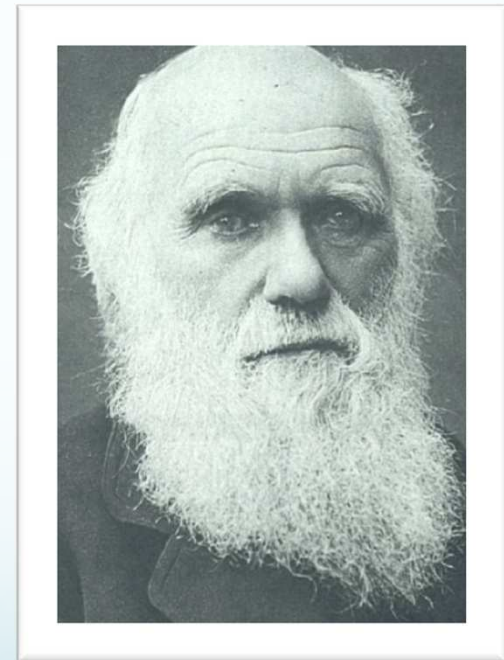


Evolution

Diversity of Life

**“Nothing in biology
makes sense EXCEPT
in the light of
evolution.”**

Theodosius Dobzhansky



Charles Darwin at 72 years
old in 1881

**EQ: Who were the early contributors to
the theory of evolution?**

History of Evolutionary Thought

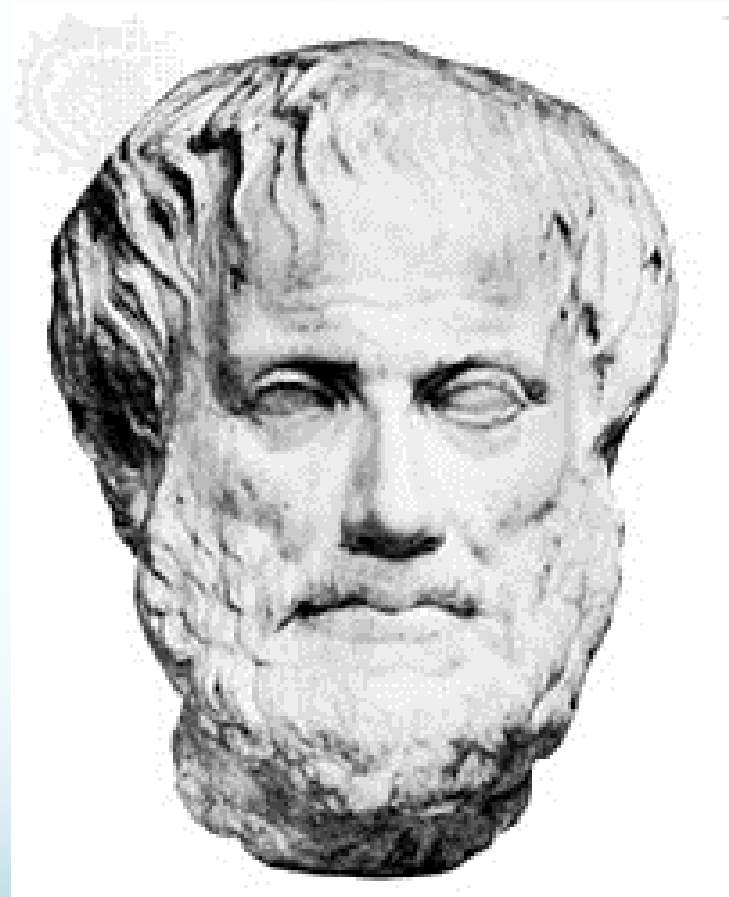


Early Ideas On Earth's Organisms

- **Aristotle believed species were fixed creations arranged by their complexity**

(Example- earthworms less complex than snakes)

- **Idea lasted approximately 2000 years**



Early Ideas On Earth's Organisms

- **Carolus Linnaeus-**
1st to group similar organisms and assign them Latin names
- Two word name
(Genus species)
- Known as **Binomial nomenclature**

(Example- humans=
"Homo sapien")



Contributors to Darwin's thinking included:

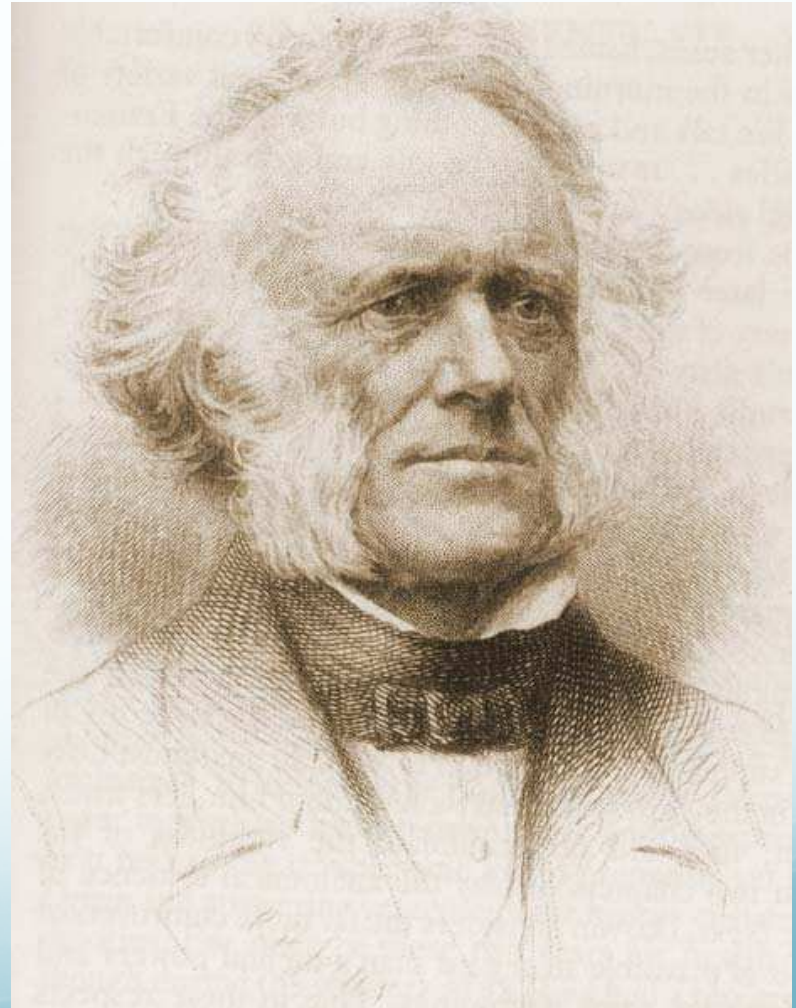
- **Charles Lyell –Uniformitarianism**
- **Georges Cuvier – species extinction (Catastrophism)**
- **Thomas Malthus – struggle for existence (resources)**

Contributors to Darwin's thinking included:

- **James Hutton – Gradualism**
- **John Baptiste Lamarck – Inheritance of acquired Characteristics and Law of Use and Disuse**
- **Alfred Russel Wallace – organisms evolved from common ancestors**

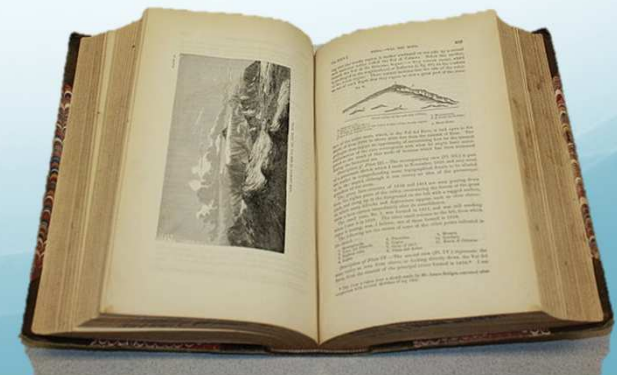
Charles Lyell

- **Proposed theory of Uniformitarianism**
- Geological processes at uniform rates building & wearing down Earth's crust
- Proposed that the **Earth was millions of years** instead of a few thousand years old



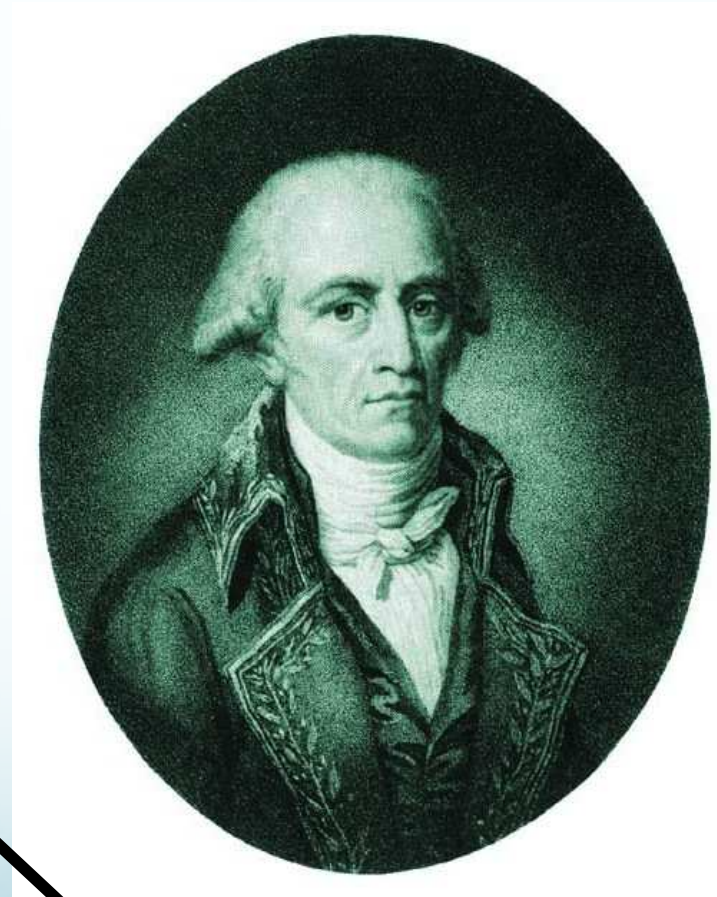
Principles of Geology

- ***Principles of Geology* published by Lyell** just before the Beagle set sail-- read by Charles Darwin.
- **Explained geological processes that shaped the earth**
- Helped Darwin understand sea shells in the Andes mountains at 12,000+ feet
 - Expanded Earth's age



Lamarck's Theory of Evolution

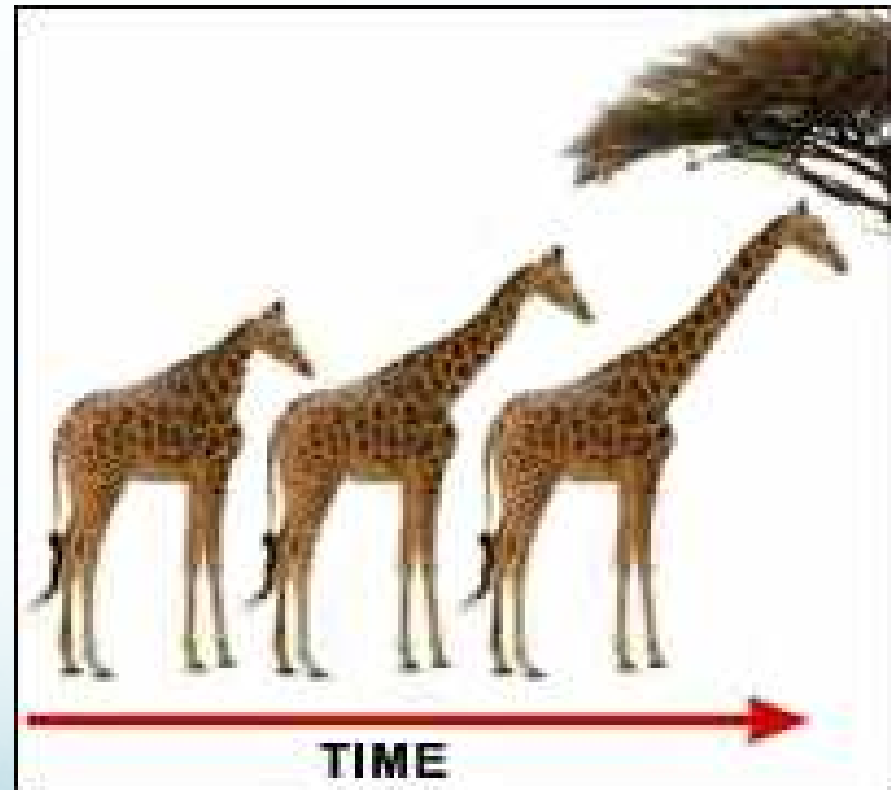
- Jean-Baptiste Lamarck, 1809
- One of first scientists to understand that **change occurs over time.**
- **Stated that changes are adaptations to environment acquired in an organism's lifetime.**
- Said acquired changes were **passed to offspring**



This is where he was a little off the mark...

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

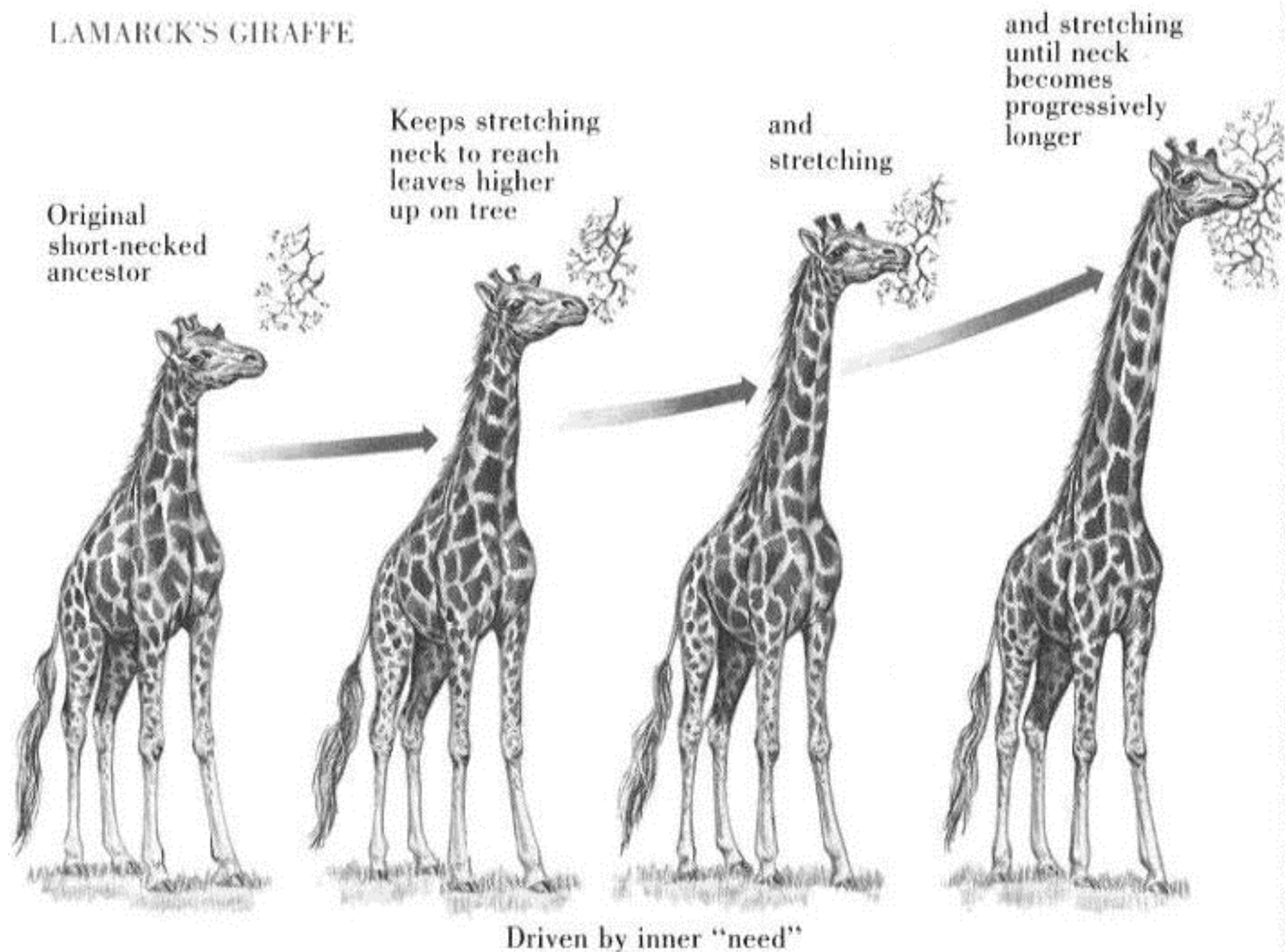


Lamarck's Theory of Evolution

- **Use & Disuse -**
Organisms could change the size or shape of organs by using them or not using them
- **Examples-**
 - Blacksmiths and their sons (muscular arms)
 - Giraffe's necks elongated (from stretching for food)



LAMARCK'S GIRAFFE



Lamarck's Theory of Evolution

- **Inheritance Of Acquired Traits**
 - Lamarck thought that traits acquired during ones lifetime would be passed to offspring



According to Lamarck's idea, this meant clipped ears of dogs could be passed to offspring!

Lamarck's Mistakes

- Lamarck Did NOT know how traits were inherited (traits are passed through **genes**- not common knowledge during his time)
 - Genes are not changed by activities in life
 - Change in genes is through mutation that occurs before an organism is born.



Lamarck's Contributions

Lamarck is credited with helping put evolution on the map and with acknowledging that the **environment plays a role in shaping the species** that live in it.

Lamarck held that **evolution was a constant process** of striving toward greater complexity and perfection.

- Even though this belief eventually gave way to Darwin's theory of natural selection, Darwin **disagreed that evolution strived for perfection.**
- **Darwin concluded evolution was based on random variation,** rather than striving towards a goal (perfection).

Darwin and Lamarck Comic Strip

Population Growth

- **Thomas Malthus**, 1798
- **Economist**
- **Observed babies being born faster than people were dying.**
- **Population size is limited by resources** such as the food supply.



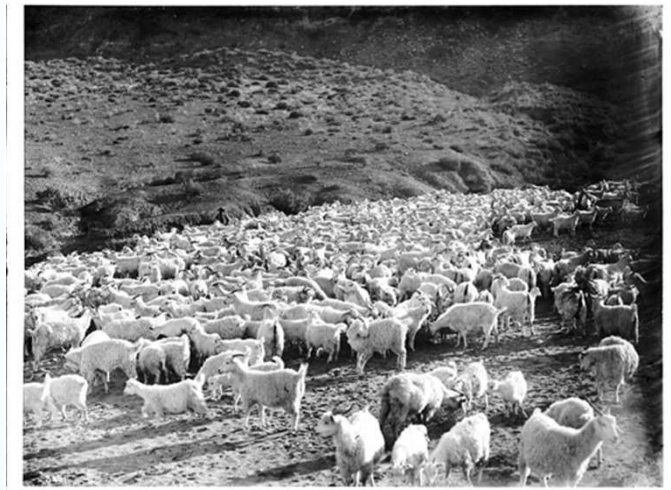
Population Growth

- Malthus reasoned that if the human population continued to grow unchecked, sooner or later there would be insufficient living space & food for everyone
- **Death rate will increase to balance population size & food supply**

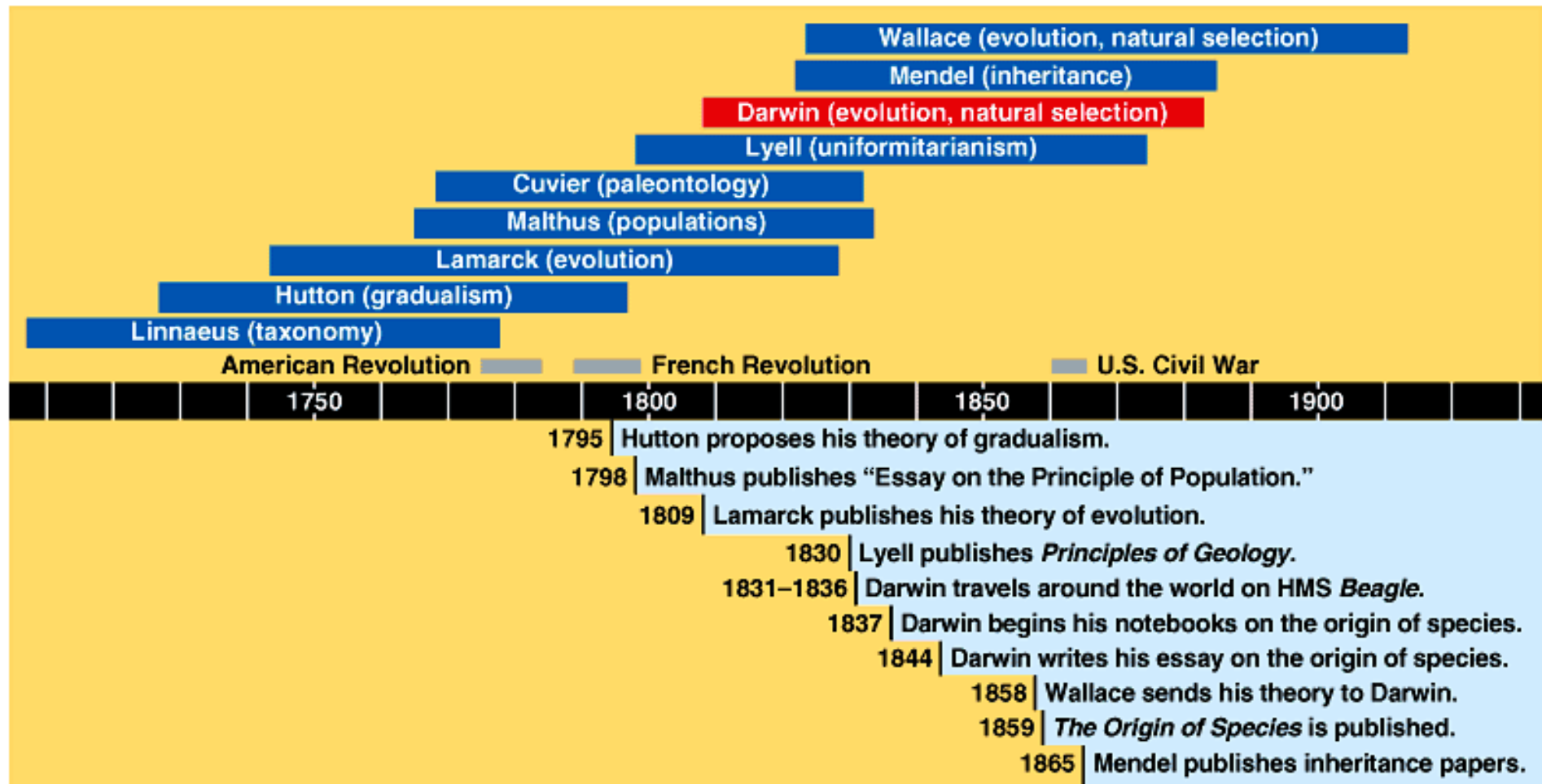


Population Growth

- Darwin realized Malthus's principles were visible in nature.
- Plants & animals **produce far more offspring than can be supported.**
 - **Most offspring die; otherwise the Earth would be overpopulated.**



Evolutionary Timeline

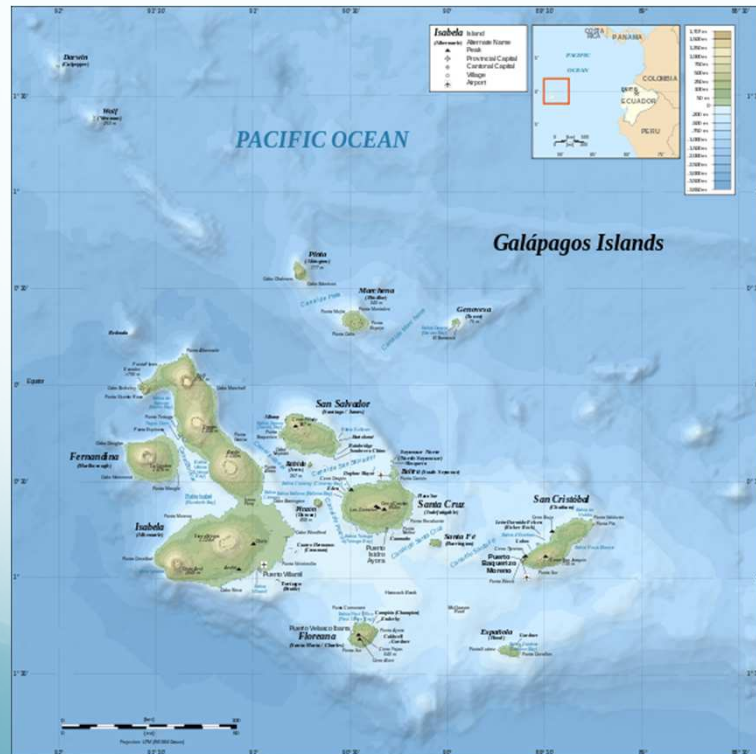


Charles Darwin the Naturalist



The Galapagos Islands

- **Group of 16 Islands 1000 km West of South America, part of Ecuador.**



The Galapagos Islands

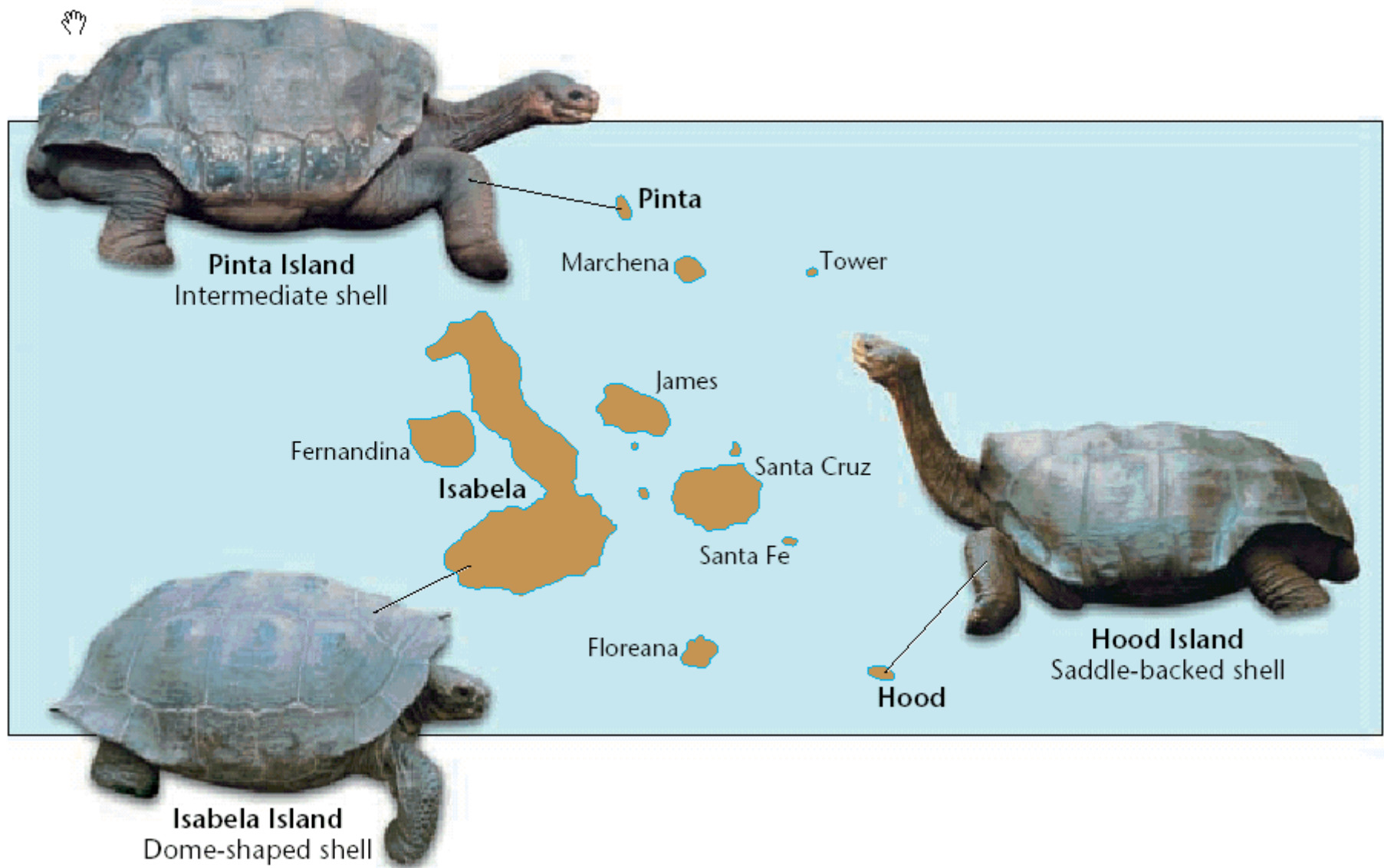
- Slightly varying climates among the islands.
- Animals On Islands that were Unique
 - Tortoises
 - Iguanas
 - Finches



The Galapagos islands are named after the unique giant tortoises that live there.



In Spanish, “galápagos” means tortoise.

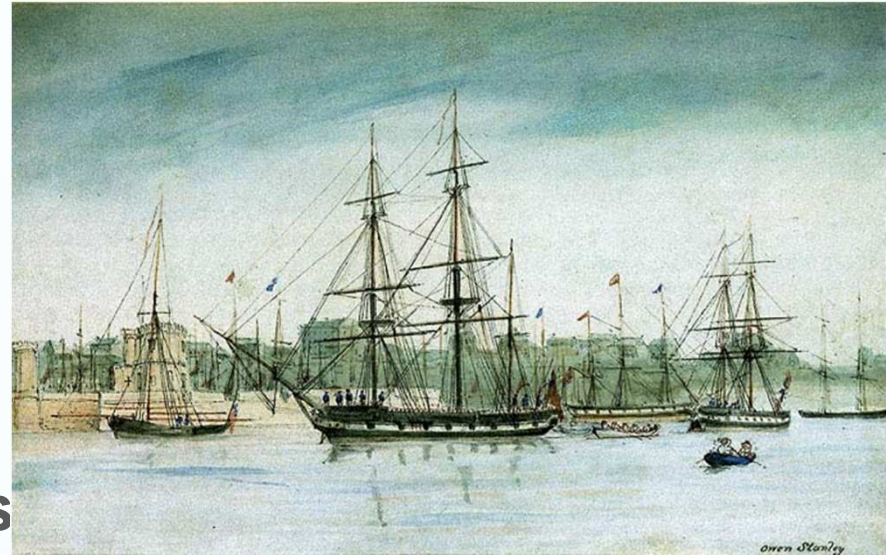


The Voyage of the Beagle

The **HMS Beagle** sailed from England on December 27th, 1831 and returned on October 2nd, 1836.

The Beagle sailed across the Atlantic Ocean to do detailed hydrographic surveys around the southern coasts of **South America**.

The Captain, Robert FitzRoy, invited Charles Darwin because he wanted a naturalist to accompany him.



The Beagle arrived at the Galapagos islands on September 15th, 1845.

The Galapagos Islands & Darwin

“It is like witnessing the appearance of new beings on earth” –Charles Darwin in regards to his trip to the Galapagos islands.

Darwin enjoyed observing the giant tortoises; it was pointed out to him that you could tell which tortoise came from which island simply by observing its shell.









However, it was the FINCHES of the Galapagos that gave Darwin his “aha” moment!

The Galapagos Islands

- Finches on the islands resembled a mainland finch
- More types of finches appeared on the islands where the available food was different (seeds, nuts, berries, insects...)
- **Finches had different types of beaks adapted to their type of food gathering**



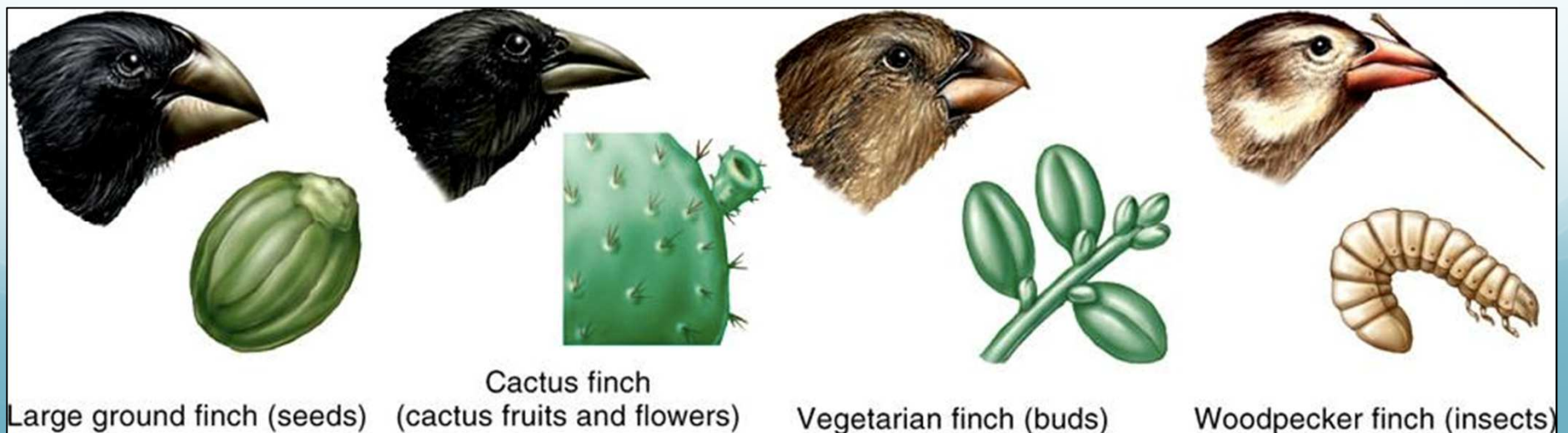
Galápagos Islands Finches

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

The Galapagos Islands & Darwin

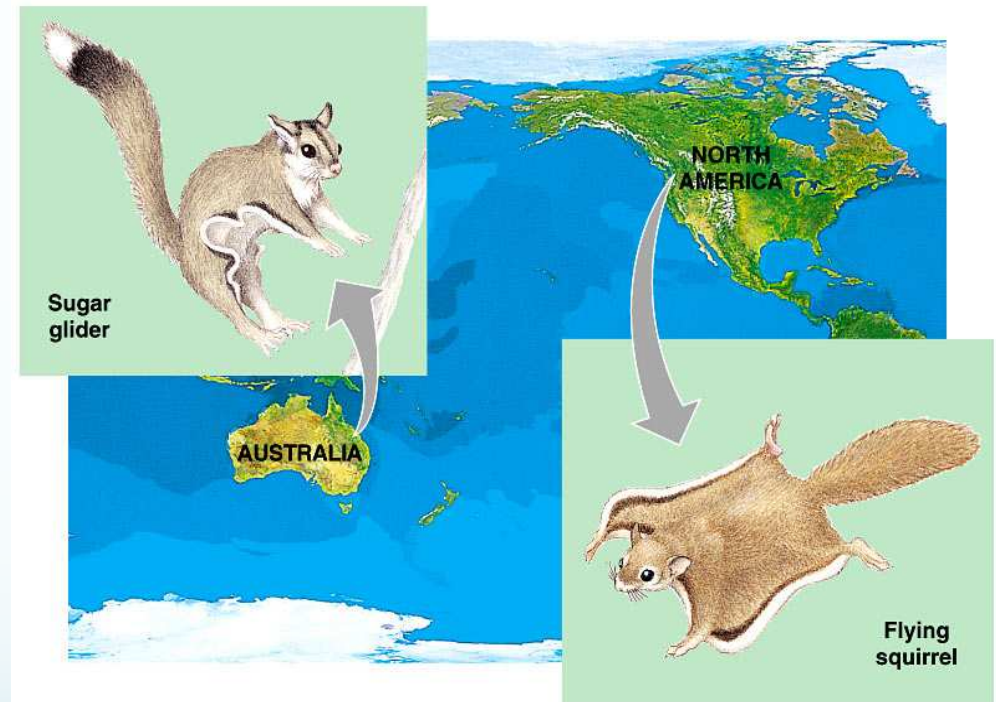
Darwin concluded that one type of finch from South America had arrived on the recently-risen islands and, like the tortoises, **had adapted to the different opportunities found on each island.**

Later, On the Origin of Species, Darwin drew heavily on the animals he saw in the Galapagos, to advance his radical notion that **their creation was not a single event, but a process of change, from one form, into many different ones.**



Darwin's Observations

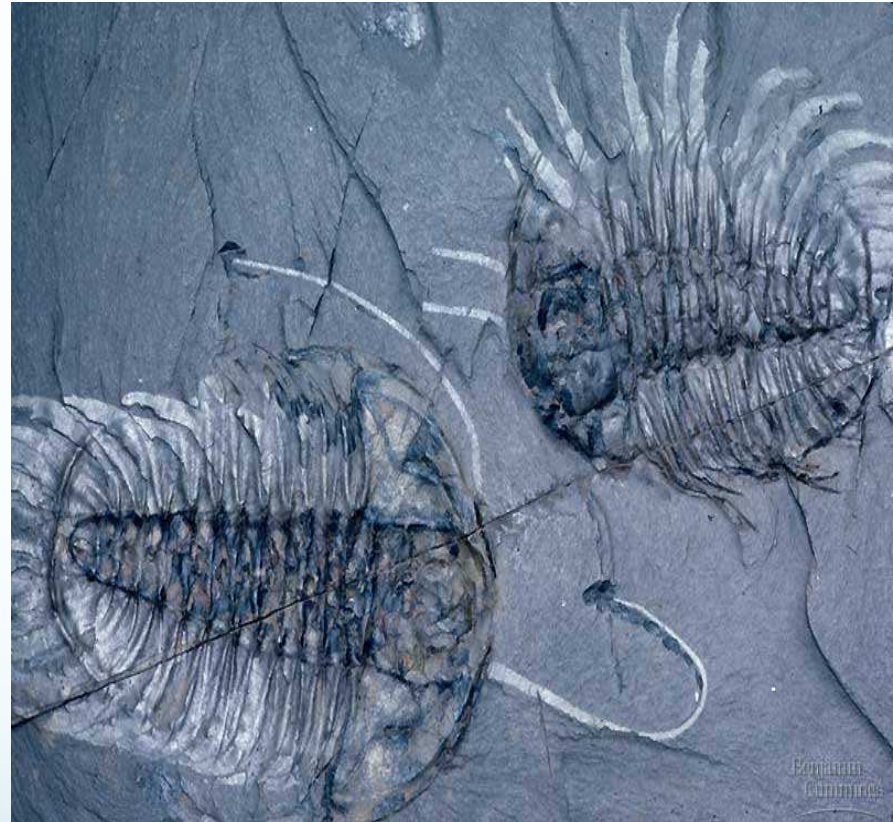
- Patterns of diversity were seen
- Unique adaptations in organisms
- Species were not evenly distributed
 - **Australia= Kangaroos, but no rabbits**
 - **S. America= llamas**



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Darwin's Observations

- Both living organisms & fossils collected
- Fossils included:
 - ✓ Trilobites
 - ✓ Giant ground sloth of South America



This species NO longer existed.
What had happened to them?

Darwin's Observations

- 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

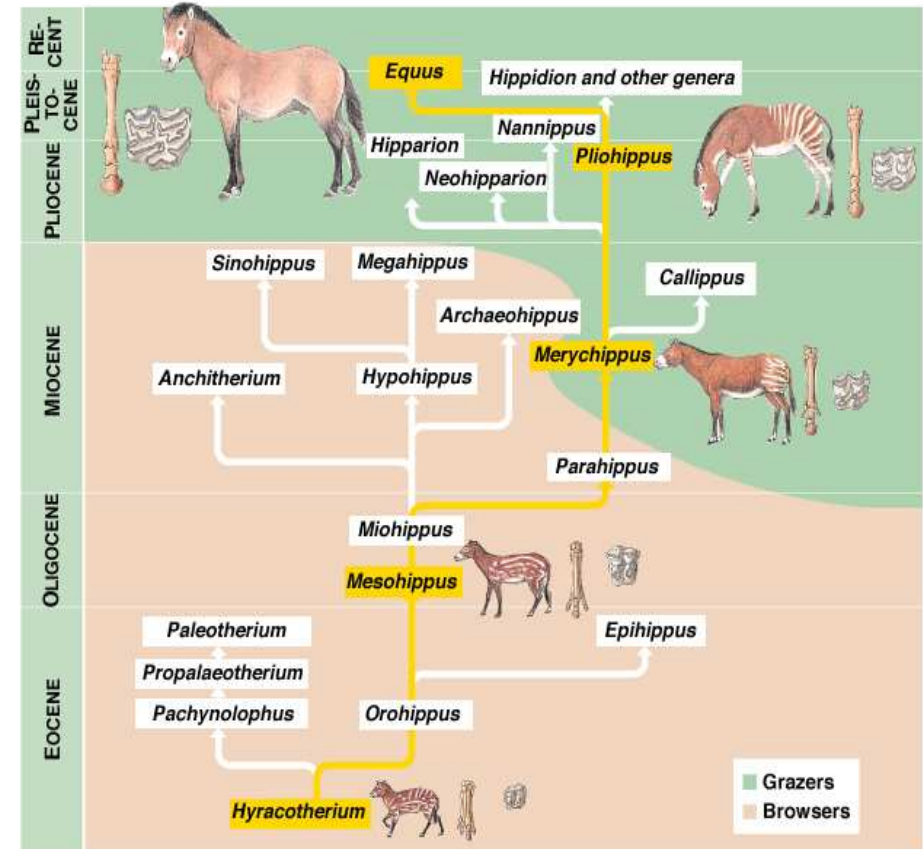
- Production of more individuals than can be supported by the environment leads to a struggle for existence among individuals.
- Only a fraction of offspring survive each generation
- Survival of the Fittest



Darwin's Conclusion

- Individuals who inherit characteristics most fit for their environment are likely to leave more offspring than less fit individuals.

- Called Natural Selection.



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Left Side Activity

- Tape in the pictures of the men that helped contribute to Darwin's theory of Natural Selection and then explain how they contributed.