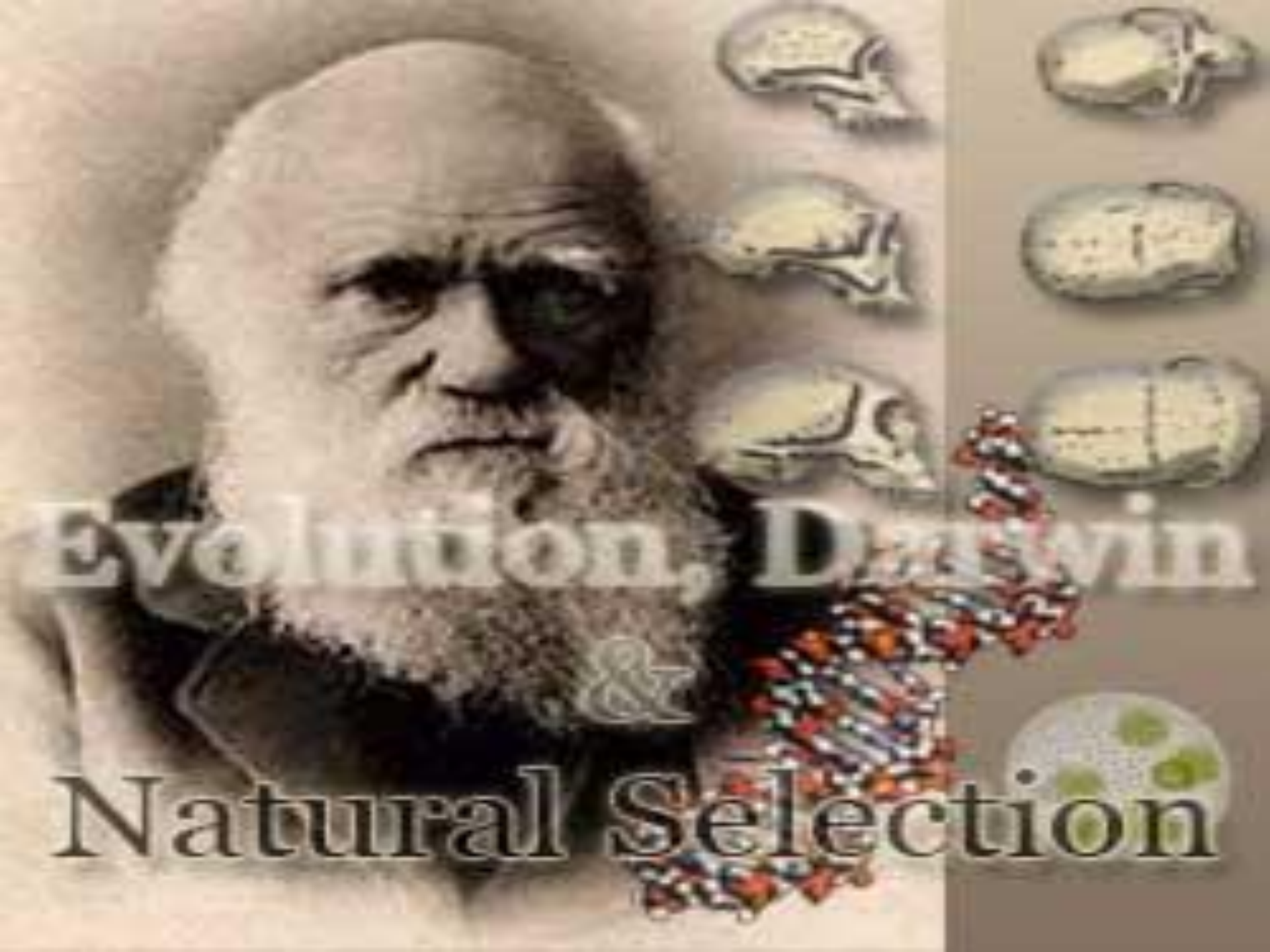
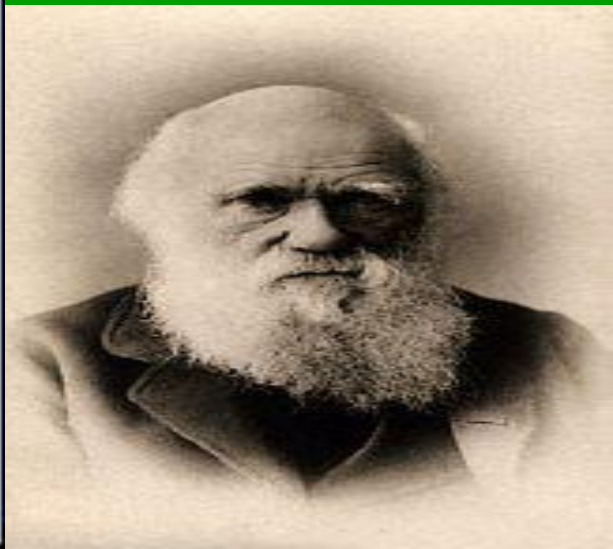

Evolution, Darwin
&
Natural Selection

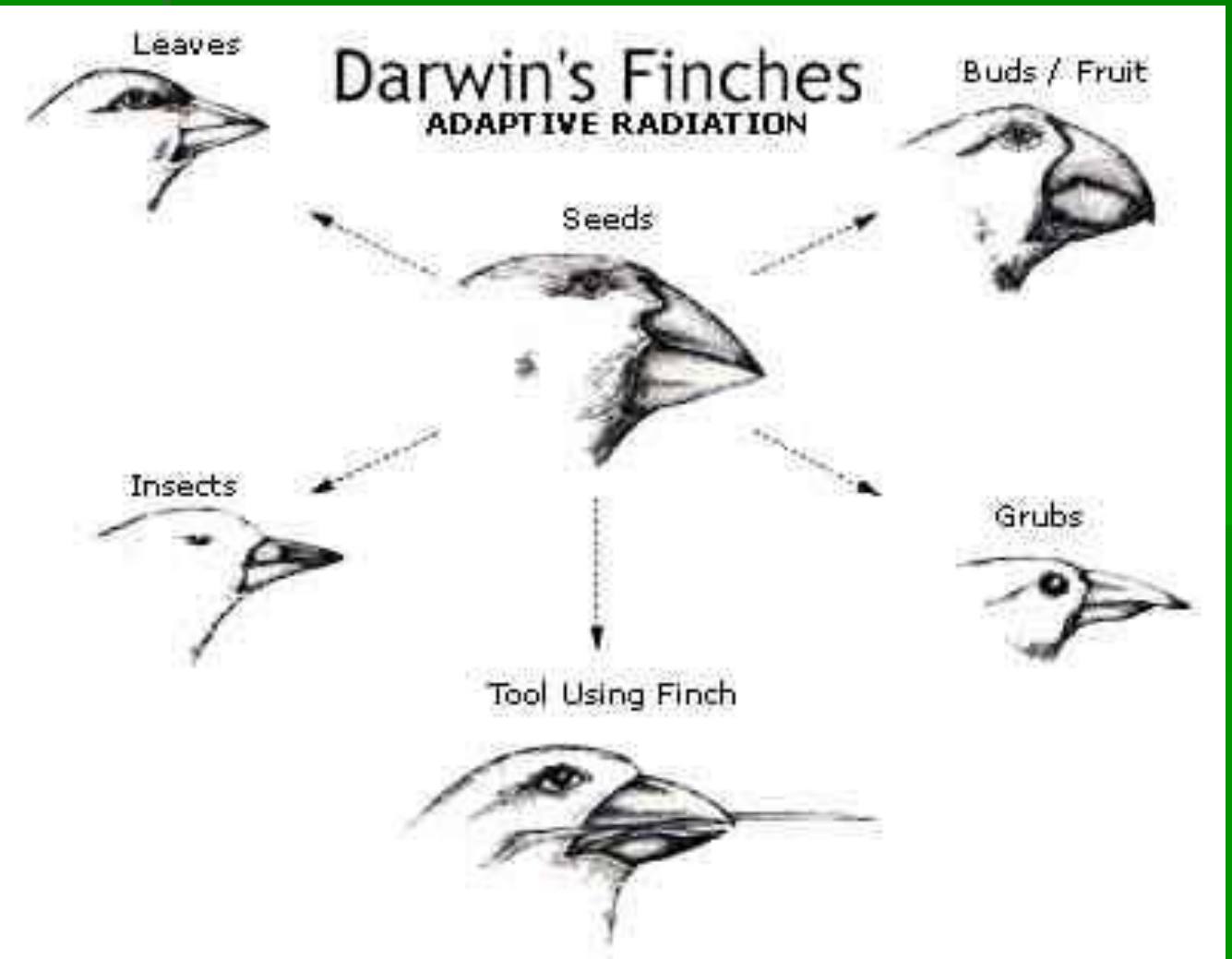
Charles Darwin (1809-1882)
Sailed around the world 1831-1836



2. What did Darwin's Travels reveal

- The diversity of living species was far greater than anyone had previously known!!
- These observations led him to develop the theory of evolution!!

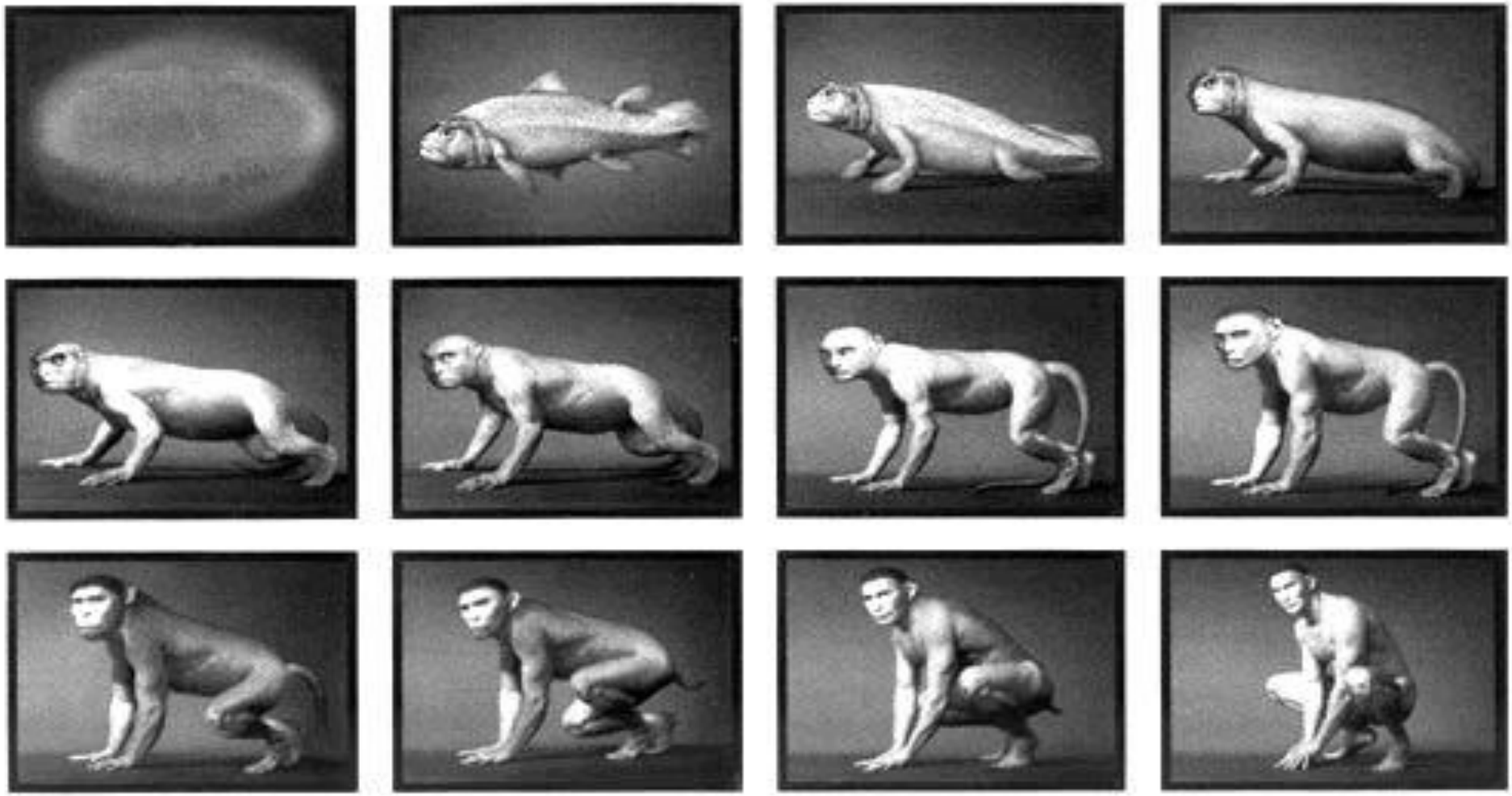
3.How did tortoises and birds differ among the islands of the Galapagos?



- Each island had its own type of tortoises and birds that were clearly different from other islands

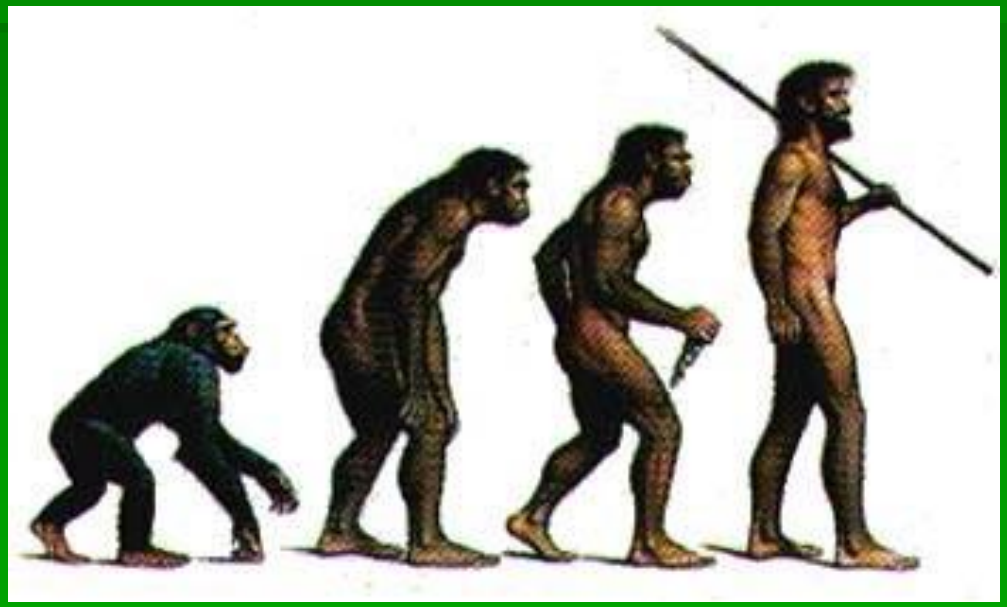
Galapagos Turtles

4. Evolution is when organisms change over time. So, modern organisms descended from ancient ones



7. Evolution is a Theory – Just like Gravity!

- Evolution is a well supported explanation of phenomena that have occurred in the natural world



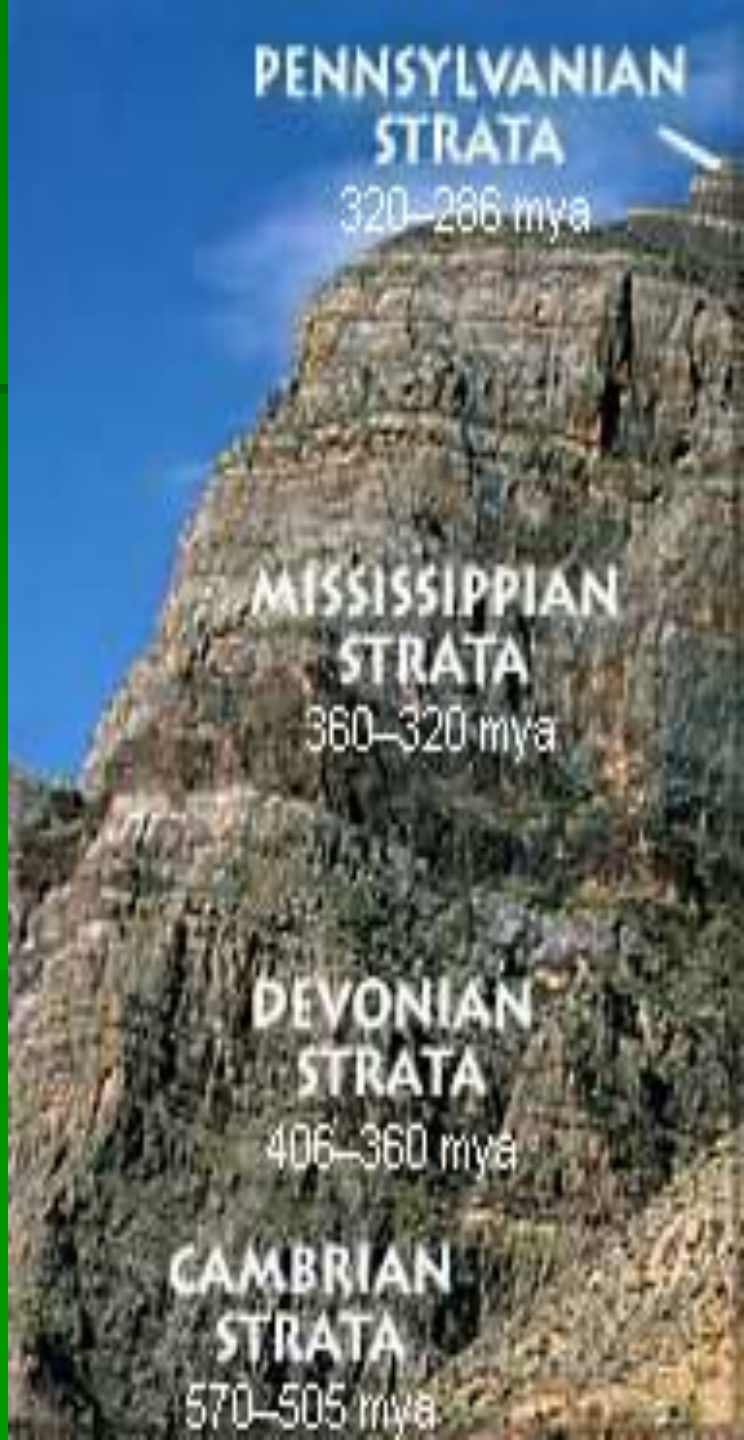
- A theory in science is a well tested hypothesis, not just a guess

5. Geologists: Hutton and Lyell

Fundamentalists said that the earth was around 6000 years old

Hutton and Lyell argued that the earth is many millions of years old b/c

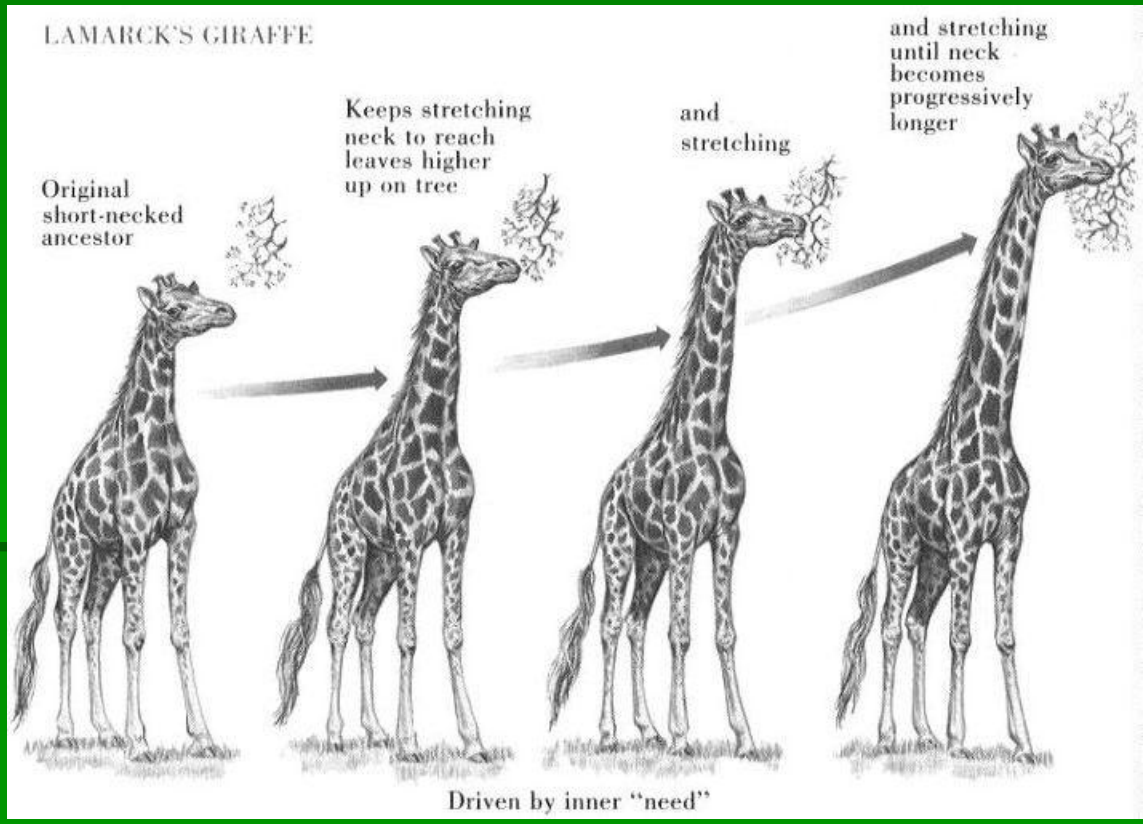
- layers of rock take time to form
- processes such as volcanoes and earthquakes shaped the earth and still occur today



6. Lamark

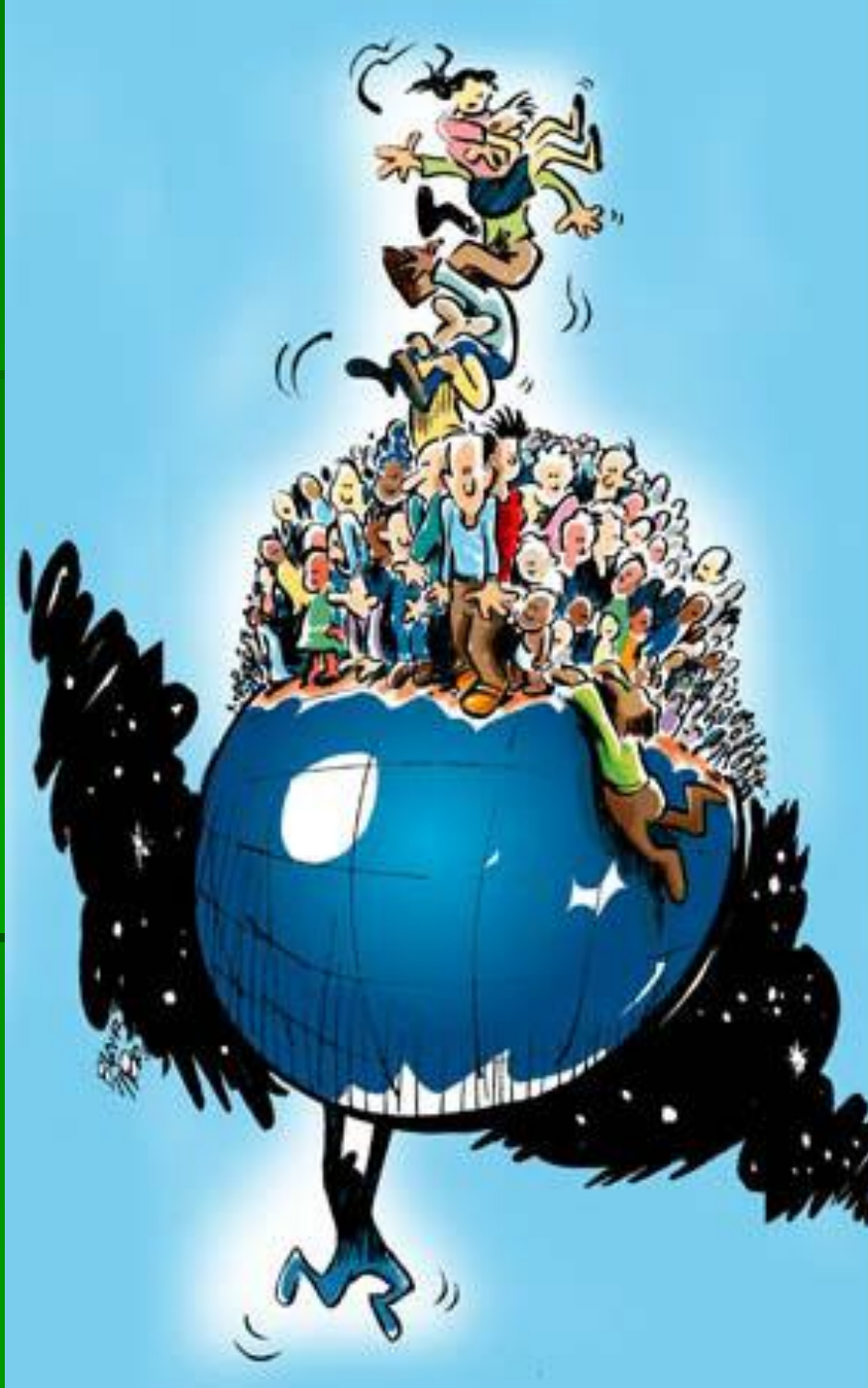
Theory of acquired characteristics

- Lamark said organisms acquired traits by using their bodies in new ways
- These new characteristics were passed to offspring
- Lamark was totally wrong!

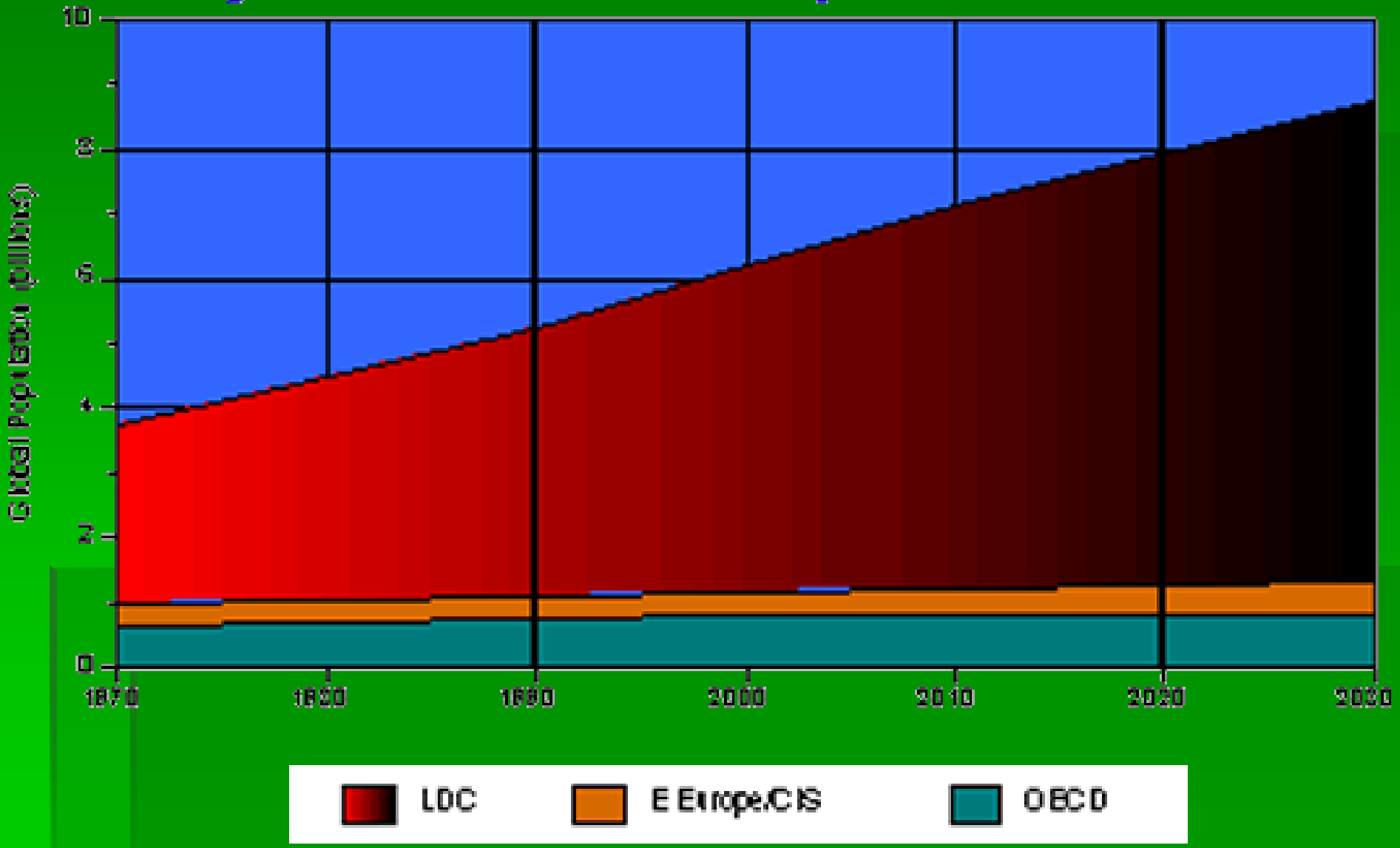


7. Malthus

- Reasoned that if the human population continued to grow unchecked, sooner or later there would be insufficient living space and food for everyone

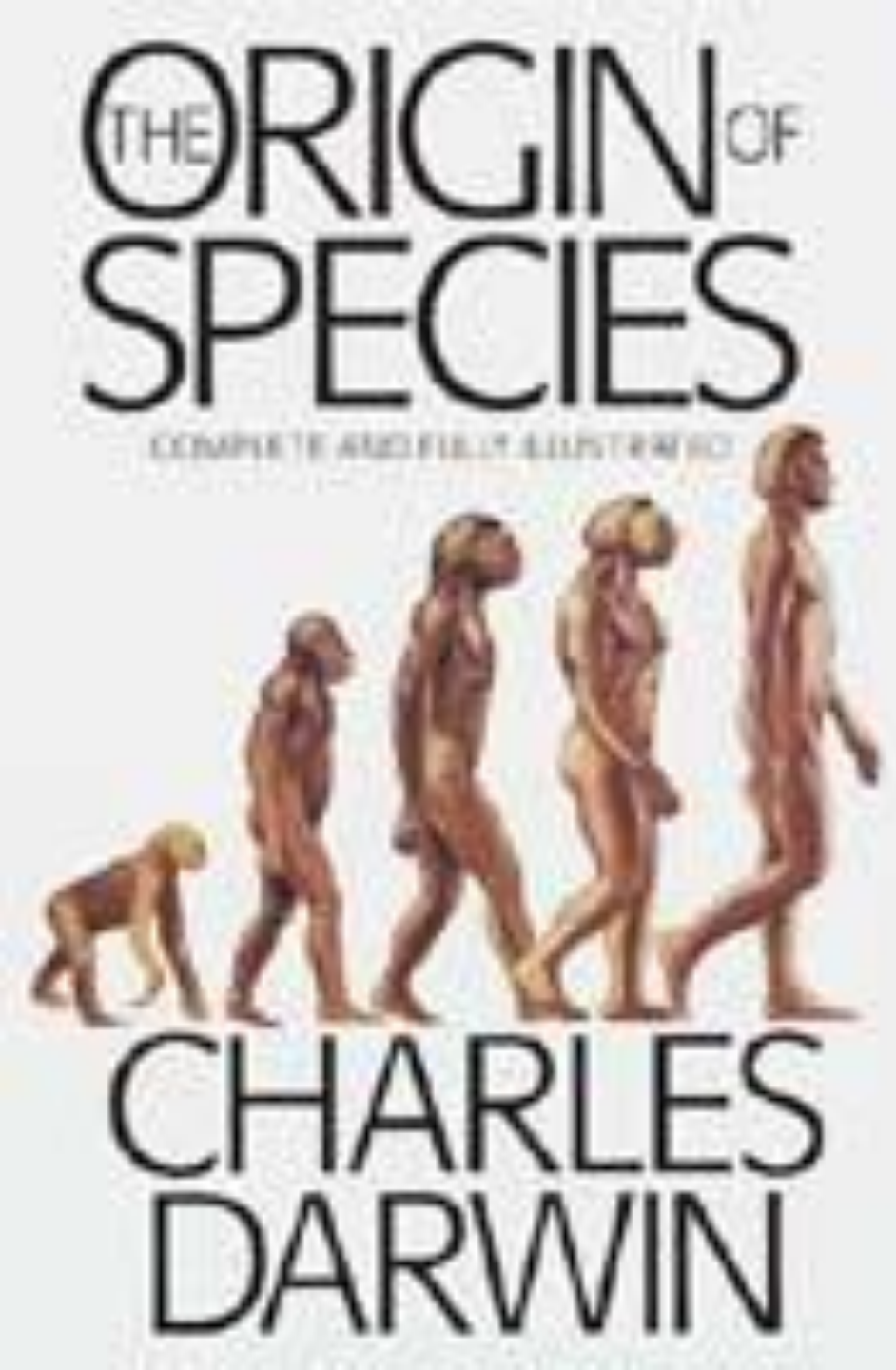


Projected Global Population



8. Darwin finally published his ideas in 1859

- Other naturalists were developing the same theory that Darwin did.
- Even though he was afraid of the Church's reaction to his book he wanted to get credit for his work.

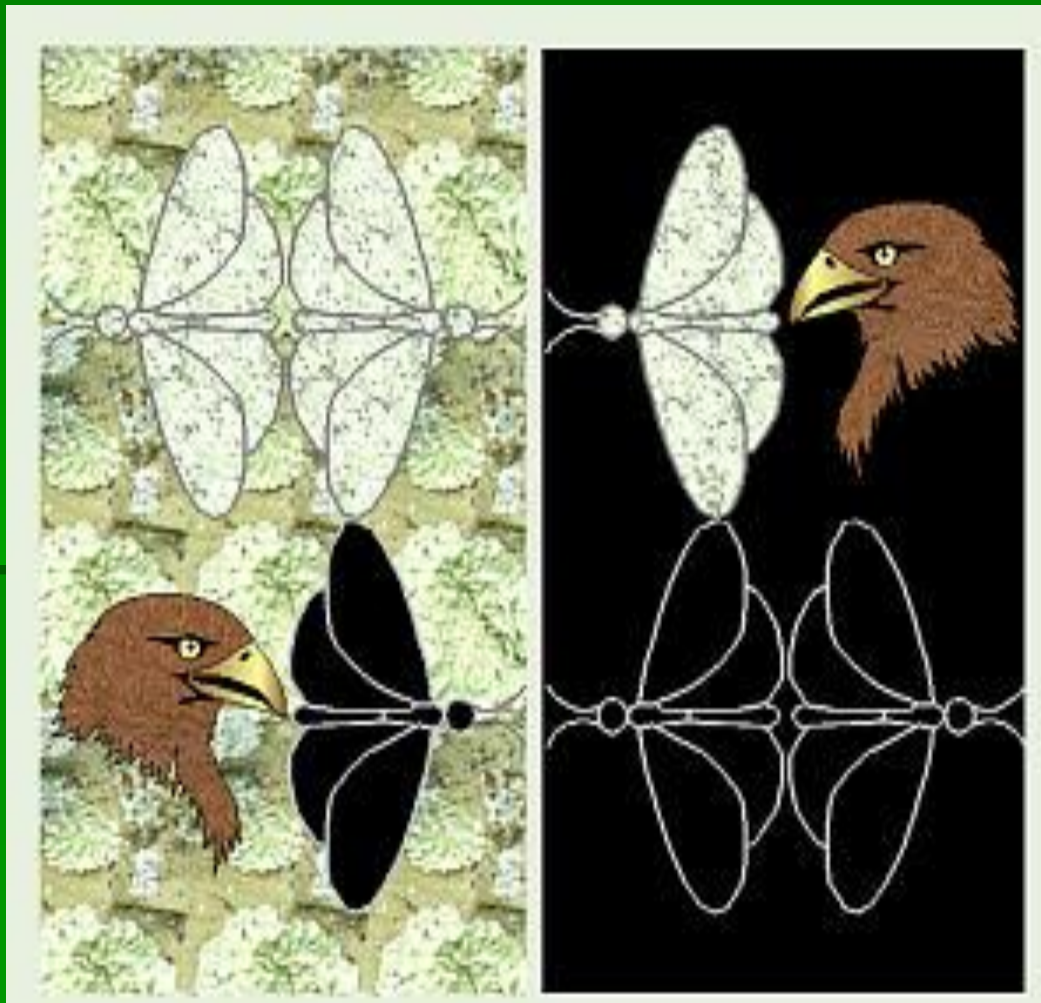


9. Artificial Selection

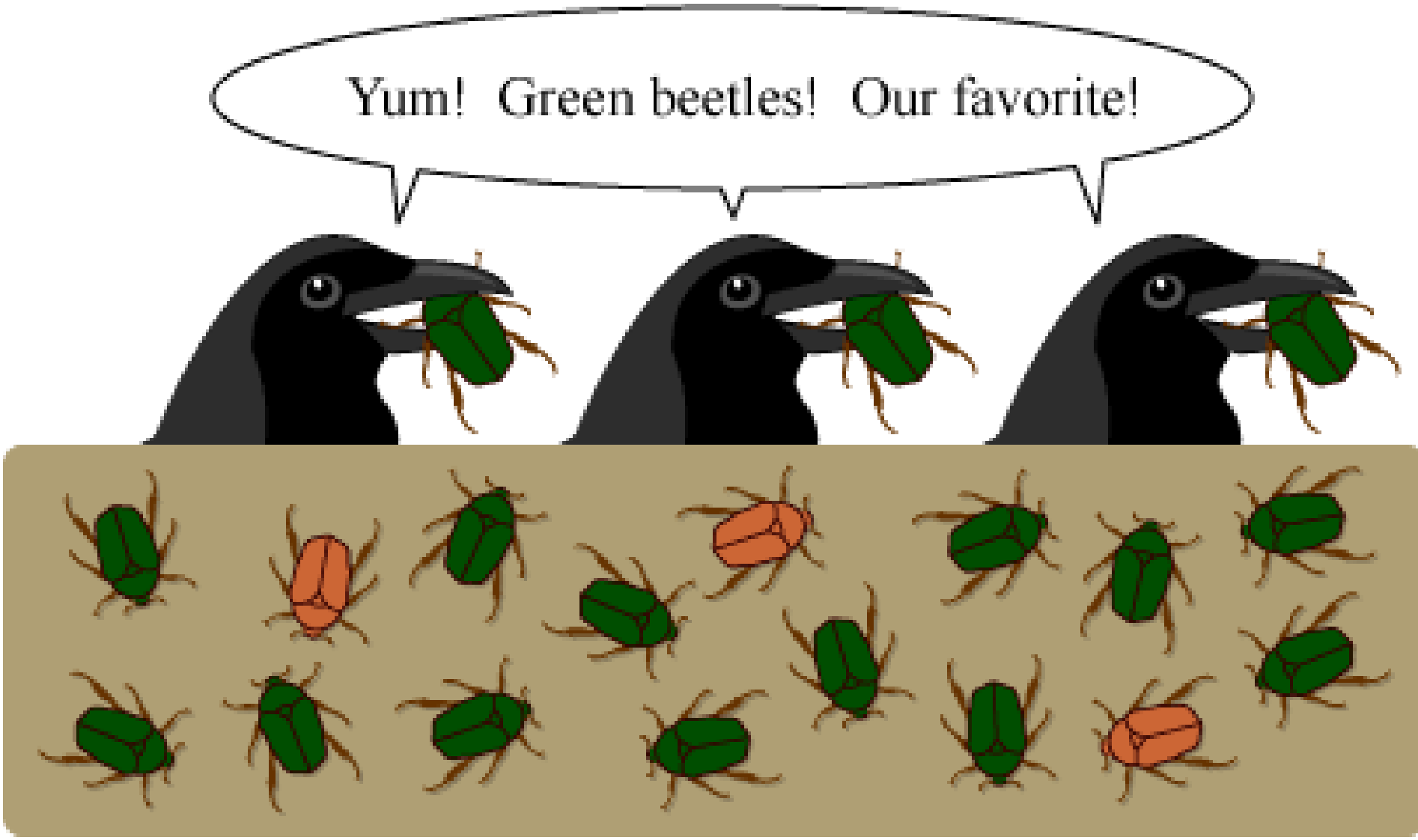
- nature provides variation, humans select variations that are useful.
- Example - a farmer breeds only his best livestock

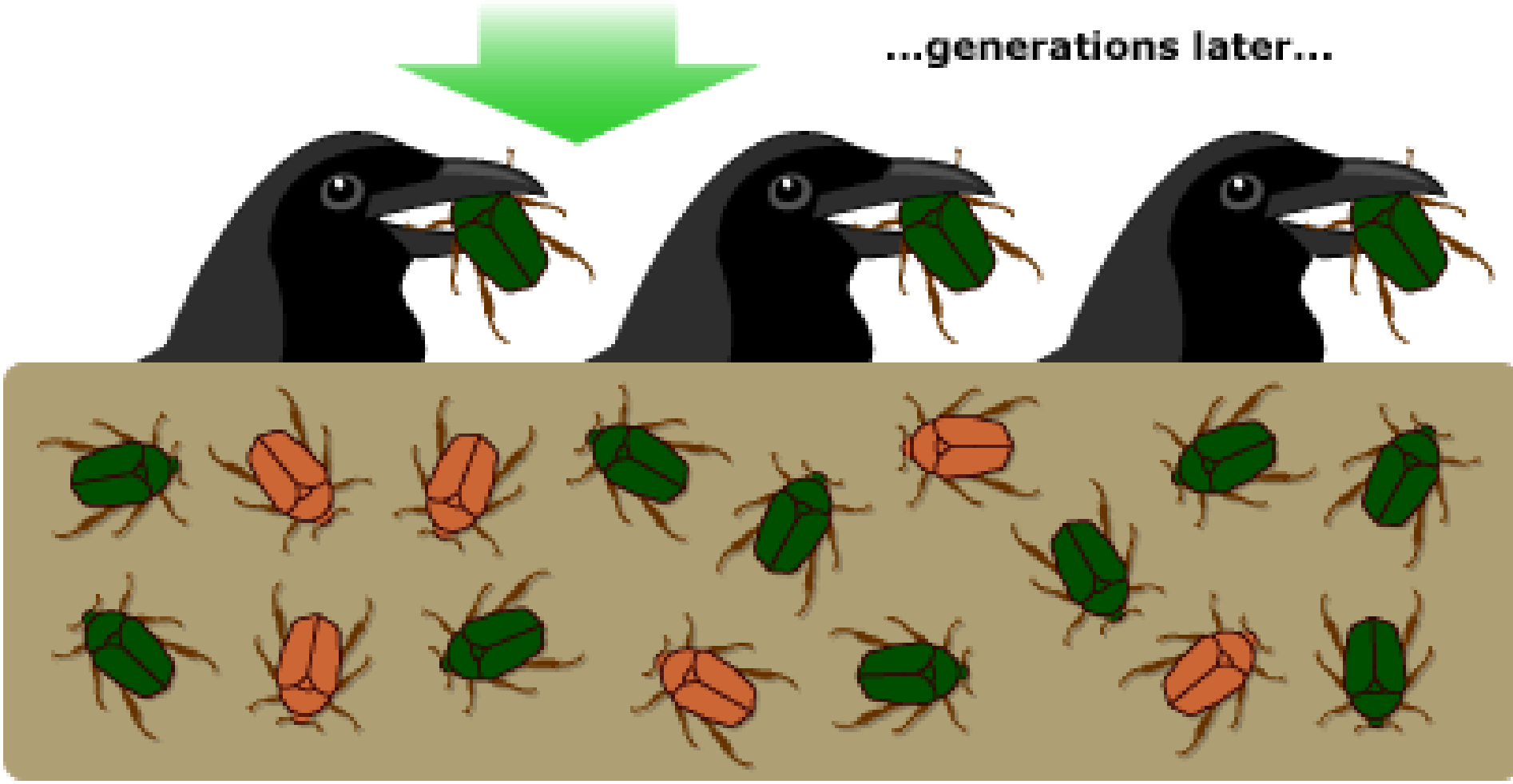
10. Natural Selection

- The traits that help an organism survive in a particular environment are “selected” in natural selection

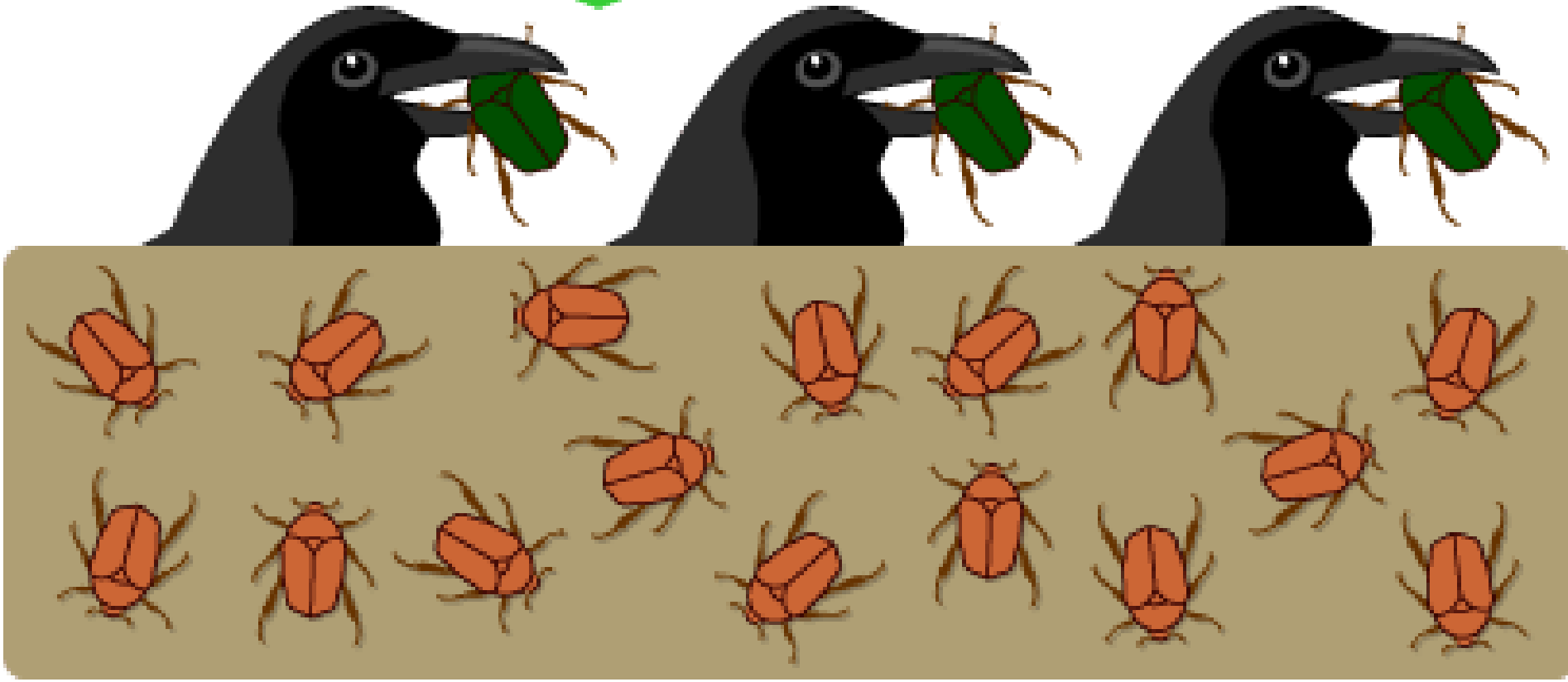


Natural selection, in a nutshell:




...generations later...

...generations later...



Green beetles have been selected against, and brown beetles have flourished.

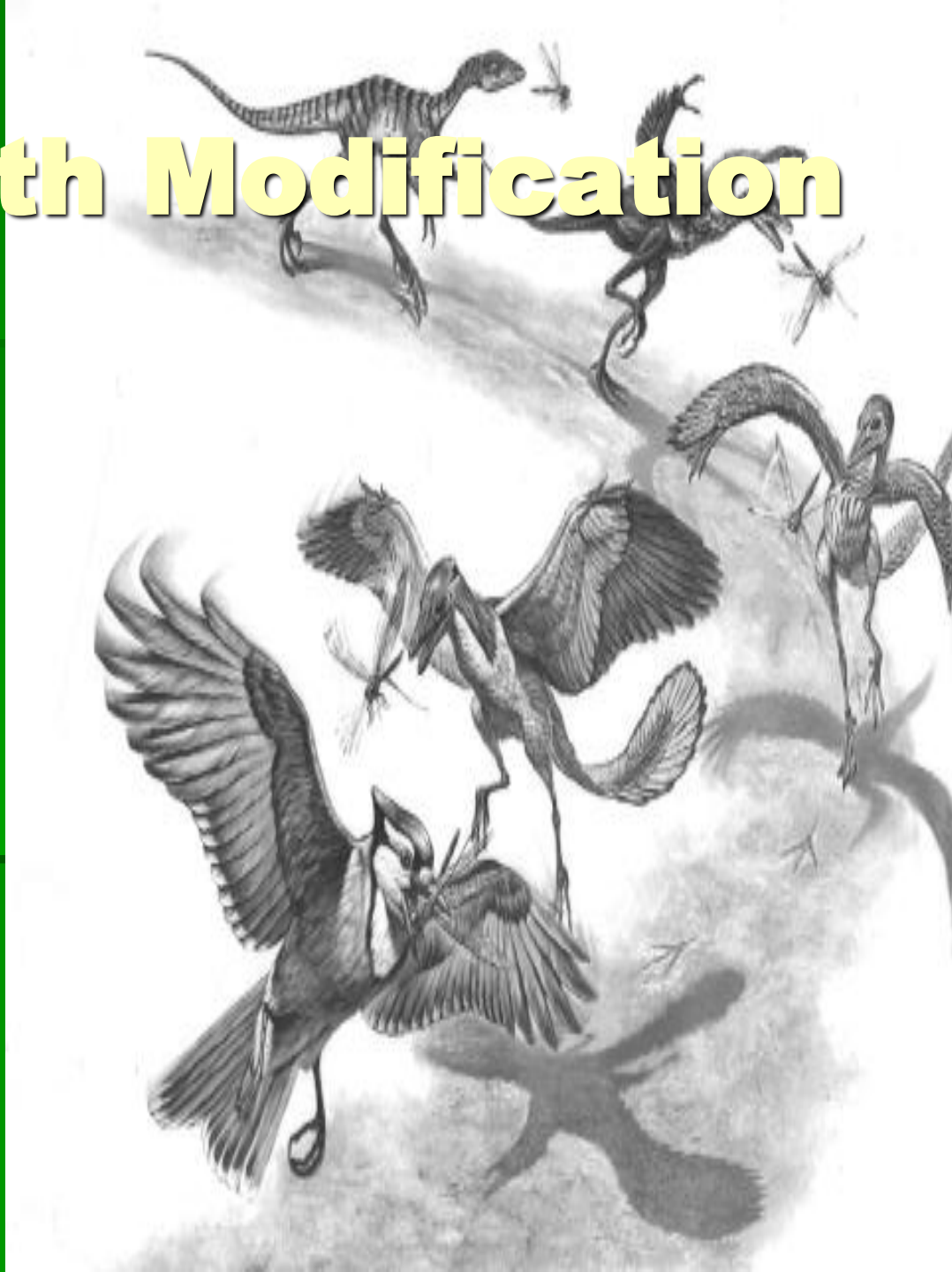
11. Natural Selection and Species Fitness

- Overtime, natural selection results in changes in the inherited characteristics of a population.
- These changes increase a species fitness (survival rate)

Natural selection does not grant organisms what they "need".

Descent with Modification

- Each living species has descended with changes from other species over time



Summary of Darwin's Theory

1. Organisms differ; variation is inherited
2. Organisms produce more offspring than survive
3. Organisms compete for resources
4. Organisms with advantages survive to pass those advantages to their children
5. Species alive today are descended with modifications from common ancestors

13. Evidence of Evolution

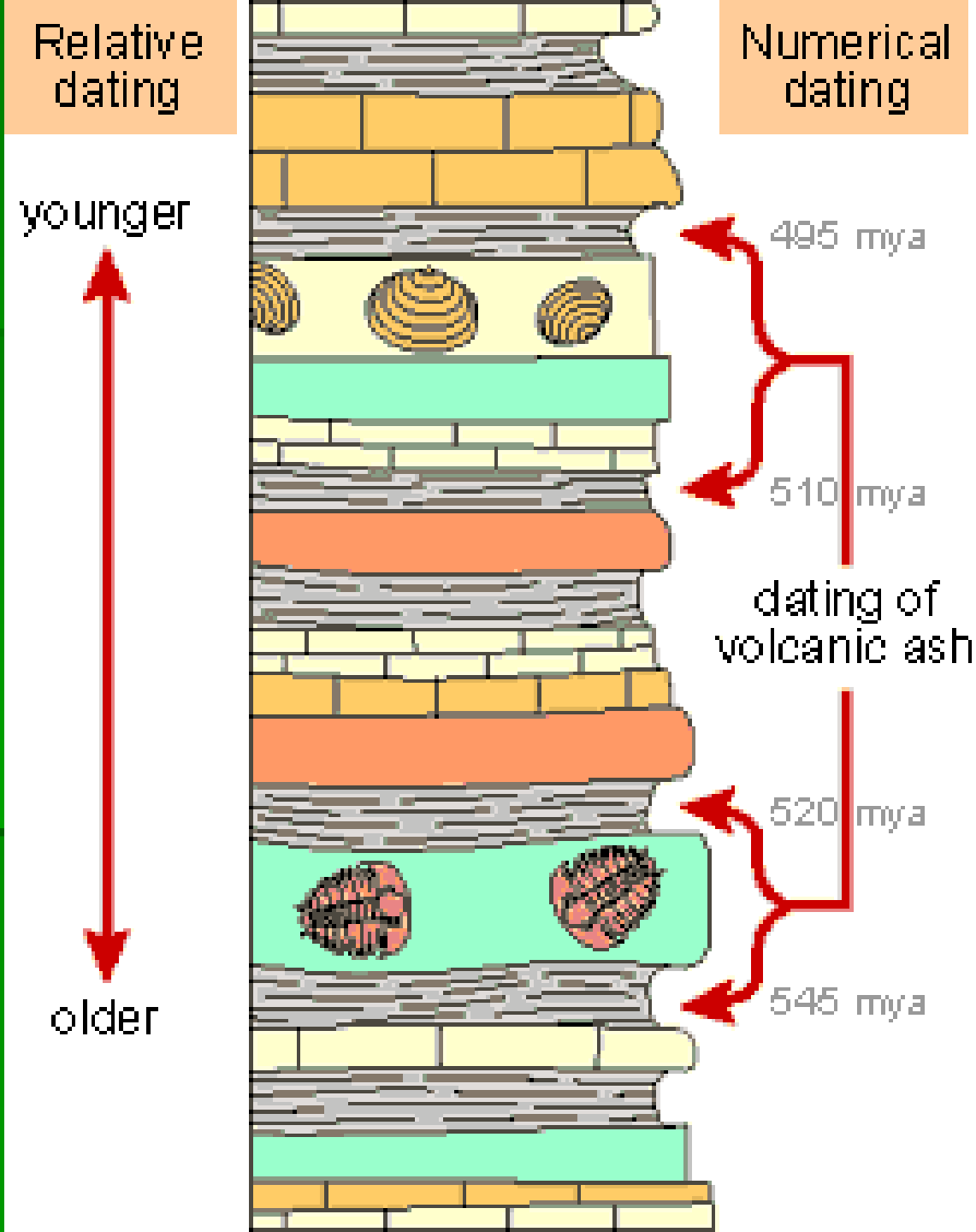
1. Fossil Record
2. Geographic Distribution of Living Species
3. Homologous Body structures
4. Similarities in Embryology

vidence of Evolution

- Fossil Record provides evidence that living things have evolved

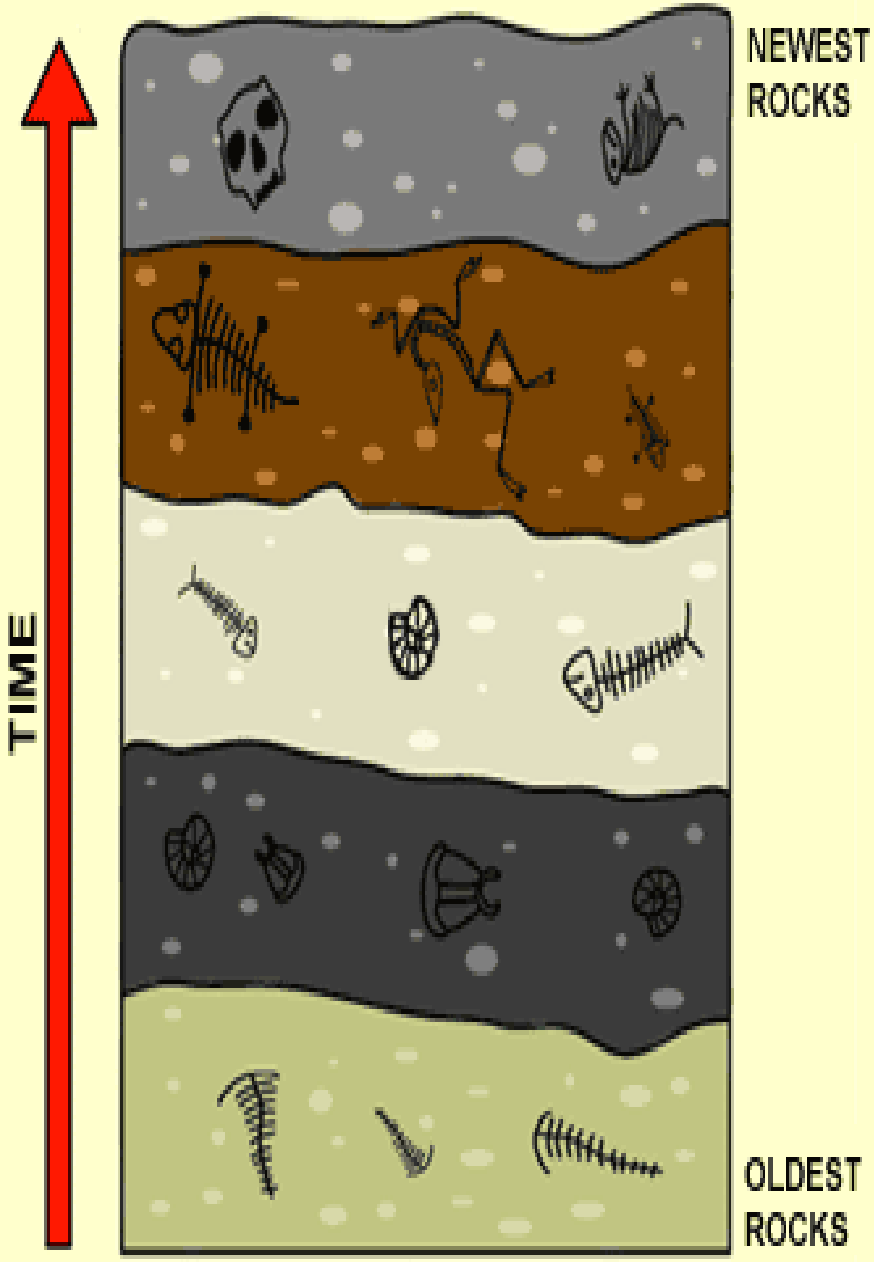
- Fossils show the history of life on earth and how different groups of organisms have changed over time

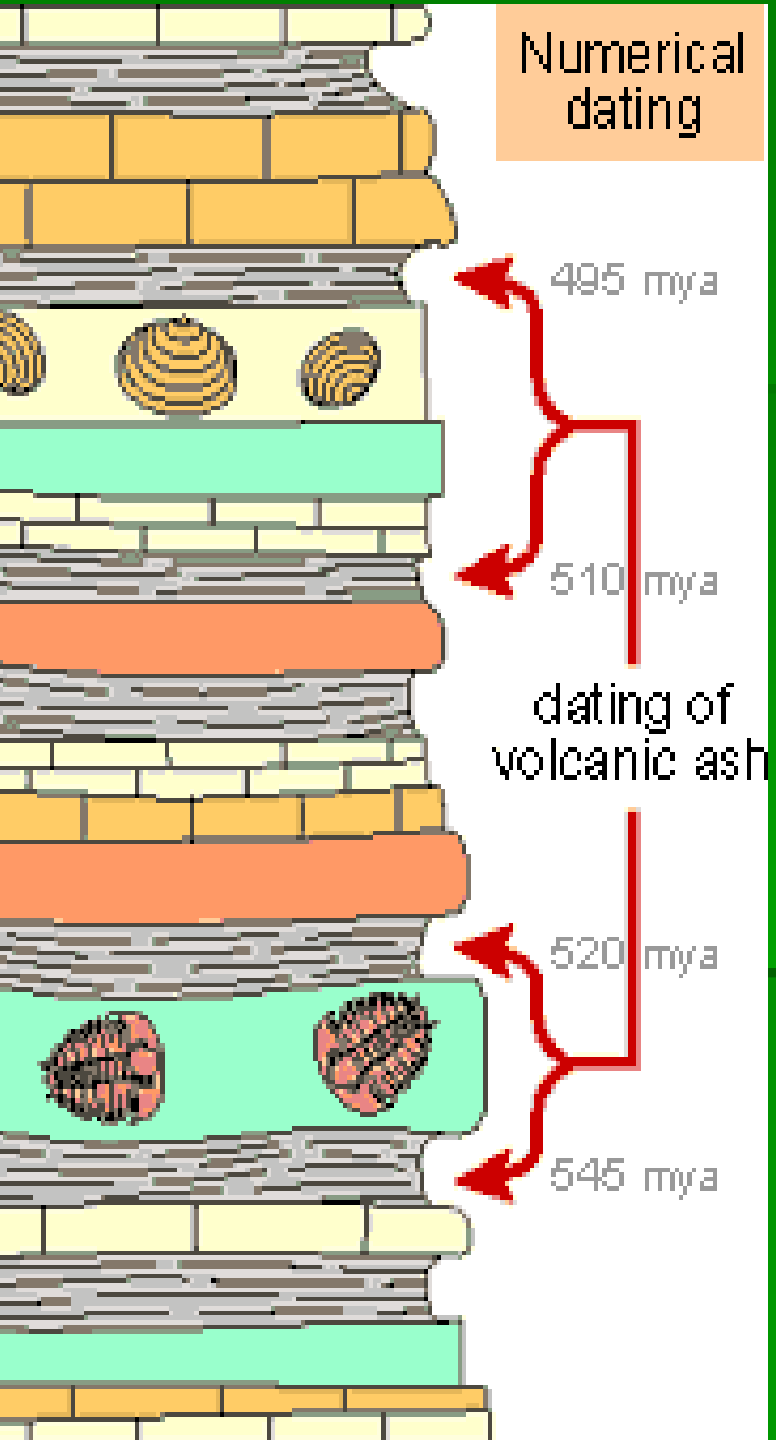
Relative vs. Absolute Dating



Relative Dating

- Can determine a fossil's relative age
- Performed by estimating fossil age compared with that of other fossils
- Drawbacks – provides no info about age in years

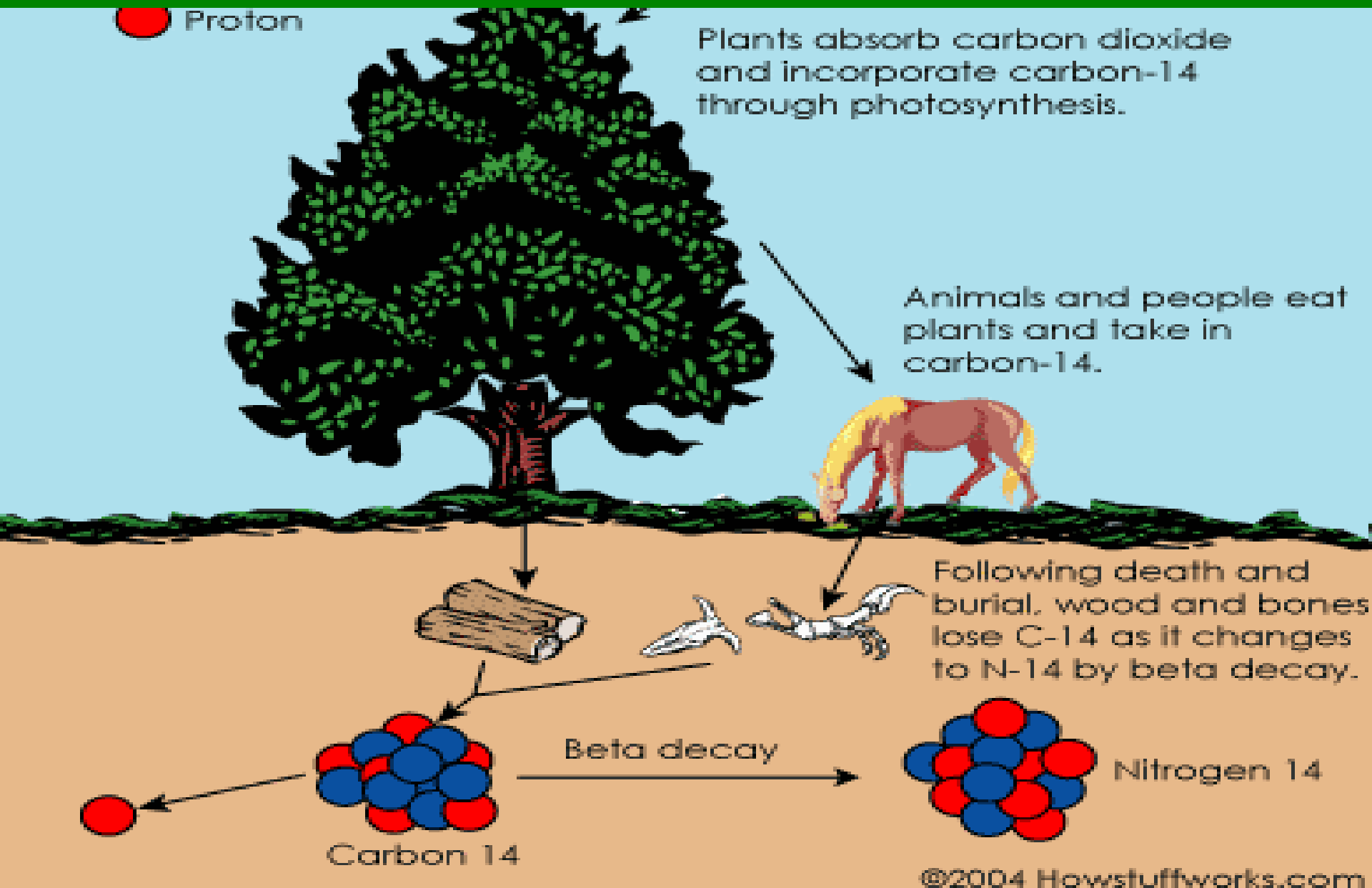




Absolute dating

- Can determine the absolute age in numbers
- Is performed by radioactive dating – based on the amount of remaining radioactive isotopes remain
- Drawbacks - part of the fossil is destroyed during the test

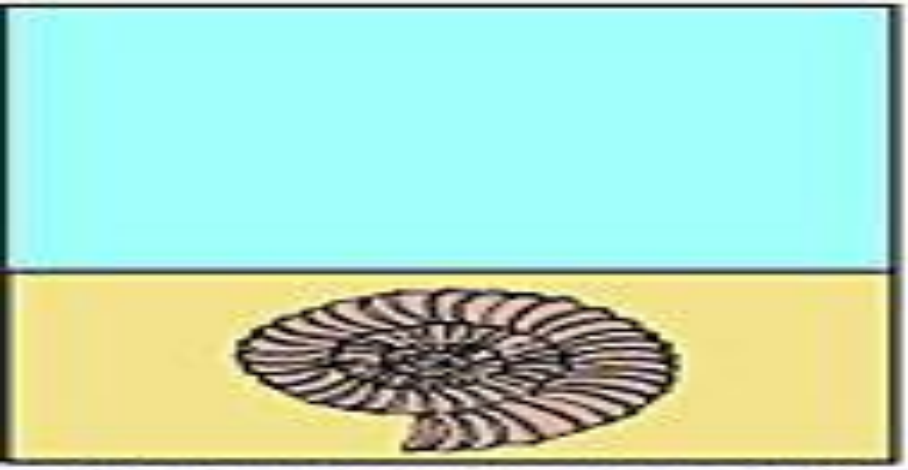
Carbon-14 Dating



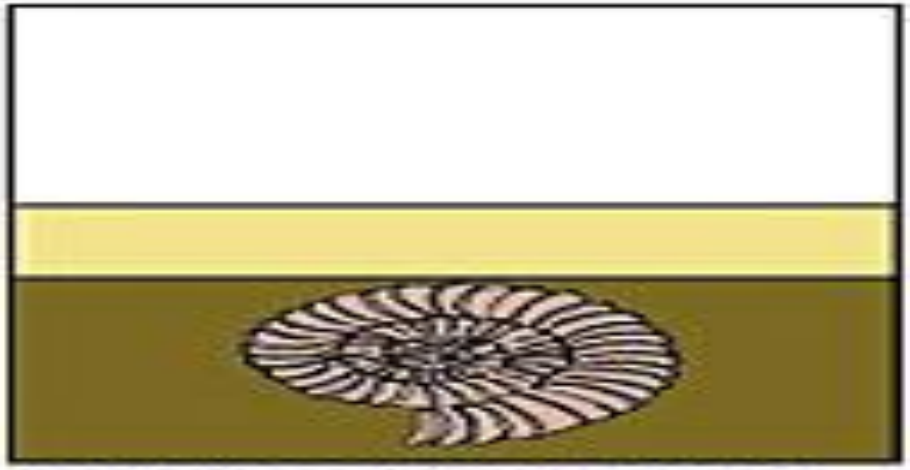
Fossil Formation SG

ammonite

ammonite dies and sinks to sea floor where it becomes buried



soft body decays leaving shell

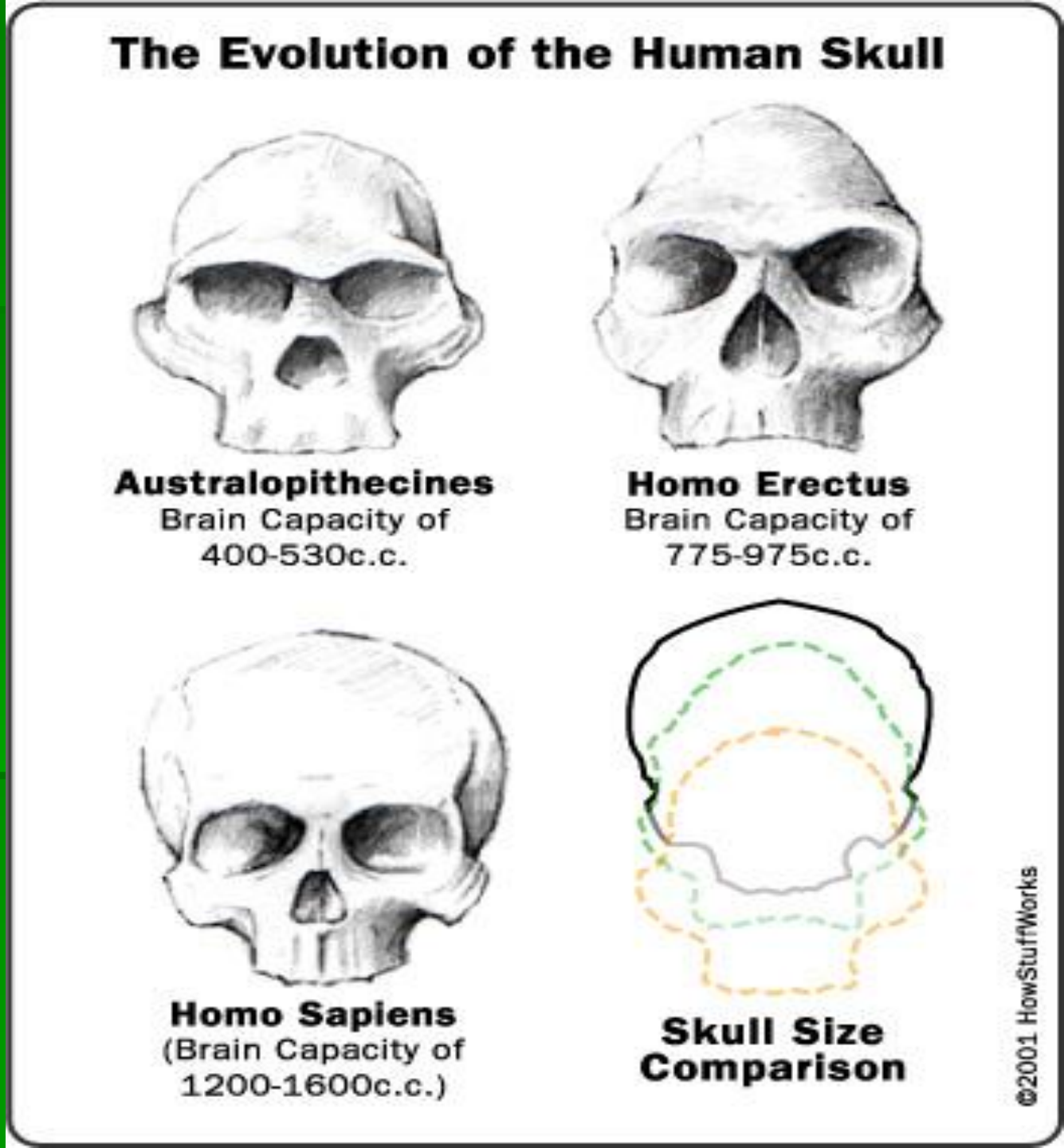


over millions of years shell is preserved as a fossil under layers of rock strata

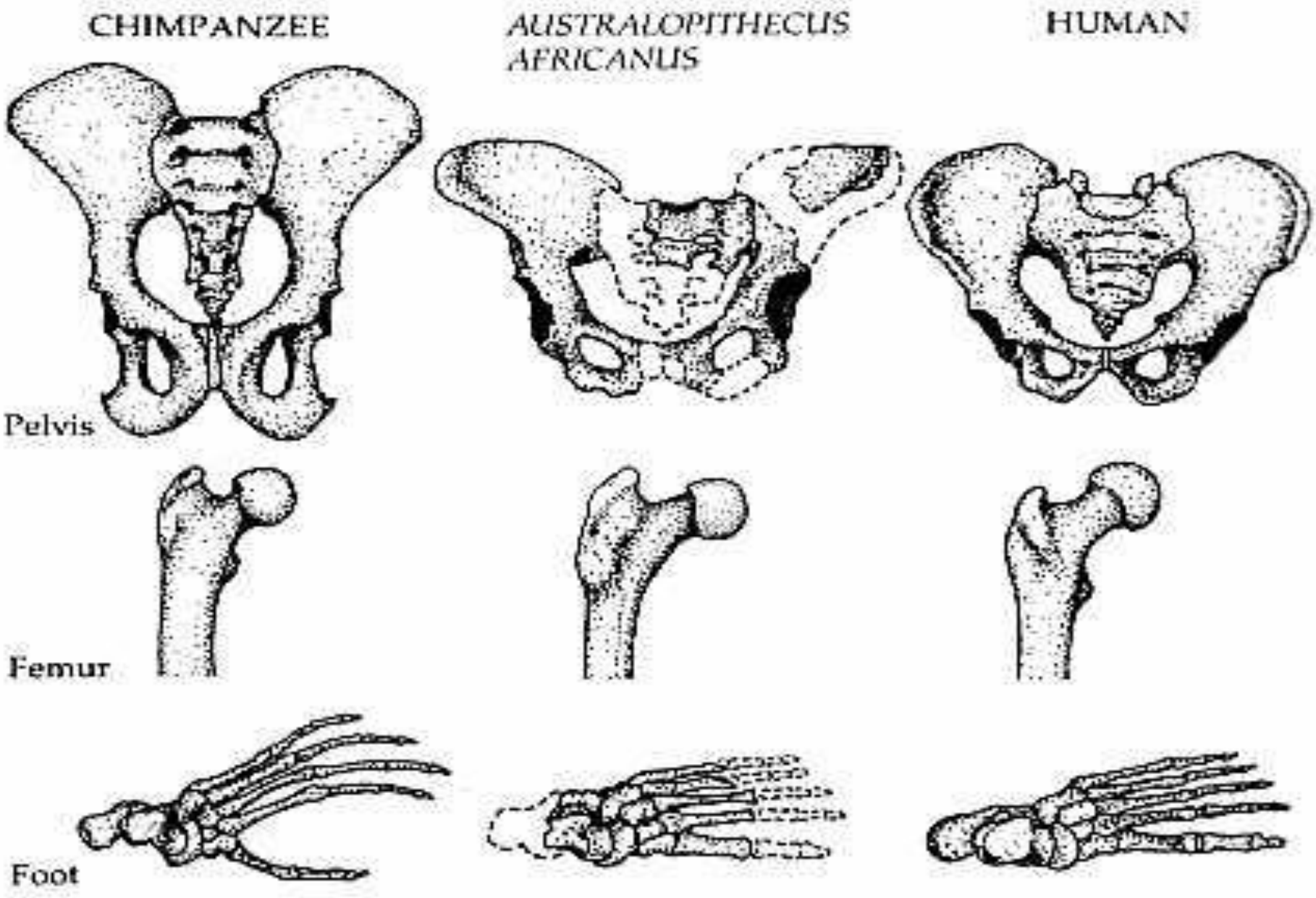
Primate Fossils

Australopithecus *Homo erectus* *Homo sapien*

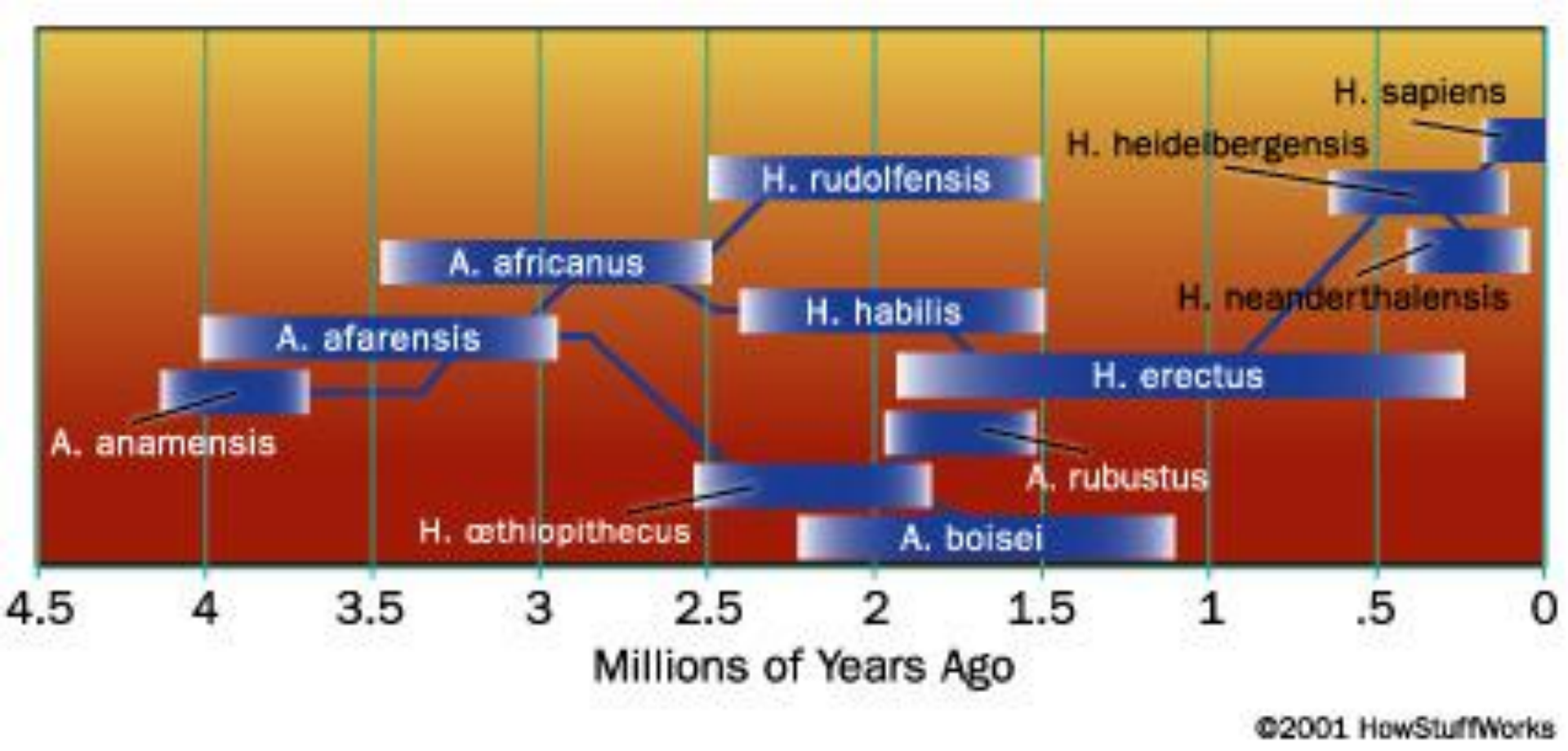
Primate Brain Capacity



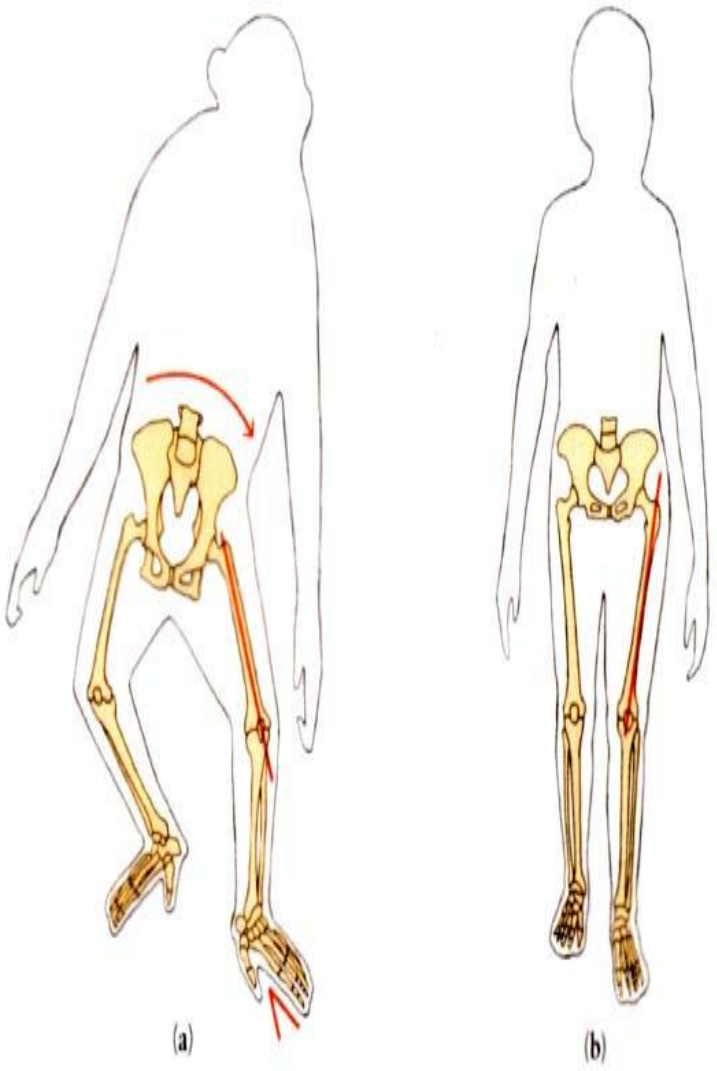
Primate Bone structure



Human Relatives



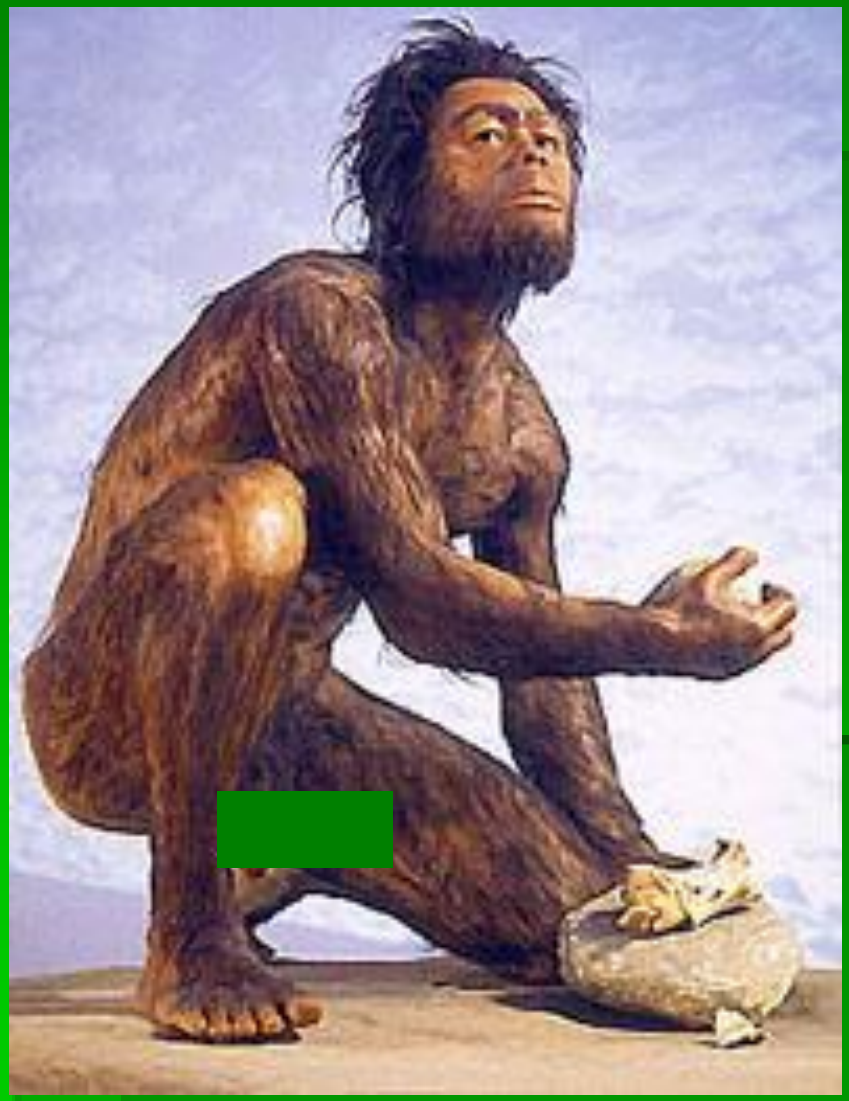
Australopithecus afarensis



chimpanzee

a. afarensis

***Homo habilis* = handy human**
1.5 to 2 mya

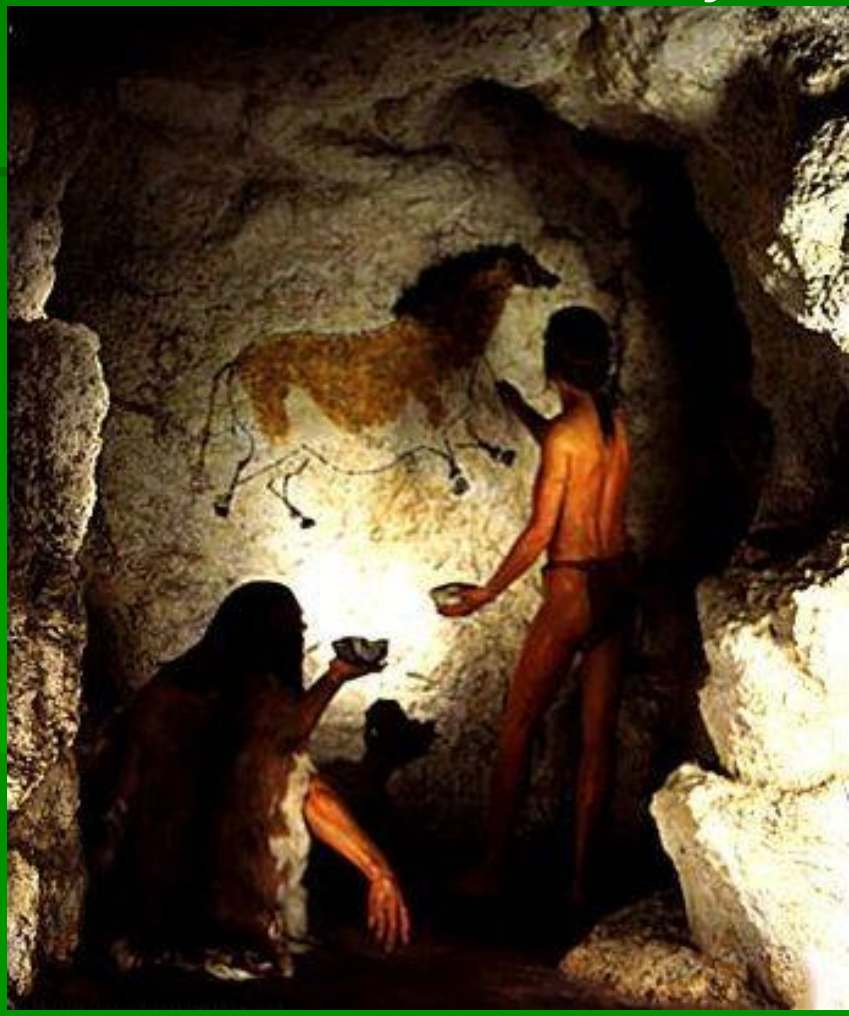


Homo erectus
1.6 mya

bipedal

Neanderthals
35,000 to 100,000 ya

Cro-Magnon
35,000 to 40,000 ya



Modern *Homo sapien*
(fully modern fossils 100,000 ya)

13. Evidence of Evolution

2. Geographic Distribution of Living Species

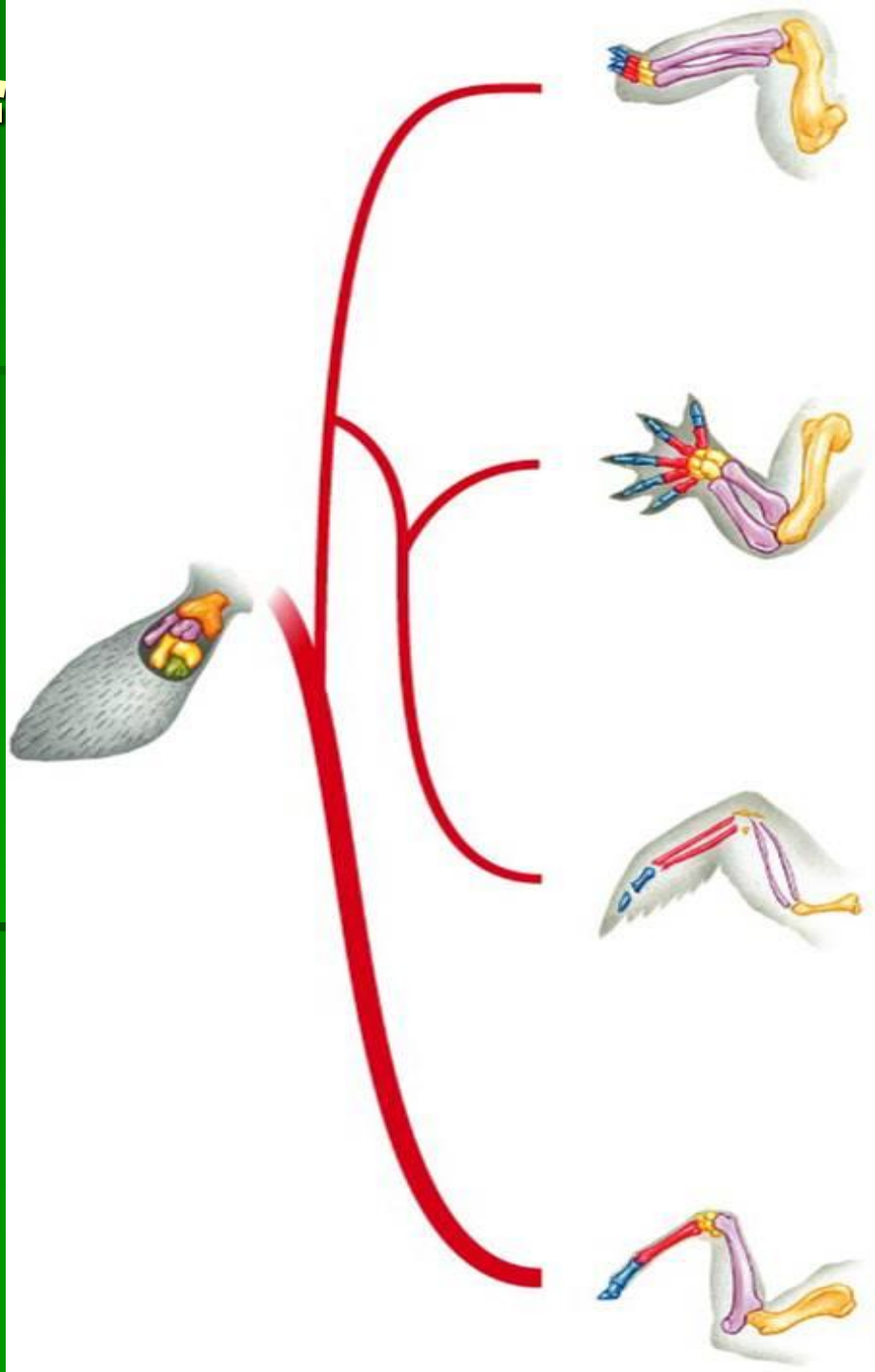
Similar animals in different locations were the product of different lines of descent

13. Evidence of Evolution

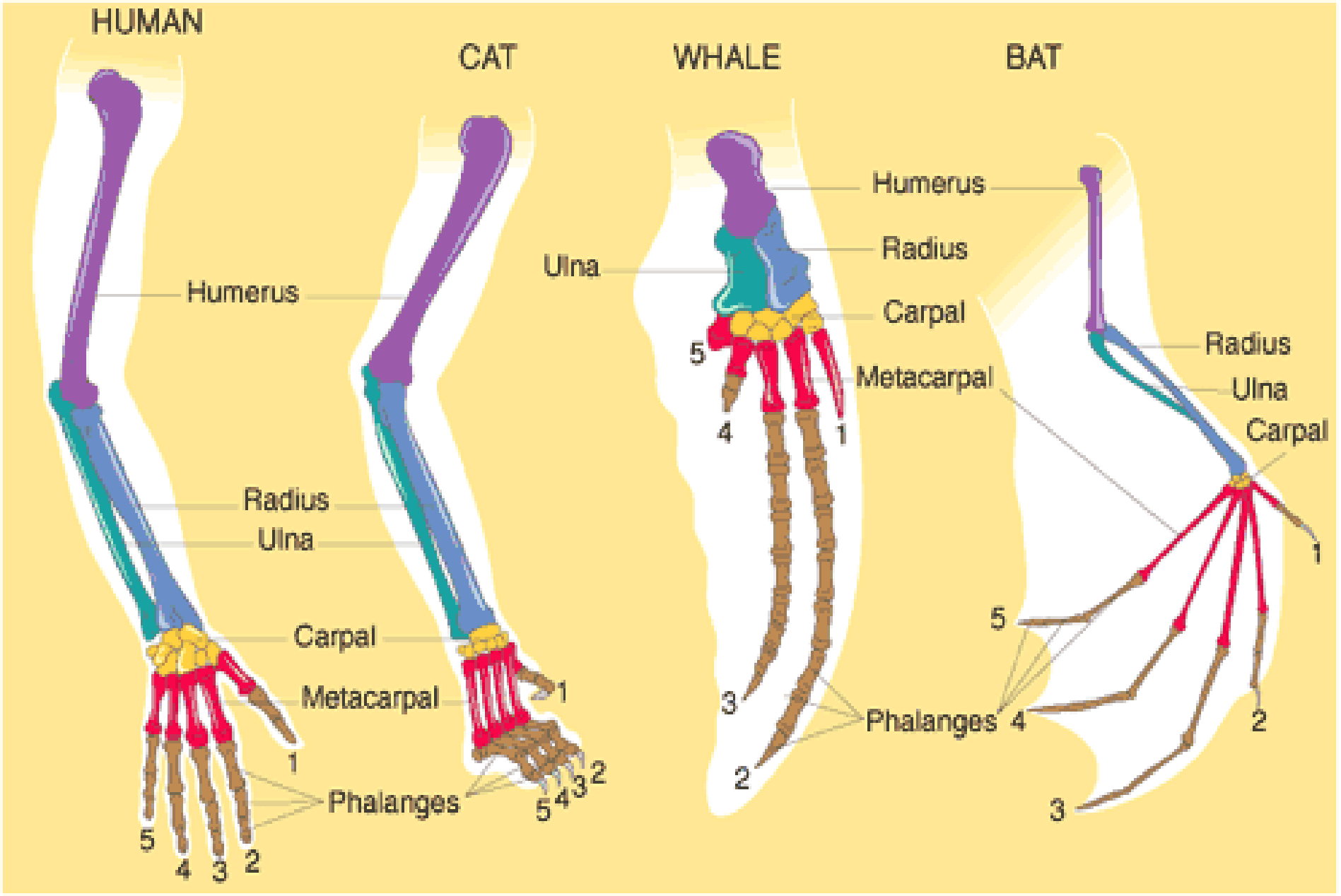
Homologous Body Structures

- Structures that have different mature forms but develop from the same embryonic tissues

e.g. Wing of bat, human arm, leg of turtle



Homologous Body Structures



Vestigial Organs

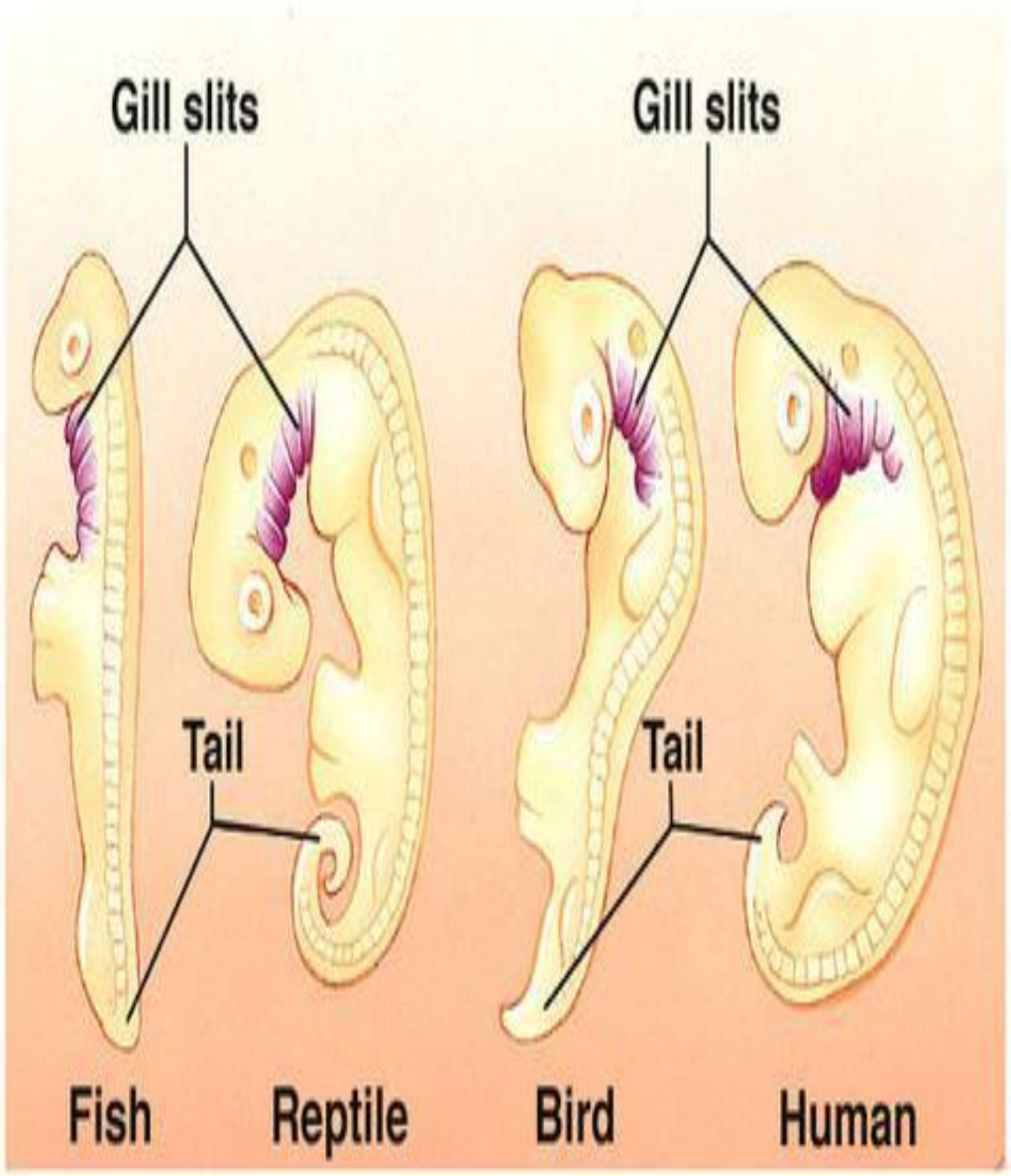
- traces of homologous organs in other species
- Organ that serves no useful function

  e.g. Appendix

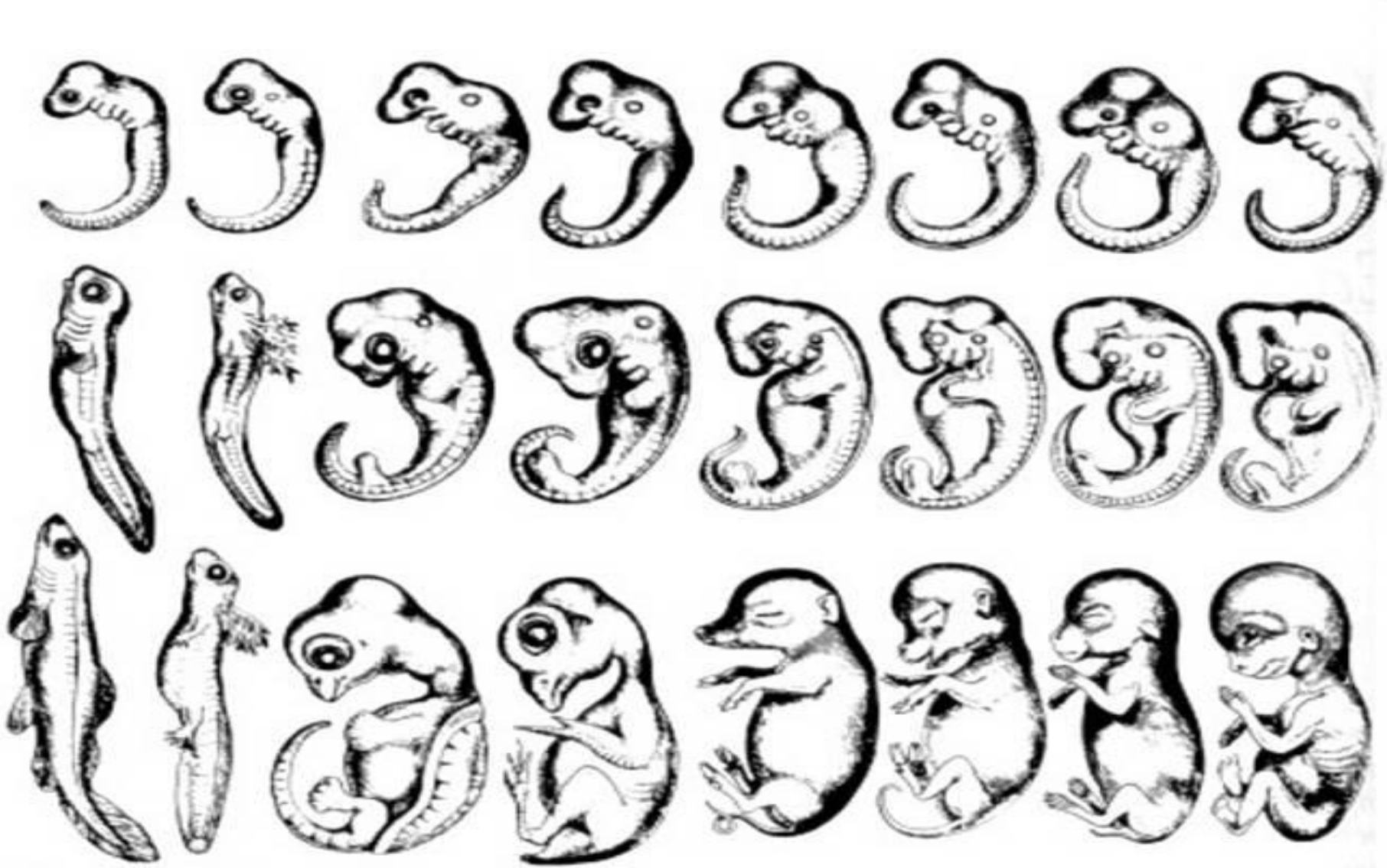
3. Evidence of Evolution

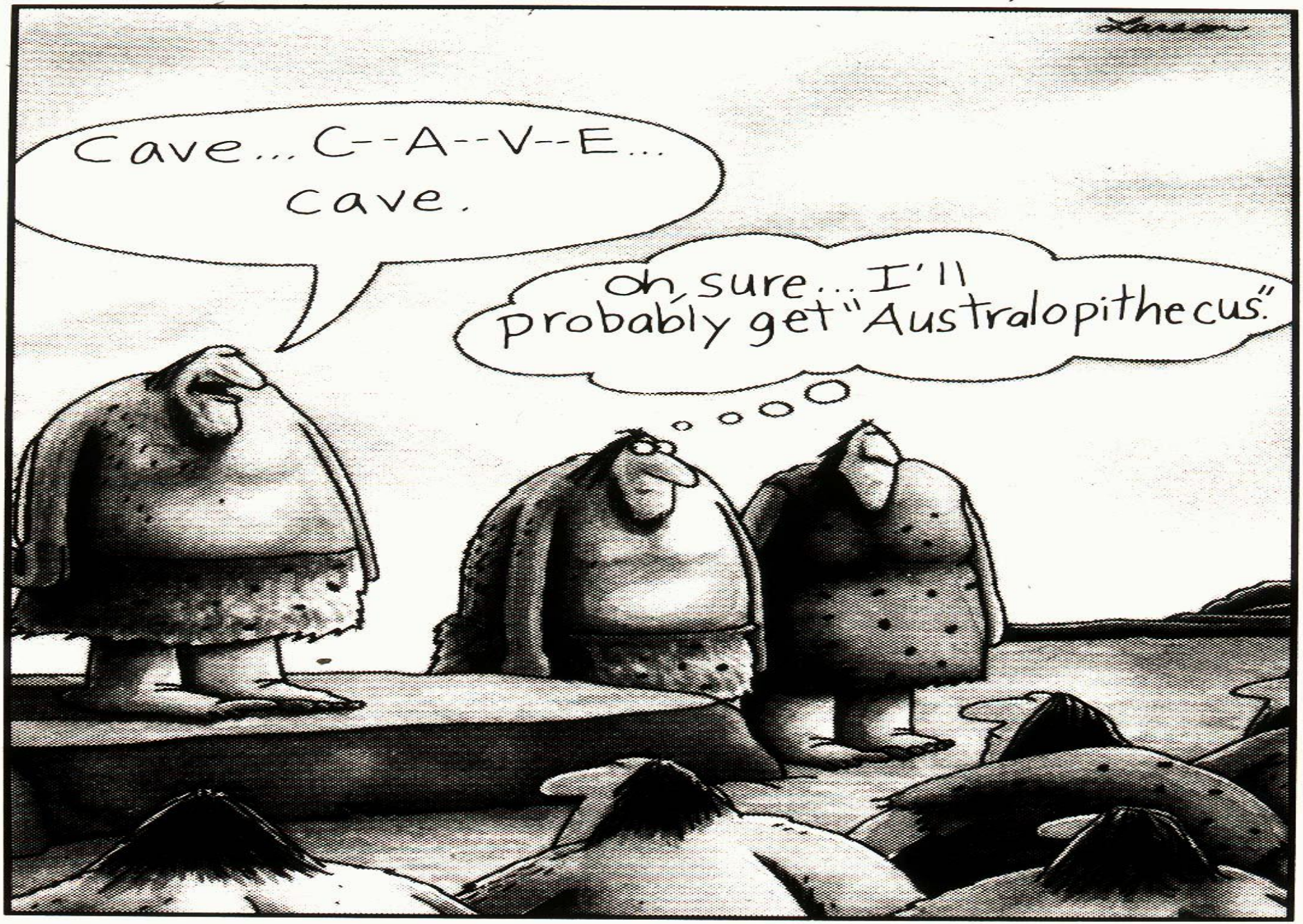
- Similarities in Embryology
  - In their early stages of development, chickens, turtles and rats look similar, providing evidence that they shared a common ancestry.

Embryos and Evolutionary History

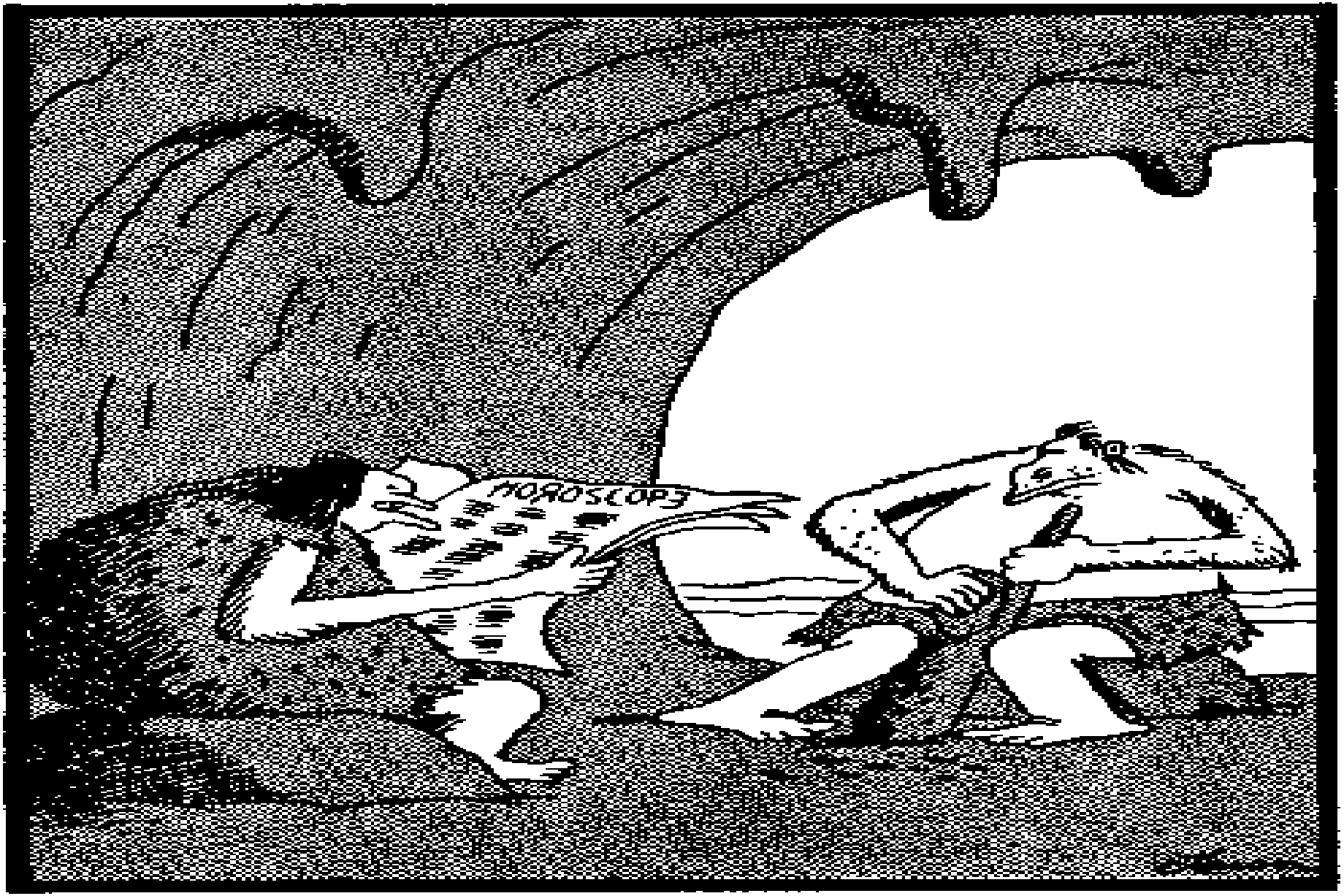


Embryological development





Primitive spelling bees



"'You have a small capacity for reason, some basic tool-making skills, and the use of a few simple words.' ... Yep. That's you."