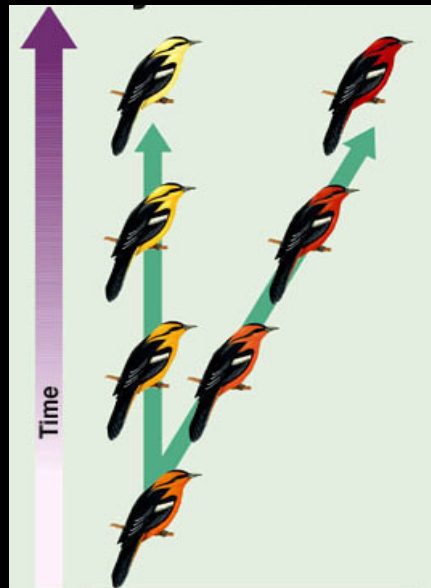
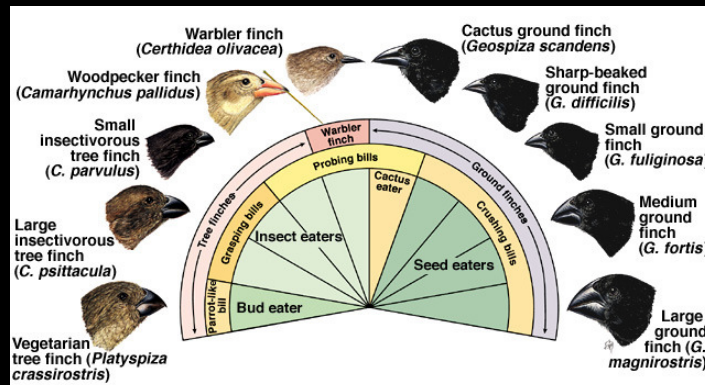


Concepts of Evolution

Evolution is the slow, gradual change in a population of organisms over time.

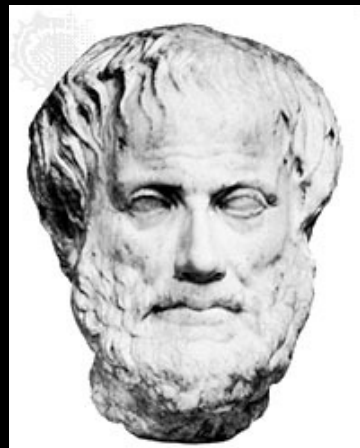


Nothing in biology makes sense EXCEPT in the light of evolution.



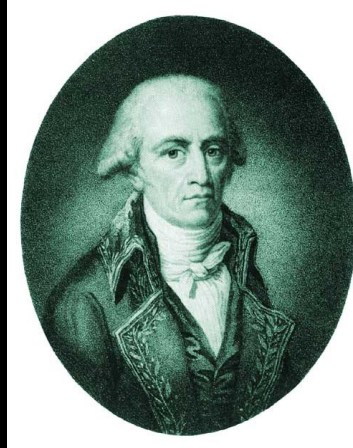
Early Ideas On Earth's Organisms

- **Aristotle** believed species were **fixed creations** arranged by their **complexity**
- **Idea lasted 2000 years**



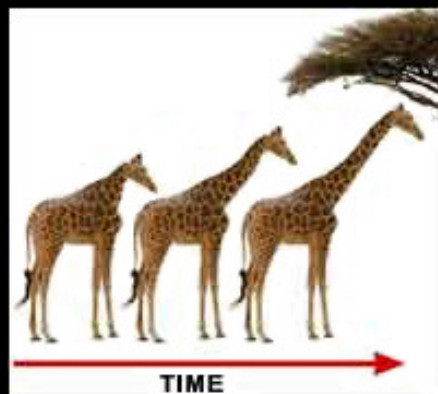
Lamarck's Theory of Evolution

- Jean-Baptiste Lamarck, 1809
- One Of First Scientists To Understand That Change Occurs Over Time
- Stated that Changes Are Adaptations To Environment acquired in an organism's lifetime
- Said acquired changes were passed to offspring



Lamarck's Theory of Evolution

- Idea called Law of Use and Disuse
- If a body part were used, it got stronger
- If body part NOT used, it deteriorated



Lamarck's Theory of Evolution

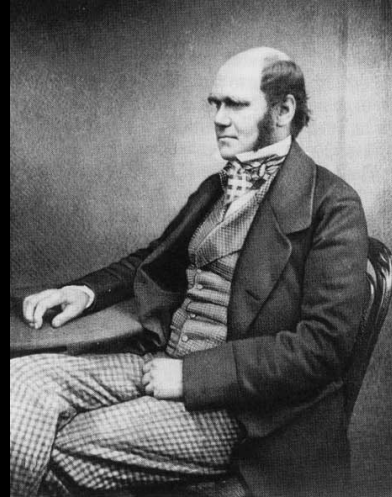
- **Inheritance of Acquired Characteristics**
- Proposed That By Selective Use Or Disuse Of Organs, Organisms Acquired Or Lost Certain Traits During Their Lifetime
- These Traits Could Then Be Passed On To Their Offspring
- Over Time This Led To New Species

Lamarck's Mistakes

- Lamarck Did NOT Know how traits were inherited (Traits are passed through genes)
- Genes Are NOT Changed By Activities In Life
- Change Through Mutation Occurs Before An Organism Is Born

Charles Darwin

- Born Feb. 12, 1809
- Joined Crew of HMS Beagle, 1831
- 5 Year Voyage around world
- A vivid Collector of Flora & Fauna
- Astounded By Variety of Life



Darwin Left England in 1831



Darwin returned 5 years later in 1836

Voyage of the Beagle

During His Travels, Darwin Made Numerous Observations And Collected Evidence That Led Him To Propose A **Revolutionary Hypothesis** About The Way Life Changes Over Time

Darwin's Observations

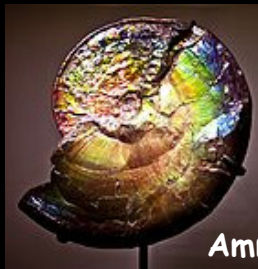
- Patterns of Diversity
- Unique Adaptations in organisms
- Species Not Evenly Distributed
 - » **Australia, Kangaroos, but No Rabbits**
 - » **S. America, Llamas**



Evidence for Evolution - The Fossil Record



Trilobites



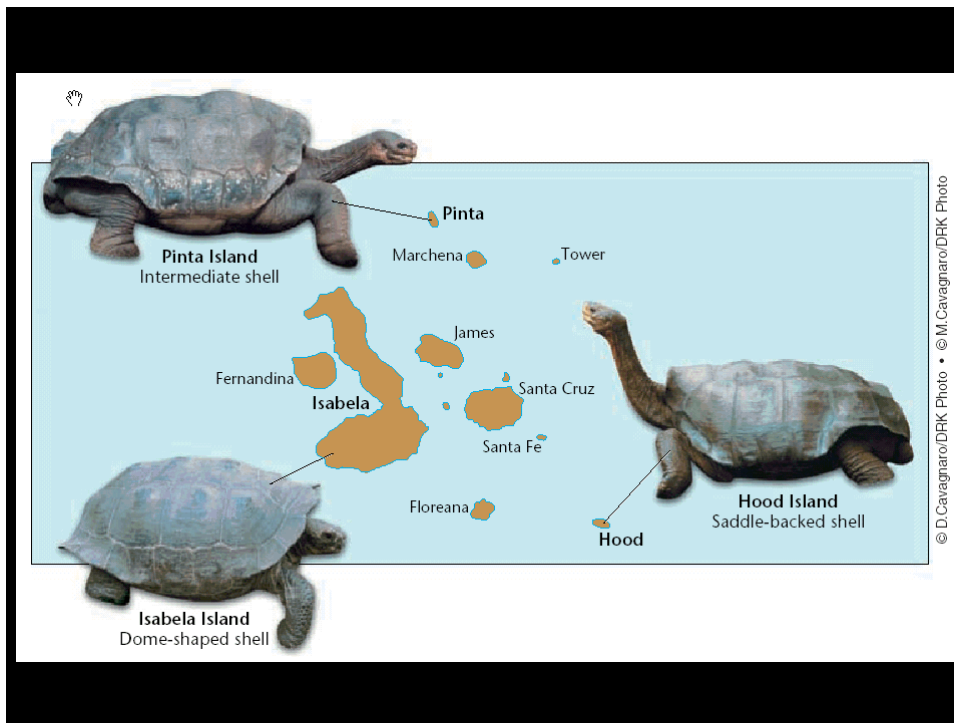
Ammonite



Darwin's Observations

- If left unchecked, the number of organisms of each species will increase exponentially, generation to generation
- In nature, populations tend to remain stable in size
- Environmental resources are limited





Darwin's Observations

- Individuals of a population vary extensively in their characteristics with **no two individuals being exactly alike.**
- Much of this variation between individuals is **inheritable.**

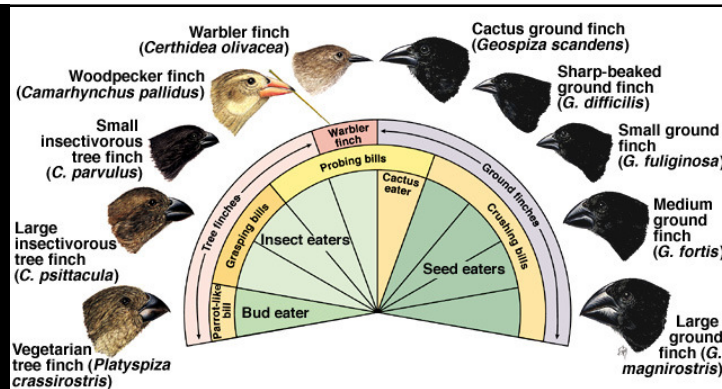


Darwin's Conclusion







- Production of more individuals than can be supported by the environment leads to a **struggle for existence among individuals**
- Only a fraction of offspring survive each generation
survival of the fittest



Darwin's Theory of Evolution




- The **unequal ability of individuals to survive and reproduce** leads to a gradual change in a population, with favorable characteristics accumulating over generations
Thus new species evolve

Galápagos Islands Finches						
Shape of Head and Beak						
Name	Vegetarian tree finch	Large insectivorous tree finch	Woodpecker finch	Cactus ground finch	Sharp-beaked ground finch	Large ground finch
Main Food	Fruit	Insects	Insects	Cactus	Seeds	Seeds
Feeding Adaptation	Parrotlike beak	Grasping beak	Uses cactus spines	Large crushing beak	Pointed crushing beak	Large crushing beak
Habitat	Trees	Trees	Trees	Ground	Ground	Ground

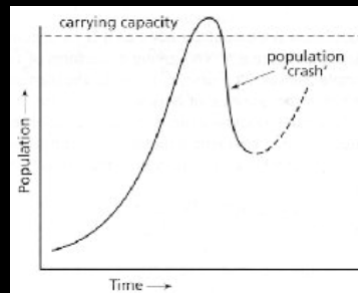
Idea That Shaped Darwin's Thinking

Theory of Thomas Malthus, 1798



Population Growth

- **Thomas Malthus**, (1766 -1834)
- **Economist**
- **Observed Babies Being Born Faster Than People Were Dying**
- **Population size limited by resources** such as the Food Supply (1799).

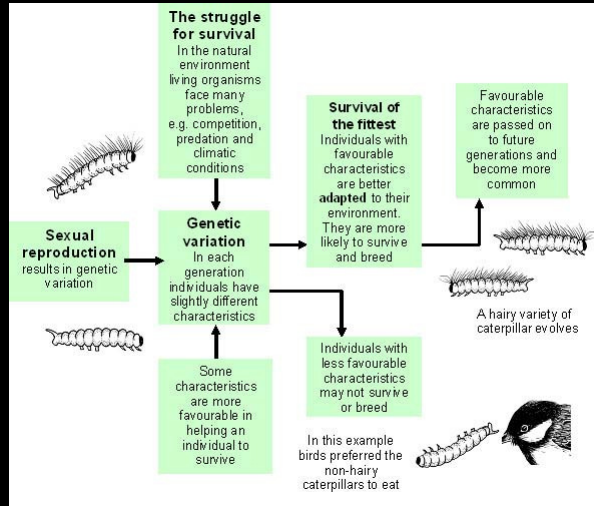


The Struggle for Existence

- **Malthus' Influence**
 - High Birth Rates & Limited Resources Would Force Life & Death Competition
- **Each Species Struggles For**
 - Food
 - Living Space
 - Mates

Natural Selection

- **Driving force for evolution**
- **During the struggle for resources, strongest survive & reproduce**
- **Idea that at least some of the differences between individuals, which impact their survival and fertility, are inheritable**



Industrial revolution and evolution of peppered moth



Wallace's Contribution

- **Alfred Russel Wallace** Independently came to same Conclusion as Darwin that species changed over time because of their struggle for existence
- When Darwin read Wallace's essay, he knew he had to publish his findings

