

DARWIN'S THEORY

Covering Miller and Levine Biology Ch16.1 and 16.2



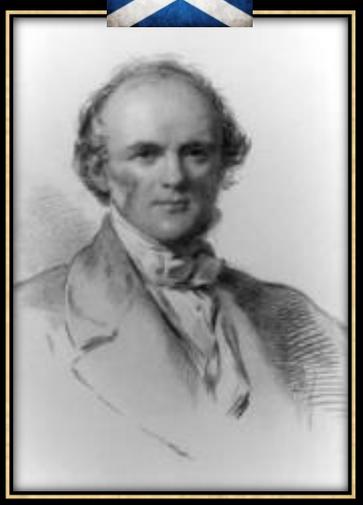
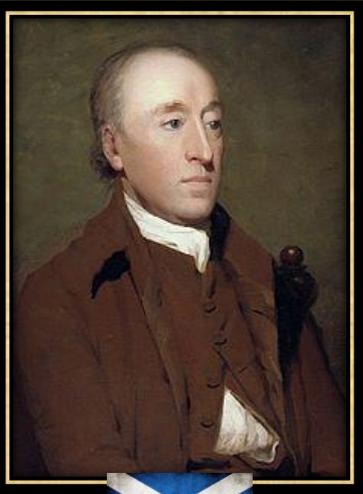
CHALLENGING IDEAS

Darwin was influenced by a number of other scientist that were challenging the prevailing consensus regarding the natural world.

Geologists **James Hutton** and **Charles Lyell**

Hutton's and later Lyell's work represent a major contribution to our understanding of Earth's geology.

- Deep Time: The arth is billions of year old NOT thousands.
- Uniformitarianism: Geological processes work in the same way today as they did in the past.
- Law of Superposition: Older sediments and thus older fossils are deposited first and later covered by newer materials leading to the stratification that we observe in sedimentary layers of the Earth today.

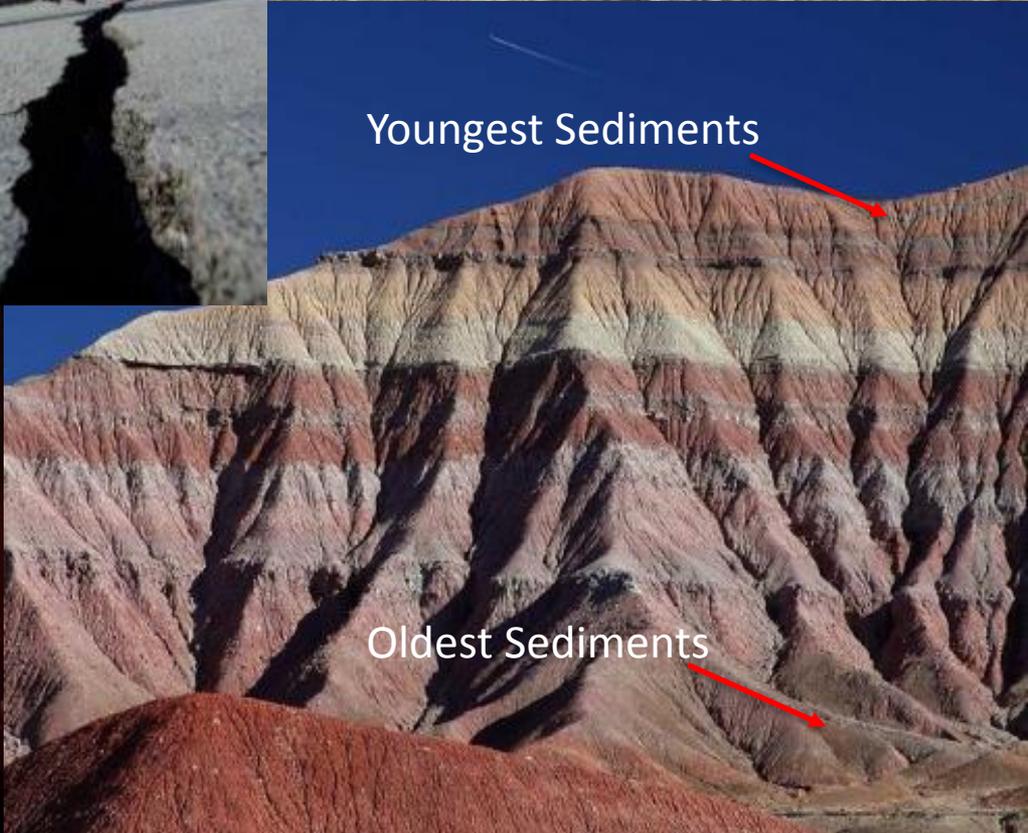




Earth processes take a very long time to create these structures



Youngest Sediments



Oldest Sediments

CHALLENGING IDEAS

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Naturalist **Jean-Baptiste Lamarck** and Economist **Thomas Malthus**

Lamarck is credited with one of the earliest theories regarding evolution.

- Correct: Species changed through generations
- Incorrect: Thought acquired traits could be passed on.



Malthus wrote about the exponential growth of European population and how it would exceed the availability of resources, (carrying capacity) leading to “famine and vice”

- Correct: Predicted exponential human population growth.
- Incorrect: Did not predict technological advances that greatly increased our ability to produce food for the masses, (Green Revolution).



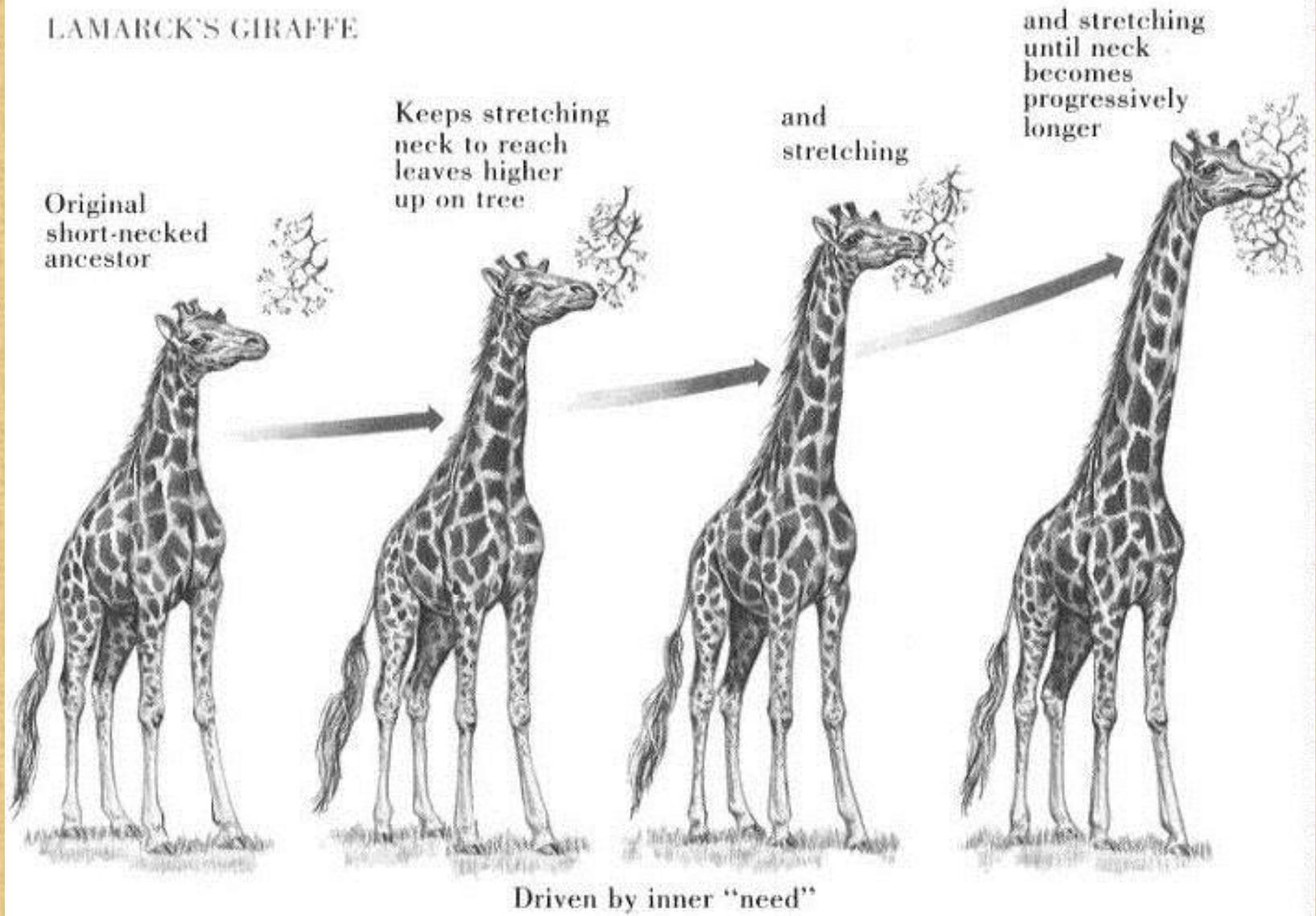
French naturalist **Jean-Baptiste Lamarck**



Two Hypotheses:

1. Organisms could change during their lifetimes by selectively using or not using various parts of their bodies.
2. Individuals could pass these acquired characteristics on to their offspring.

LAMARCK'S GIRAFFE



How are Lamarck's hypotheses incorrect?

Economist Thomas Malthus

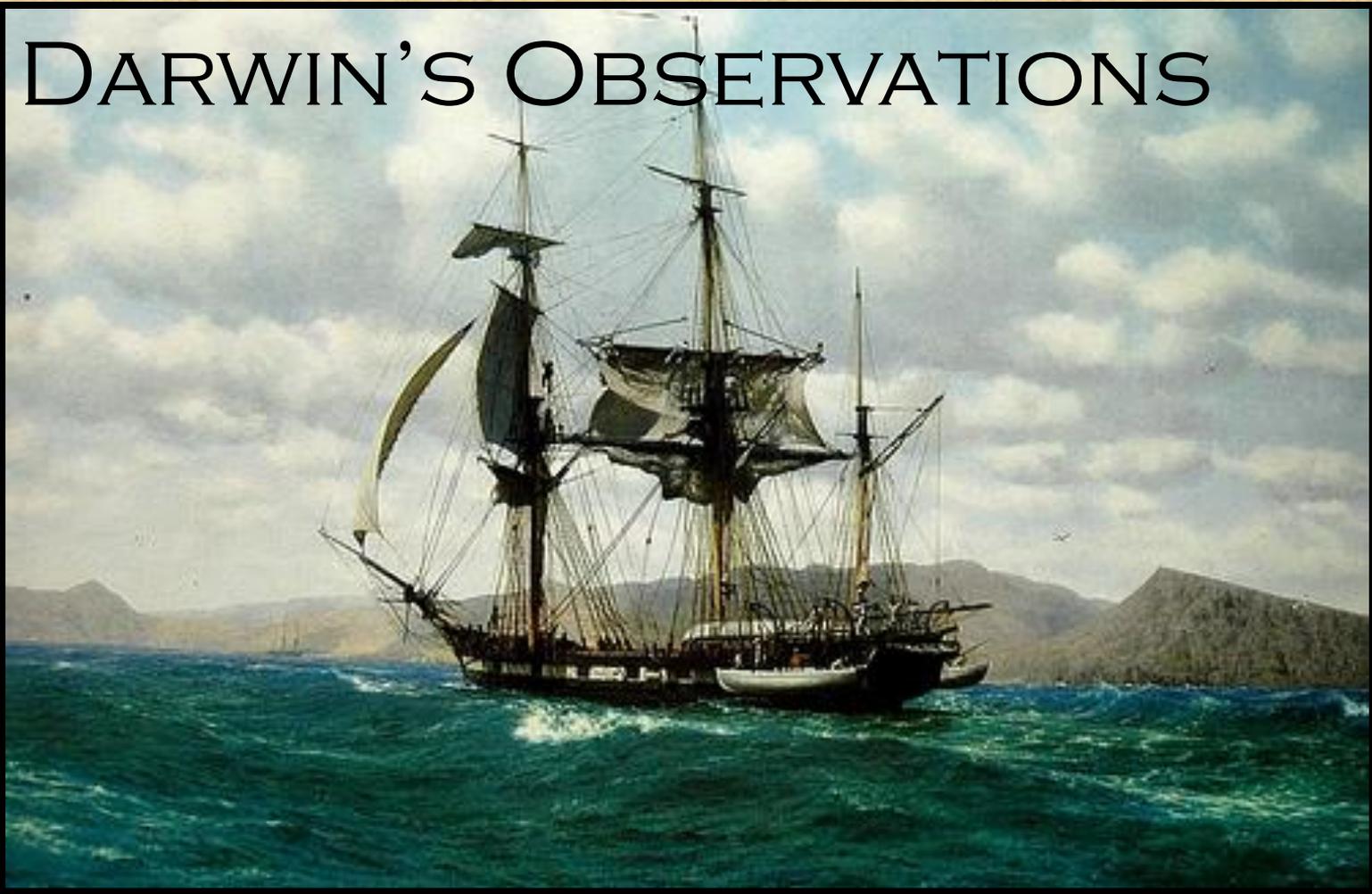
Observed London's overcrowding.

Realized that if human growth grew unchecked, there would not be enough resources for everyone.



Darwin knew this idea also applied to other organisms.

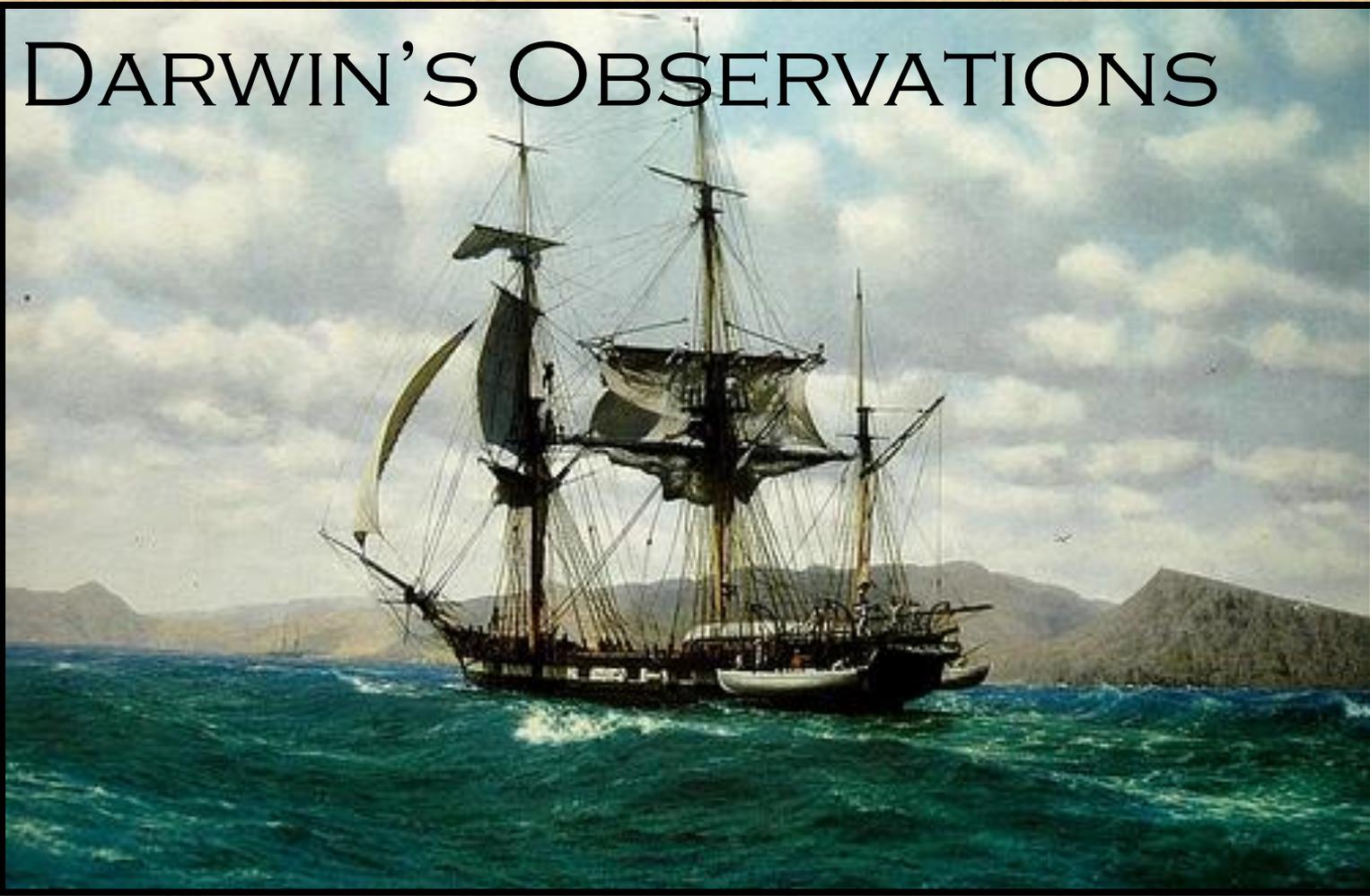
DARWIN'S OBSERVATIONS



Before leaving on his journey Darwin is exposed to these revolutionary ideas.

1. The Earth is much older than we previously believed.
2. Sediments are laid down with the older fossil material in deeper sediments.
3. Species change through time.
4. Species can reproduce beyond the environments ability to support them.

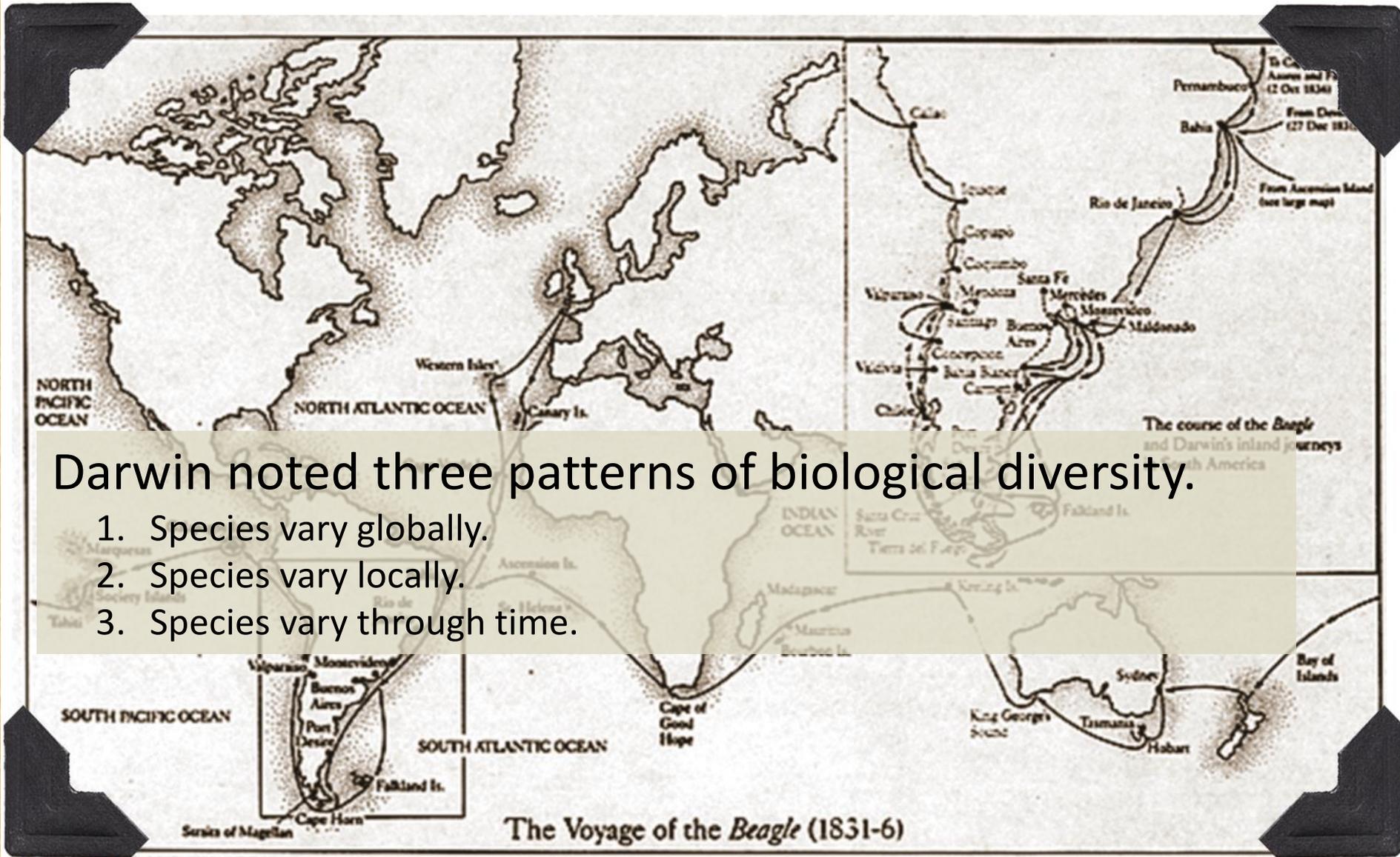
DARWIN'S OBSERVATIONS



In his five year journey aboard the H.M.S. Beagle Darwin makes a wide variety of observations that begin to influence his thinking.

- He observes fossils of extinct species that resemble some extant species.
- He experiences an earthquake.
- He finds marine fossils in the Andes Mountains.
- He finds similar but distinct species in close proximity to each other.

DARWIN'S OBSERVATIONS



DARWIN'S OBSERVATIONS

1. Species vary globally

Distinct species that inhabit separate, but ecologically similar habitats possess similar adaptations.



DARWIN'S OBSERVATIONS

2. Species vary locally

Distinct, yet related, animal species often occupied different habitats within a local area.



Isabela Island Tortoises have dome-shaped shells and short necks.

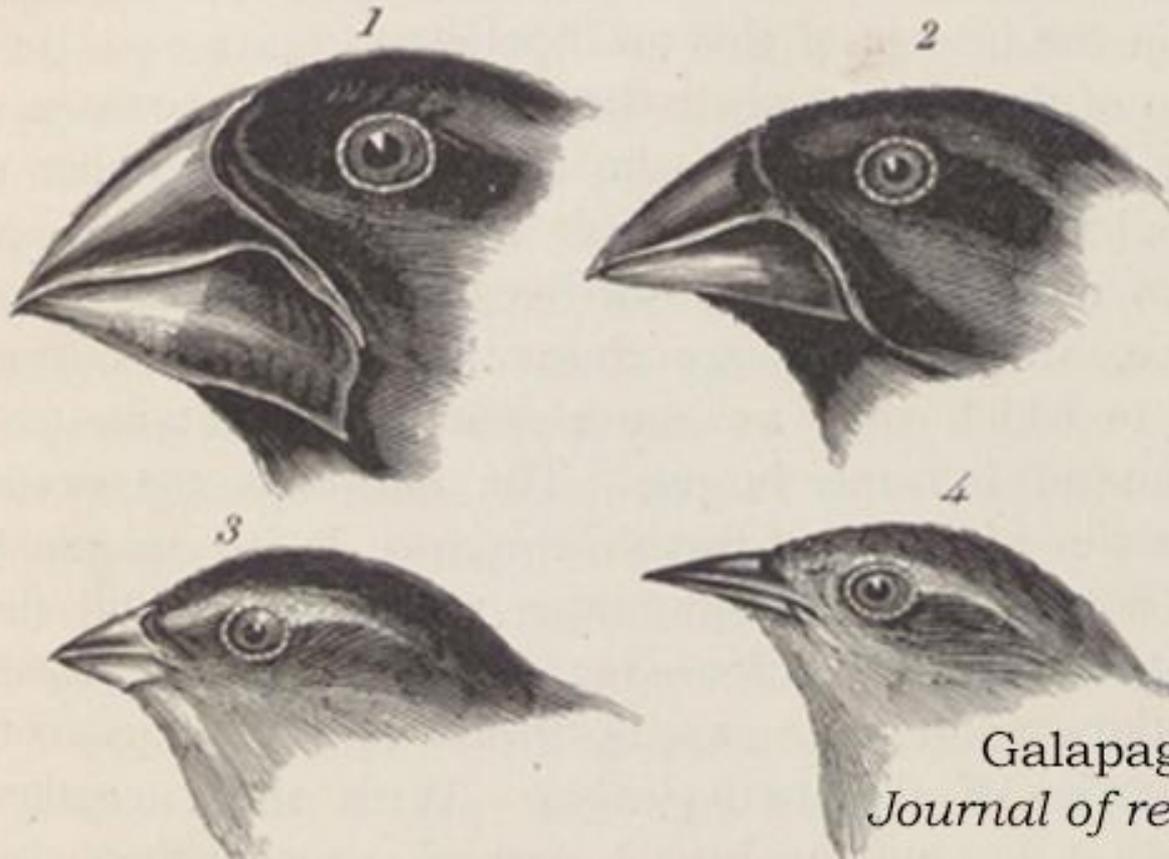


Hood Island Tortoises have curved shells that are open around their necks and legs.

These herbivores both lived off vegetation. How do you think vegetation growth differed from island to island?

DARWIN'S OBSERVATIONS

Darwin's Finches



Galapagos finches
Journal of researches, 1845

DARWIN'S OBSERVATIONS

3. *Species vary over time*

Darwin noticed that some fossils of extinct animals were similar to living species.

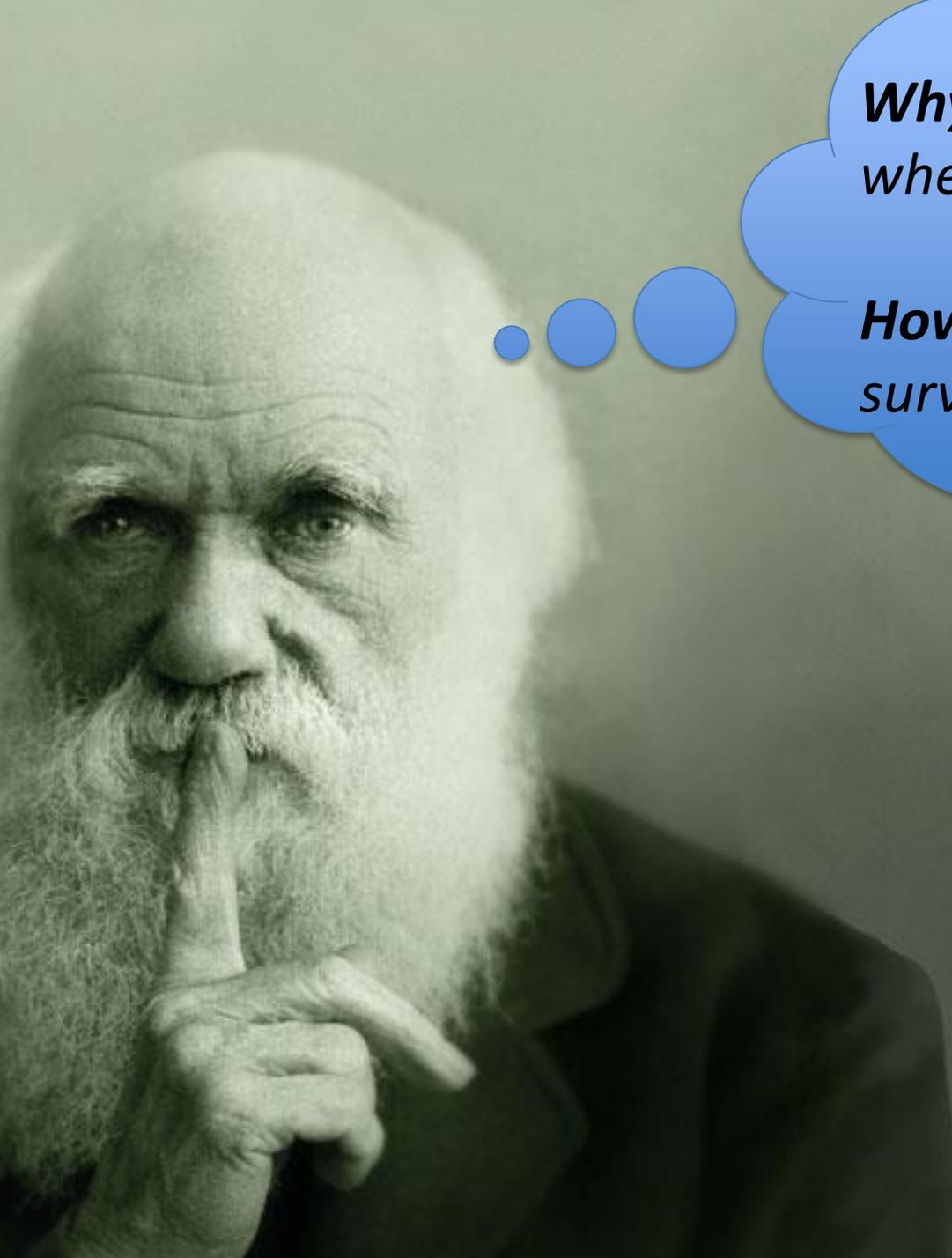


Glyptodont



Megatherium





Why do some organisms survive when others don't?

How do certain organisms survive when many do not?

Ernst Mayr: Summary of Darwin

- **OBSERVATION #1:** All species have such great potential fertility that their population size would increase exponentially if all individuals that are born reproduced successfully.
- **OBSERVATION #2:** Populations tend to remain stable in size, excepting seasonal fluctuations.
- **OBSERVATION #3:** Environmental resources are limited.
- **INFERENCE #1:** Production of more individuals than the environment can support leads to a struggle for existence among individuals of a population, with only a fraction of offspring surviving each generation.
- **OBSERVATION #4:** Individuals of a population vary extensively in their characteristics; no two individuals are exactly alike.
- **OBSERVATION #5:** Much of this variation is heritable.
- **INFERENCE #2:** Survival in the struggle for existence is not random, but depends in part on the hereditary constitution of the individuals. Those individuals whose inherited traits best fit them to their environments are likely to leave more offspring than less fit individuals.
- **INFERENCE #3:** This unequal ability of individuals to survive and reproduce will lead to a gradual change in a population with favorable characteristics accumulating over the generations.

Summary of Darwin's Theory:

- Natural selection is differential success in reproduction (unequal ability of individuals to survive and reproduce)
- Natural selection occurs through an interaction between the environment and the variability inherent among the individual organisms making up a population.
- The process of natural selection is the adaptation of populations of organisms to their environment