EVOLUTION

Presented by

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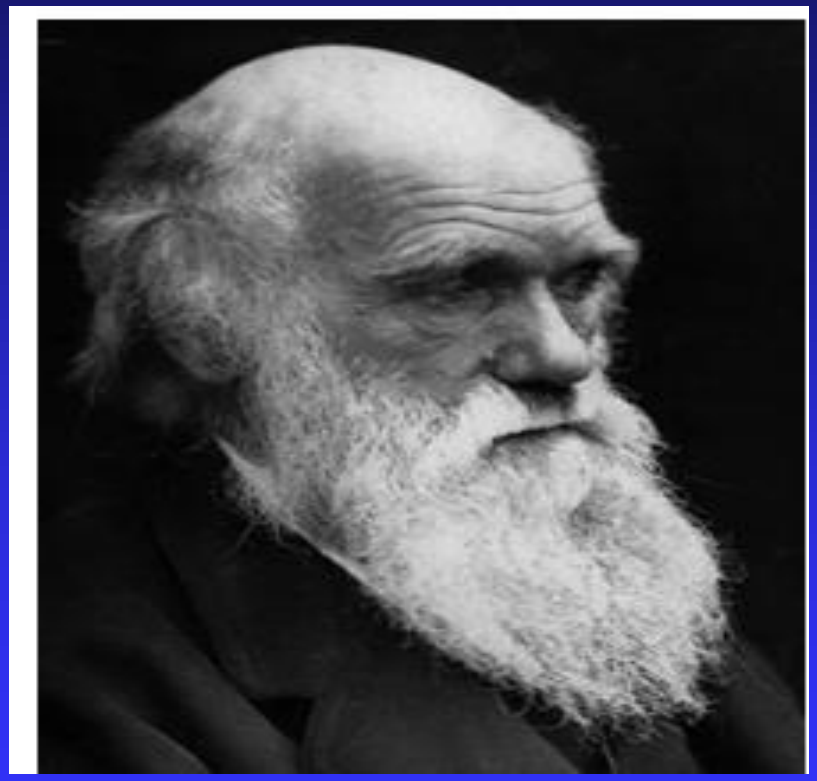
Charles Darwin



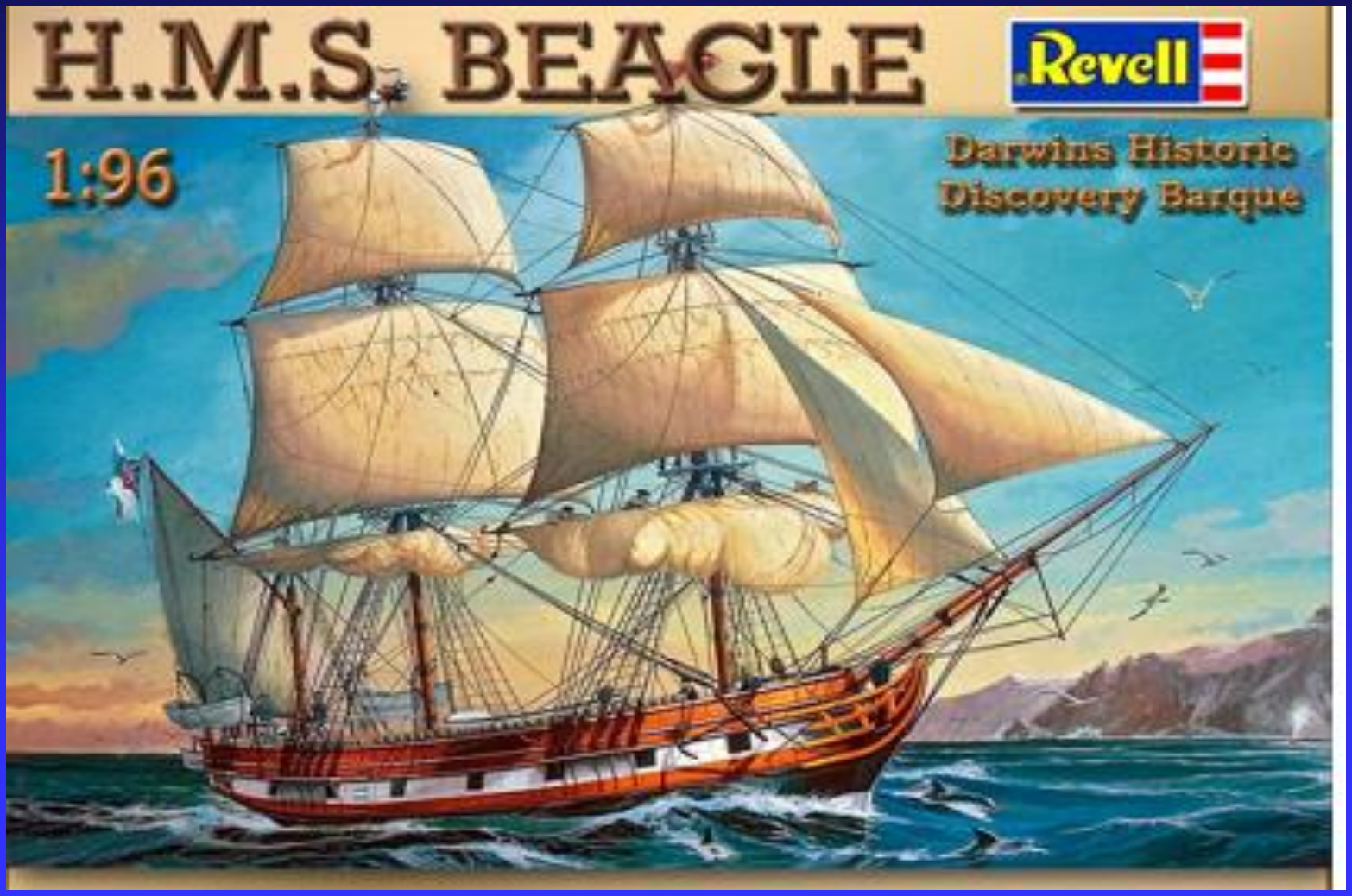
Darwin's Theory of Evolution

- **Evolution**, or change over time, is the process by which modern organisms have descended from ancient organisms.

- A scientific **theory** is a well-supported testable explanation of phenomena that have occurred in the natural world.

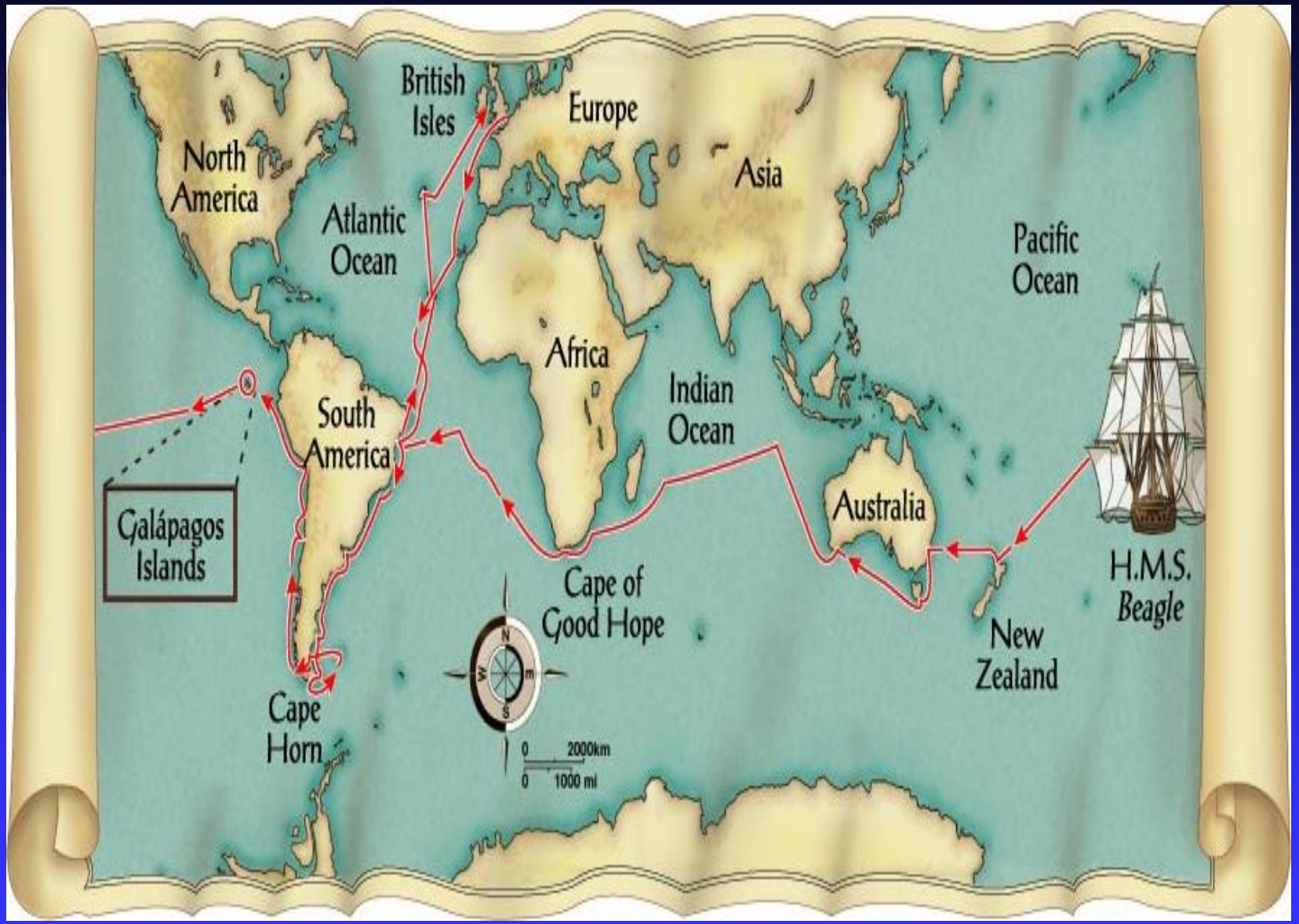
How do you think Darwin came up with his theory?

Voyage of the Beagle



Voyage of Beagle

- **Dates:** February 12th, 1831
- **Captain:** Charles Darwin
- **Ship**: H.M.S. Beagle
- **Destination:** Voyage around the world.
- **Findings:** evidence to propose a revolutionary hypothesis about how life changes over time


British Isles
Europe
North America
Asia
Atlantic Ocean
Pacific Ocean
Africa
Indian Ocean
South America
Australia
Galápagos Islands
H.M.S. Beagle
Cape of Good Hope
New Zealand
Cape Horn
0 2000km
0 1000 mi

Patterns of Diversity

- Darwin visited Argentina and Australia which had similar grassland ecosystems.
  - those grasslands were inhabited by very different animals.
  - neither Argentina nor Australia was home to the sorts of animals that lived in European grasslands.

Patterns of Diversity

- Darwin posed challenging questions.
  - Why were there no rabbits in Australia, despite the presence of habitats that seemed perfect for them?
  - Why were there no kangaroos in England?

Living Organisms and Fossils

- Darwin collected the preserved remains of ancient organisms, called **fossils**.
- Some of those fossils resembled organisms that were still alive today.

Living Organisms and Fossils

- Others looked completely unlike any creature he had ever seen.
- As Darwin studied fossils, new questions arose.
  - Why had so many of these species disappeared?
  - How were they related to living species?

Fossils

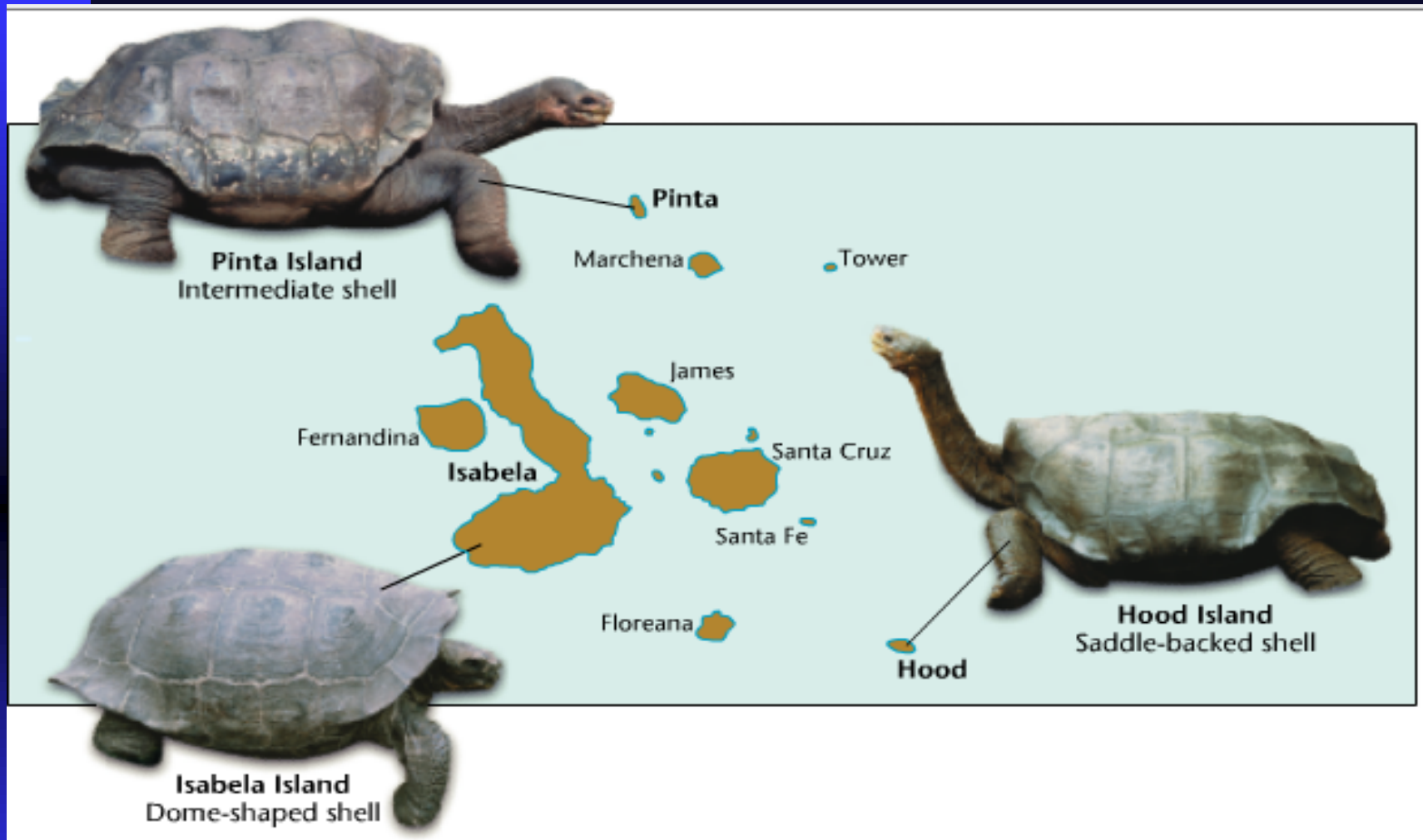
The Galapagos Island

- The smallest, lowest islands were hot, dry, and nearly barren-Hood Island-sparse vegetation

- The higher islands had greater rainfall and a different assortment of plants and animals-Isabela- Island had rich vegetation.

The Galapagos Island

- Darwin was fascinated in particular by the land tortoises and marine iguanas in the Galápagos.
- Giant tortoises varied in predictable ways from one island to another.
- The shape of a tortoise's shell could be used to identify which island a particular tortoise inhabited.



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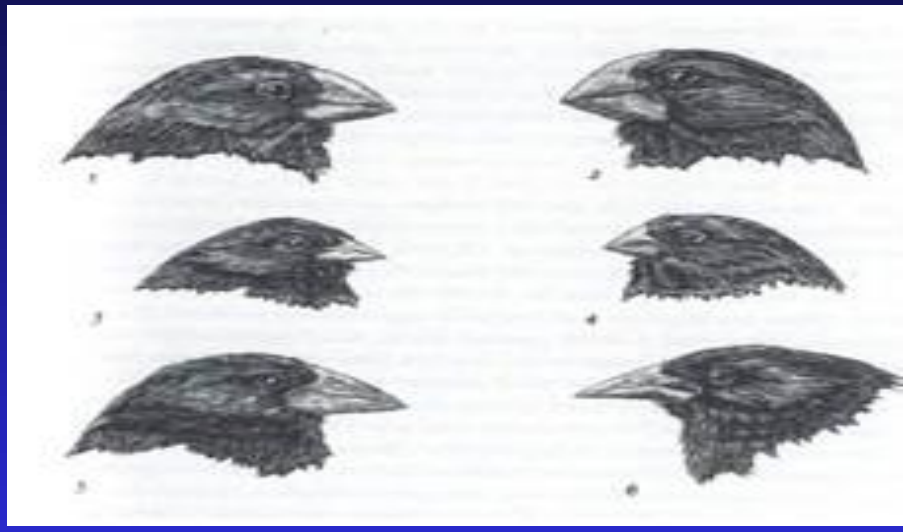
Variation Among Tortoises Darwin observed that the characteristics of many animals and plants varied noticeably among the different Galápagos Islands. Among the tortoises, the shape of the shell corresponds to different habitats. The Hood Island tortoise (right) has a long neck and a shell that is curved 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.

Animals found in the Galapagos

- Land Tortoises
- Darwin Finches
- Blue-Footed Booby
- Marine Iguanas

Animals



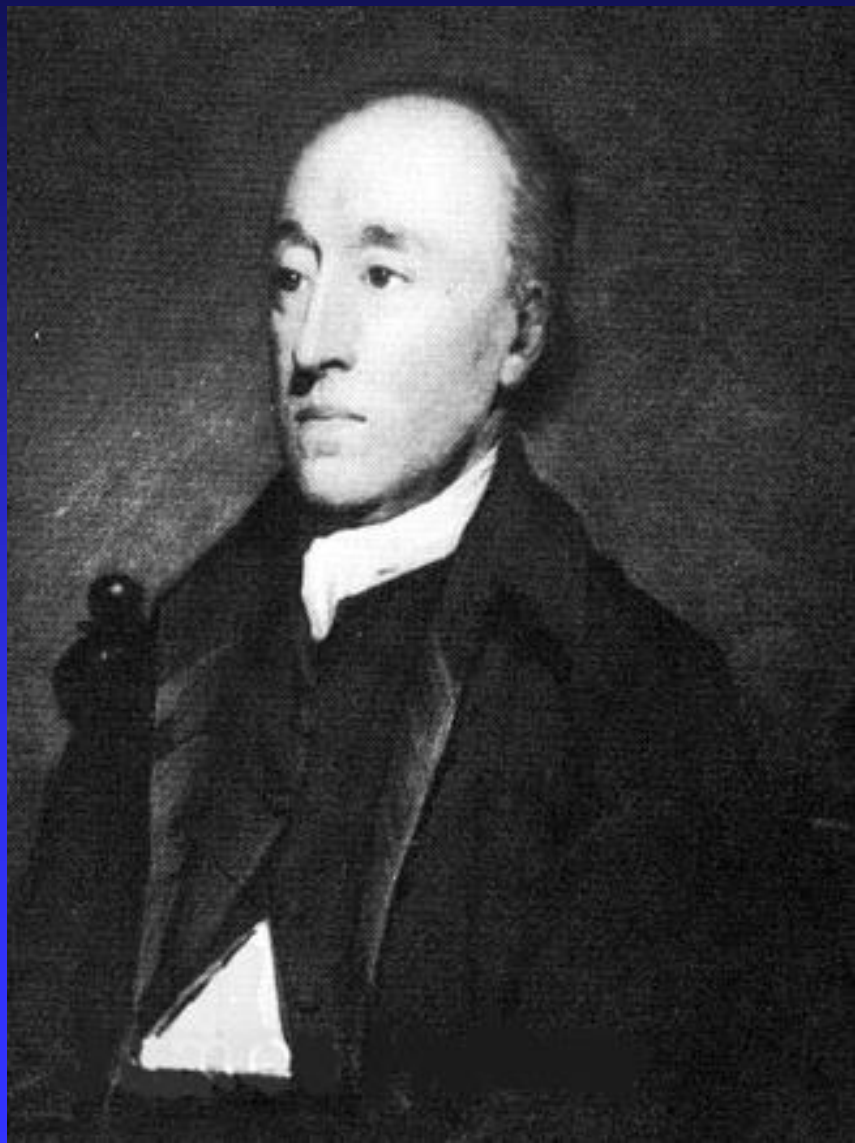
The Journey Home

- Darwin Observed that characteristics of many plants and animals vary greatly among the islands

- **Hypothesis:** Separate species may have arose from an original ancestor

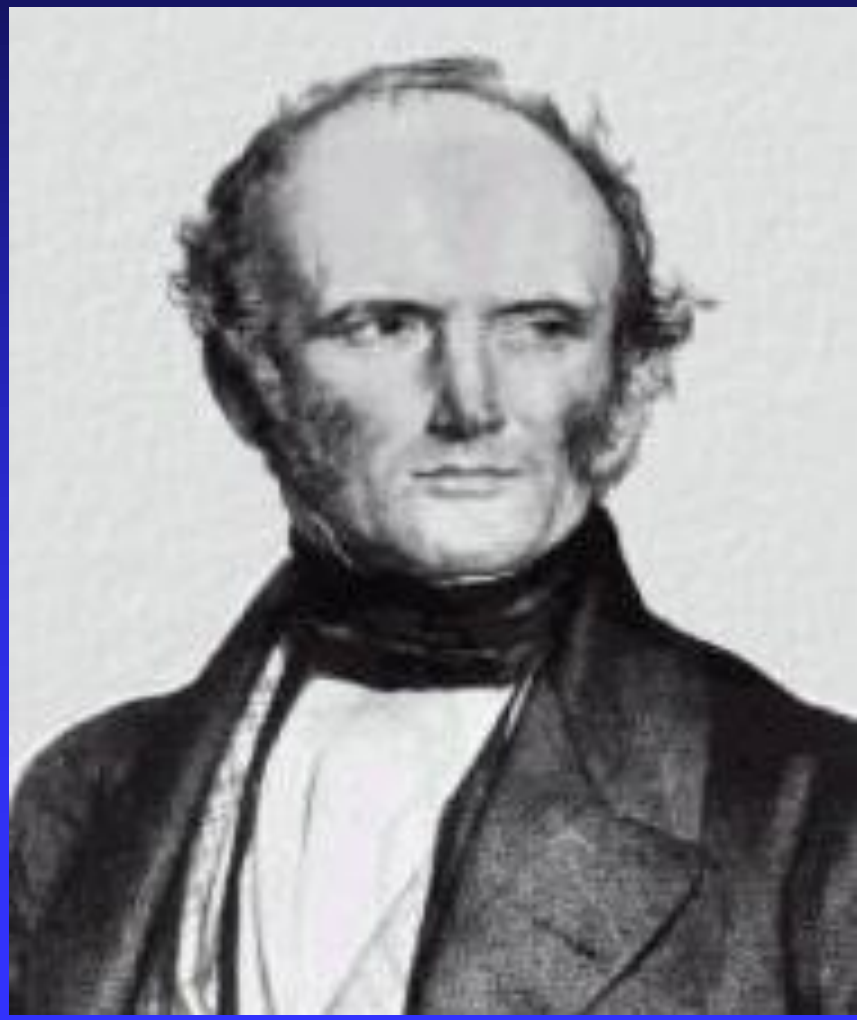
Ideas that shaped Darwin's Thinking

- **James Hutton:**
- 1795 Theory of Geological change
  - Forces change earth's surface shape
  - Changes are slow
  - Earth much older than thousands of years



Ideas that Shaped Darwin's Thinking

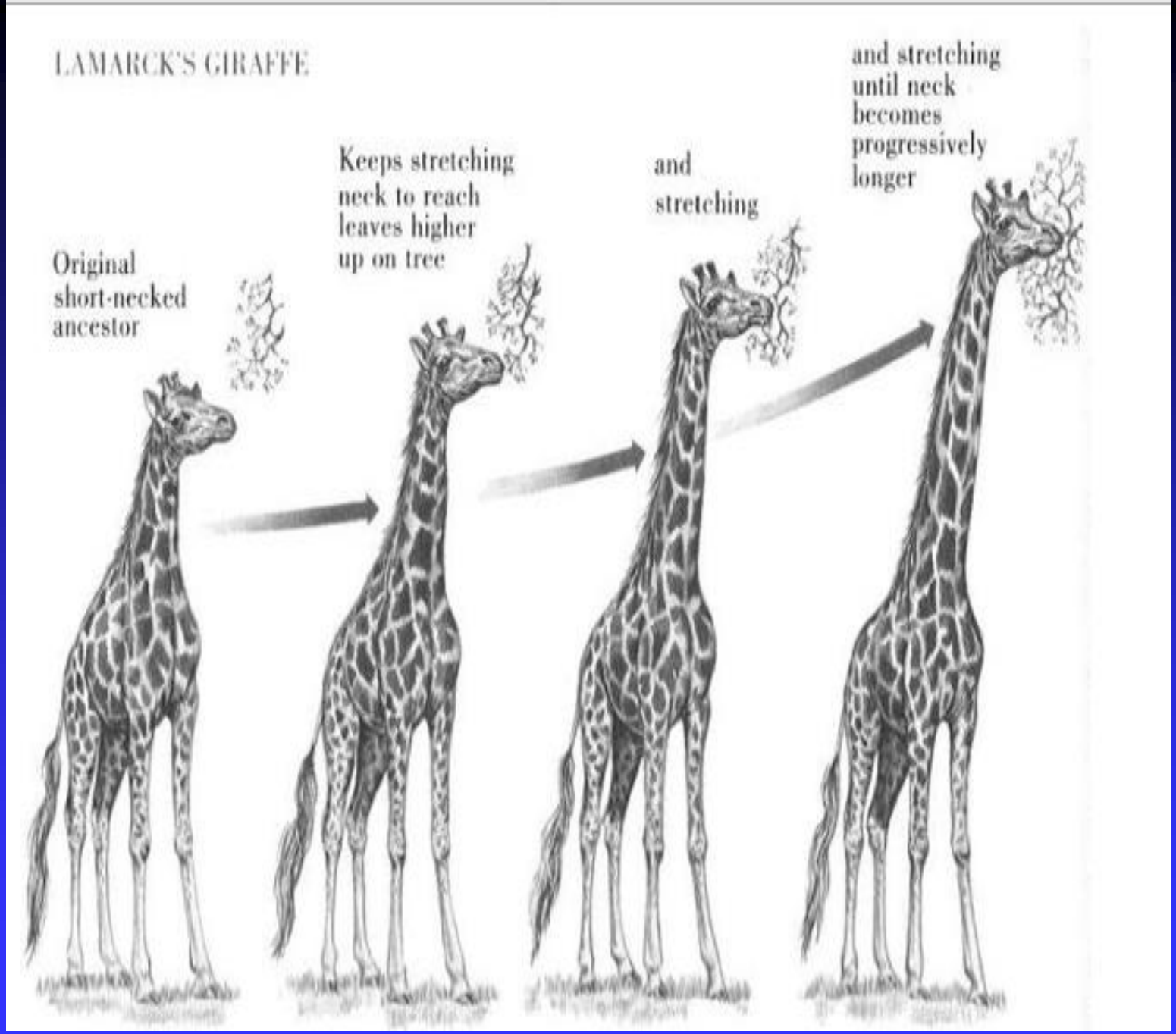
- **Charles Lyell**
- Book: *Principles of Geography*
- Geographical features can be built up or torn down
- Darwin thought if earth changed over time, what about life?

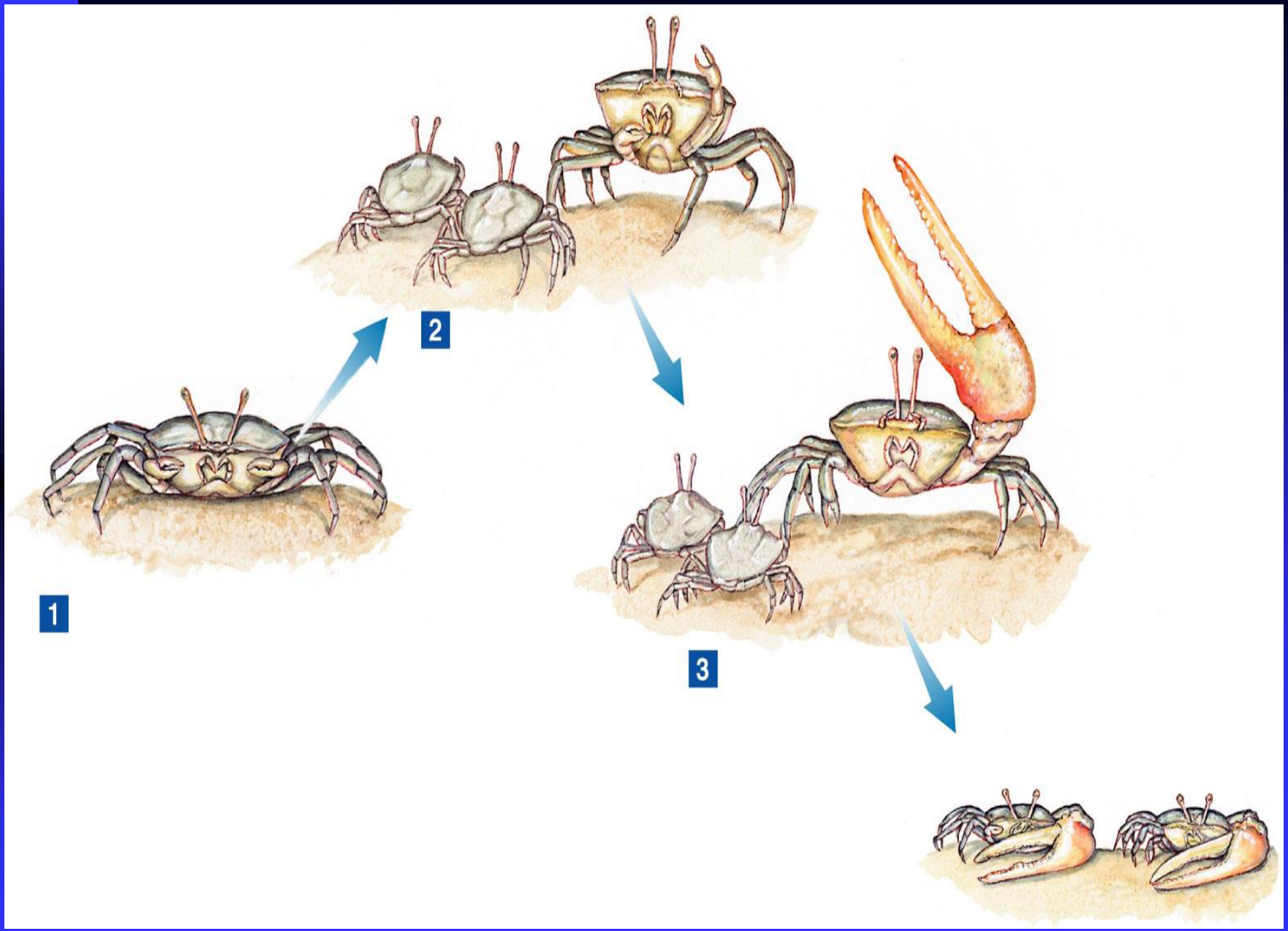


Lamarck

Lamarck's Theory of Evolution

- Tendency toward Perfection(Giraffe necks)
- Use and Disuse (bird's using forearms)
- Inheritance of Acquired Traits


LAMARCK'S GIRAFFE
Original short-necked ancestor
Keeps stretching neck to reach leaves higher up on tree
and stretching
and stretching until neck becomes progressively longer


1
2
3

Population Growth

- **Thomas Malthus-** 19th century English economist
- If population grew (more Babies born than die)
  - Insufficient living space
  - Food runs out
  - Darwin applied this theory to animals

Publication of Orgin of Species

- Russel Wallace wrote an essay summarizing evolutionary change from his field work in Malaysia
- Gave Darwin the drive to publish his findings

Natural Selection & Artificial Selection

- **Natural variation--**differences among individuals of a species

- **Artificial selection-** nature provides the variation among different organisms, and humans select those variations they find useful.

Evolution by Natural Selection

- **The Struggle for Existence-**members of each species have to compete for food, shelter, other life necessities

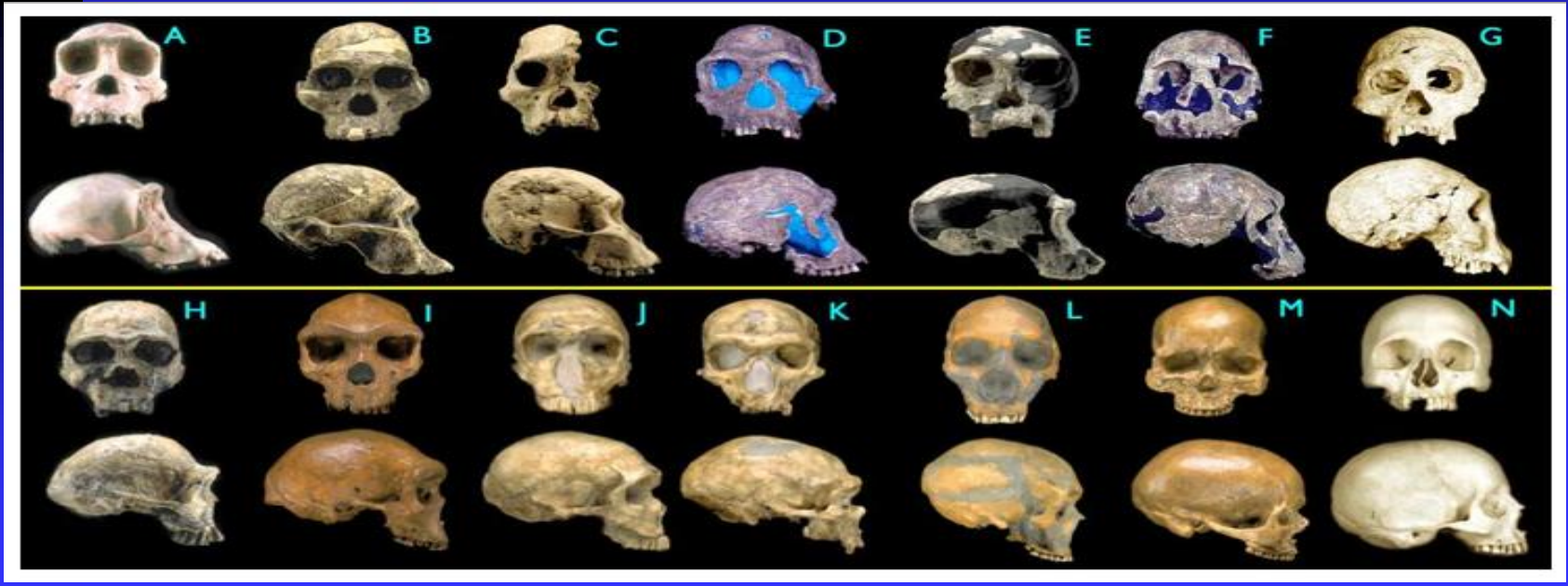
- **Survival of the Fittest-**Some individuals better suited for the environment

Natural Selection

- Over time, natural selection results in changes in inherited characteristics of a population. These changes increase a species fitness in its environment

Descent

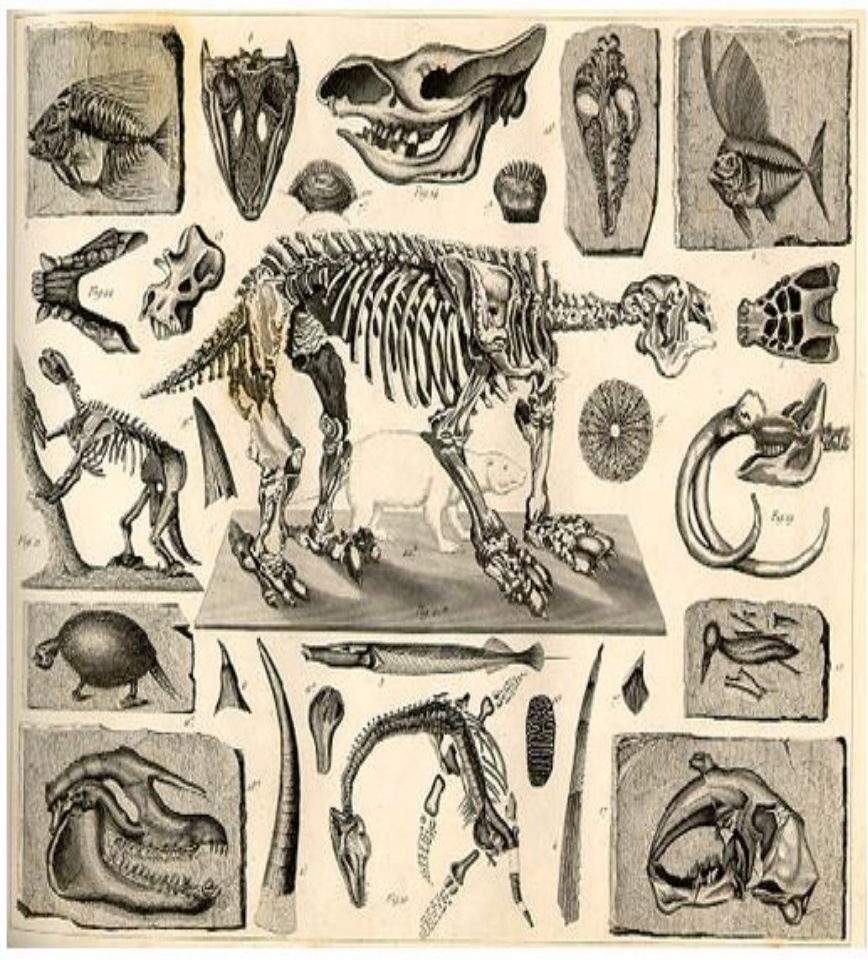
- **Descent with Modification-**Each living organism has descended, with changes from other species over time
- **Common Descent-** were derived from common ancestors



Evidence of Evolution

- The Fossil Record
- Geographic Distribution of Living Things
- Homologous Body Structures
- Similarities in Early Development

Evidence for Evolution



- **The Fossil Record-** Layer show change
- Geographic Distribution of Living Things
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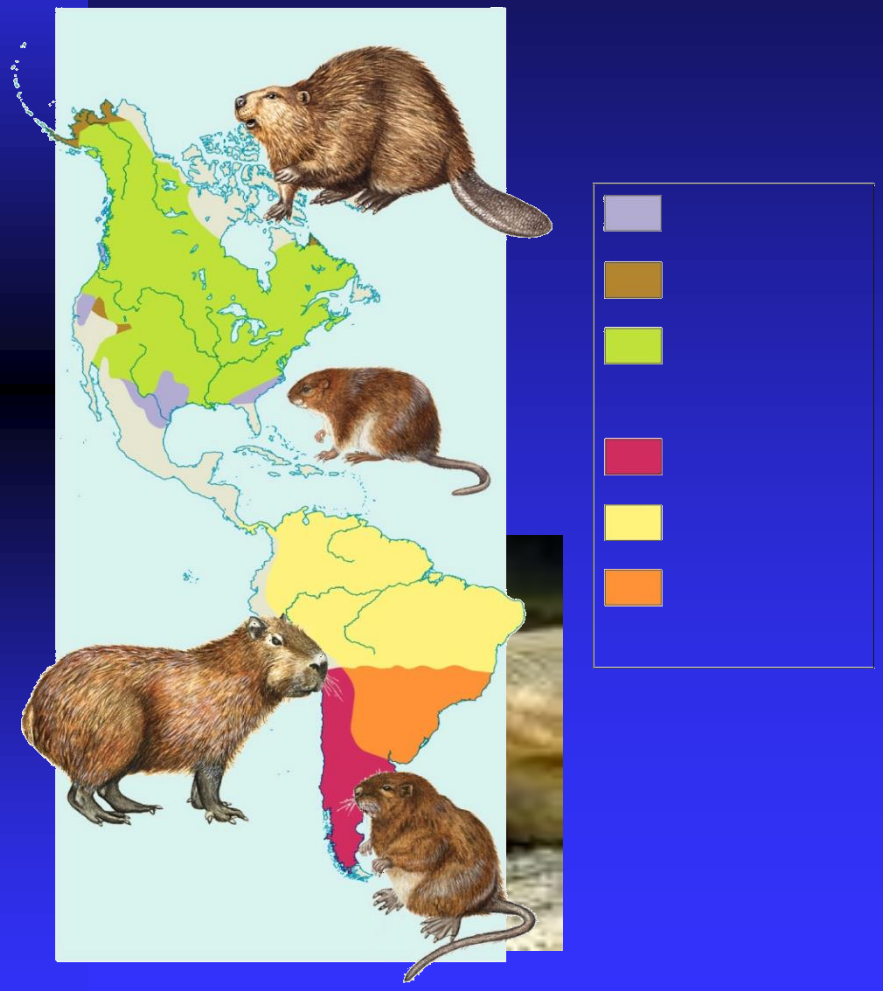
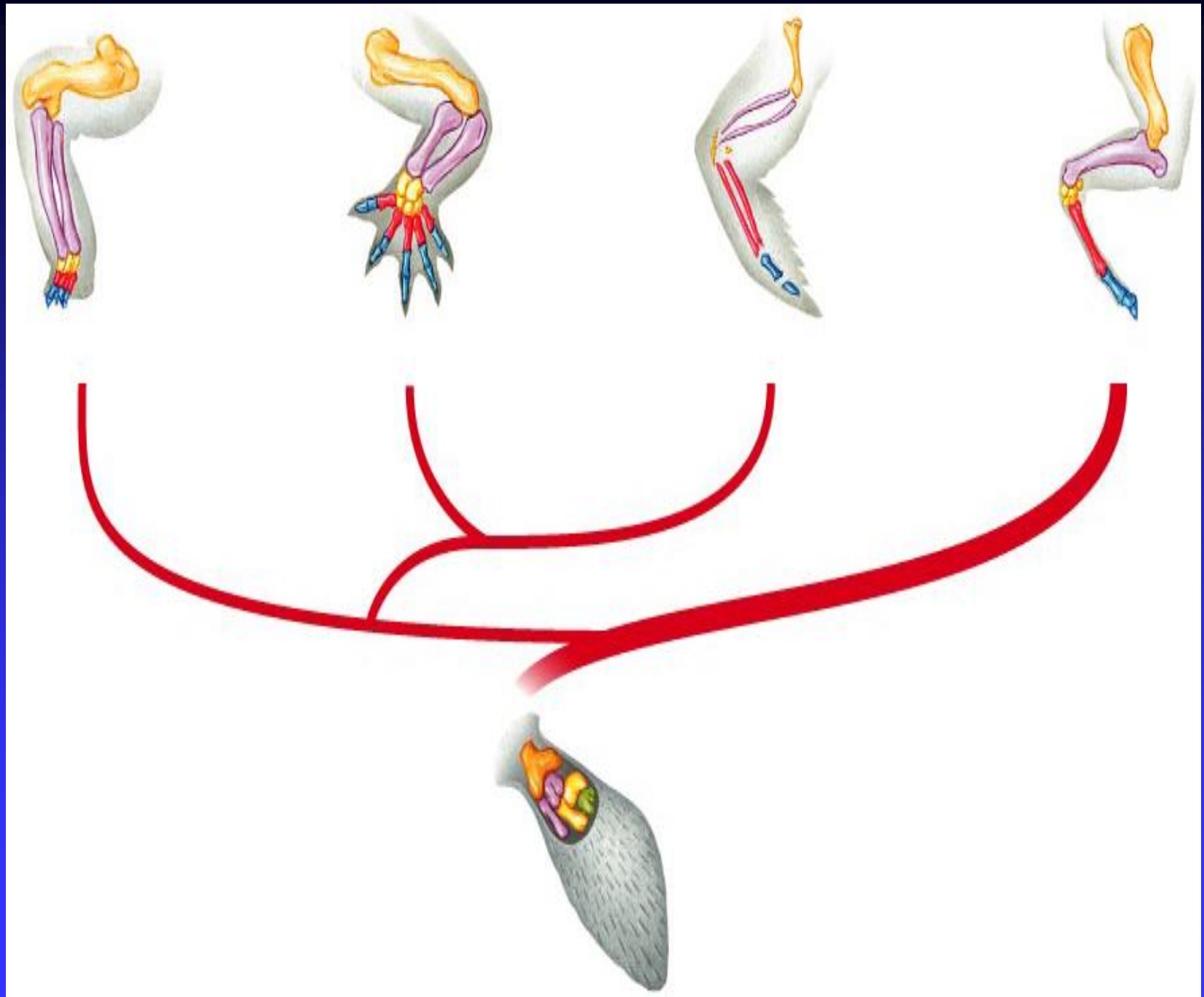
Evidence of Evolution



- The Fossil Record
- **Geographic Distribution of Living Things-**similar environments have similar types of organisms
- Homologous Body Structures
- Similarities in Early Development

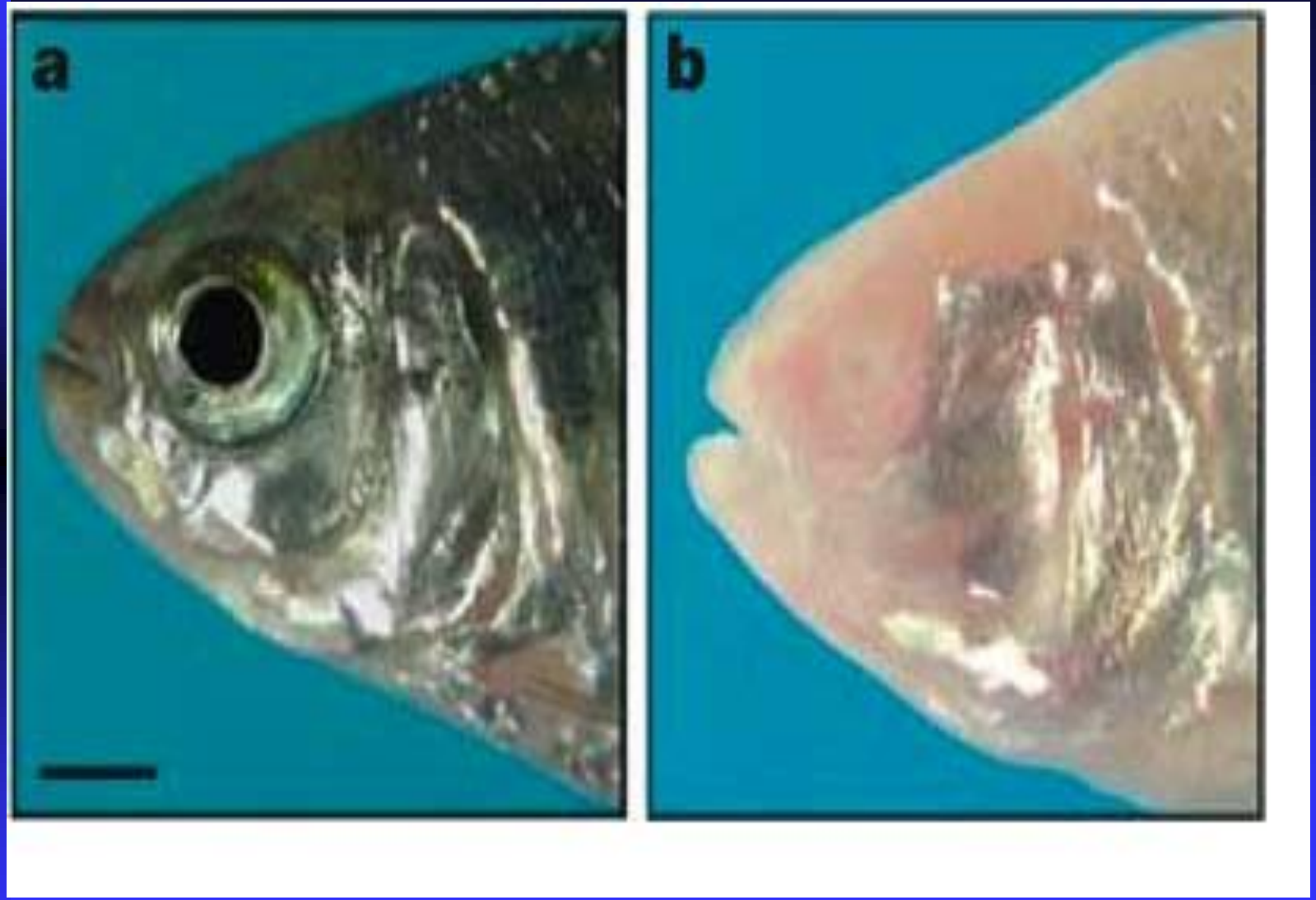
Homologous Structures

- **Homologous Structures**-structures that have different mature forms in different organisms, but develop from the same embryonic tissue

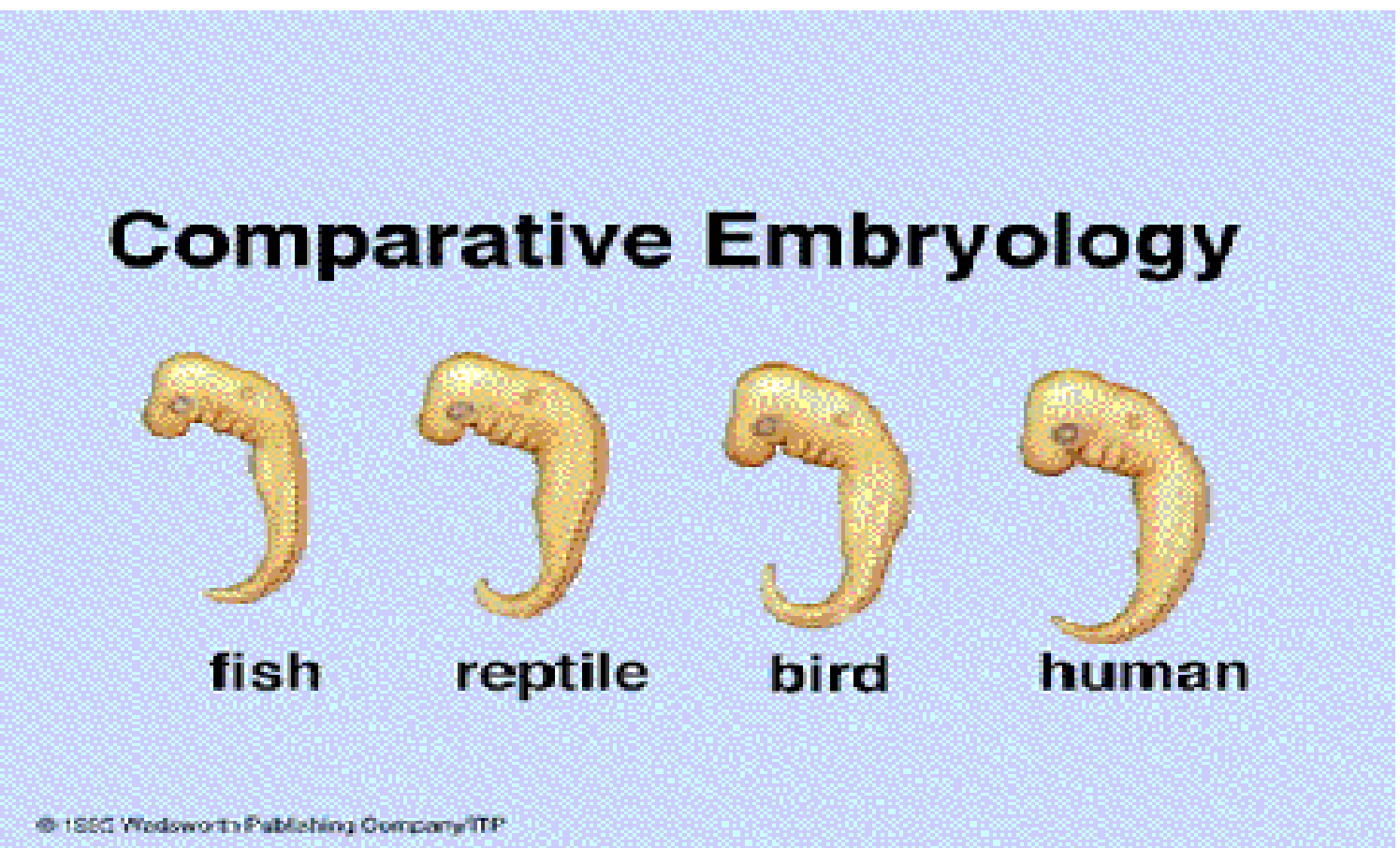


Evidence for Evolution

- **Vestigial organs-**organs that serve no useful function in an organism
- i.e.) appendix, miniature legs, arms


a
b

Similarities in Early Development



Summary of Darwin's Theory

- Individuals in nature differ from one another
- Organisms in nature produce more offspring than can survive, and many of those who do not survive do not reproduce.

Summary of Darwin's Theory

- Because more organisms are produce than can survive, each species must struggle for resources

- Each organism is unique, each has advantages and disadvantages in the struggle for existence

Summary (cont.)

- Individuals best suited for the environment survive and reproduce most successful
- Species change over time

Summary (cont.)

- Species alive today descended with modification from species that lived in the past
- All organisms on earth are united into a single family tree of life by common descent

Mesonychid

Ambulocetus

Rodhocetus

Basilosaurus