

The background is a light green color with several decorative elements. There are three thick, curved green lines that sweep across the frame. Two starburst shapes, each with eight points, are also present: one in the upper right and one in the lower left.

Theory

Pattern and Process

Definition of Science:

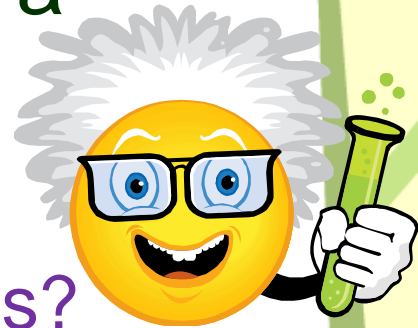
- * Science is based on evidence and always changing.
- * Scientists test explanations and predictions of natural phenomena.
- * Some questions are outside the realm of science because they deal with phenomena that are NOT scientifically testable.
 - Can you think of anything science can't answer? (Outside the realm of science?)



Scientific Hypothesis

- * Hypotheses are tentative and testable statements that are supported or not supported by observational evidence.
- * Hypotheses that have been many times through experimentation and with a wide variety of conditions and are incorporated into theories.

– Can you name any scientific theories?



Scientific Theories

- * A theory is what one or more hypotheses become once they have been verified and accepted to be true after multiple independent experiments.
- * They are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.



Scientific Laws

- * A scientific law describes how a single action occurs.
- * A scientific law is very similar to a theory except that a theory explains an entire group of related phenomena.
- * A theory is much more complex and dynamic.



CHECKPOINT



HYPOTHESIS

THEORY

SCIENTIFIC LAW

PREDICTION

**GRAND
SYNTHESIS OF
INFORMATION**

GRAVITY

CHECKPOINT

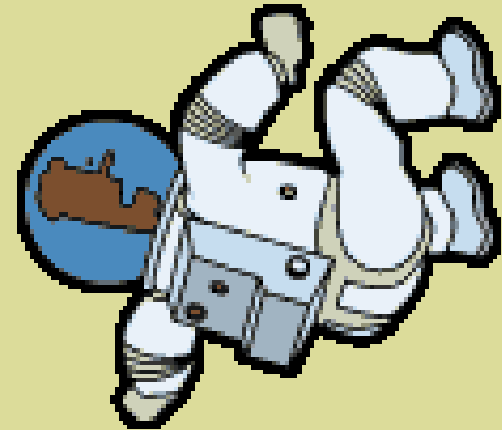


✳ Which of these contains the most scientific knowledge?

–HYPOTHESIS

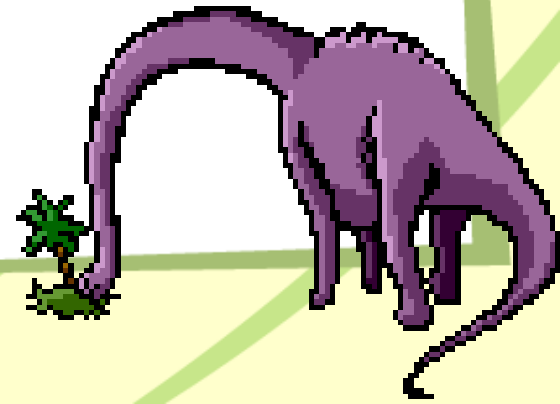
–THEORY

–LAW

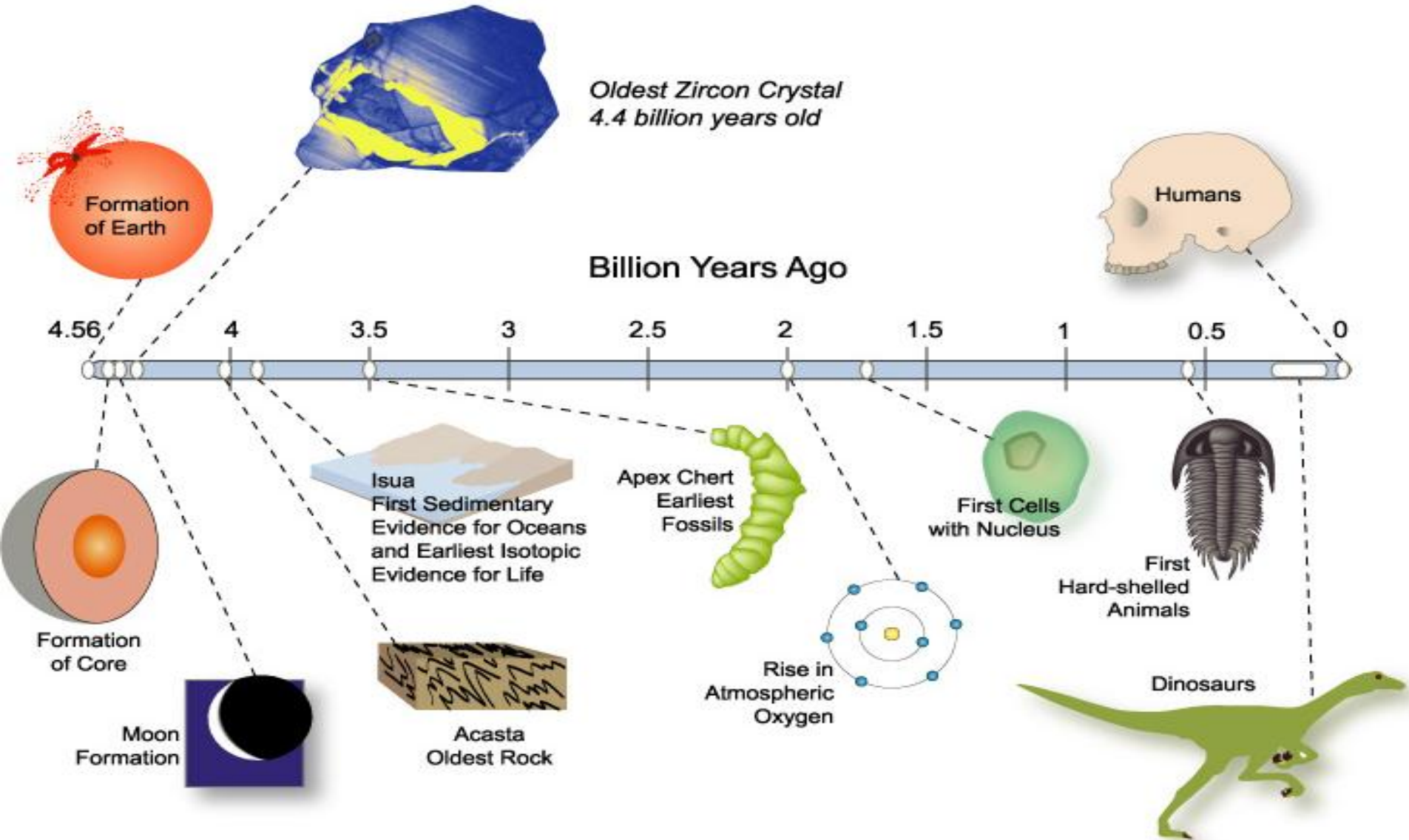


Theoretical Patterns on Earth

- * Often patterns of theories are called evidence.
- * The next few slides show patterns or evidence for the Theory of Evolution.
- * Evolution is generally defined as change over time.
- * See if these observations fit.



DOES THIS EVIDENCE SHOW CHANGE OVER TIME?



DOES THIS EVIDENCE SHOW CHANGE OVER TIME?

Evolution of Life

Early Earth was hot; atmosphere contained poisonous gases.



Earth cooled and oceans condensed.



Simple organic molecules may have formed in the oceans..



Small sequences of RNA may have formed and replicated.



First prokaryotes may have formed when RNA or DNA was enclosed in microspheres.



Later prokaryotes were photosynthetic and produced oxygen.



An oxygenated atmosphere capped by the ozone layer protected Earth.



First eukaryotes may have been communities of prokaryotes.



Multicellular eukaryotes evolved.



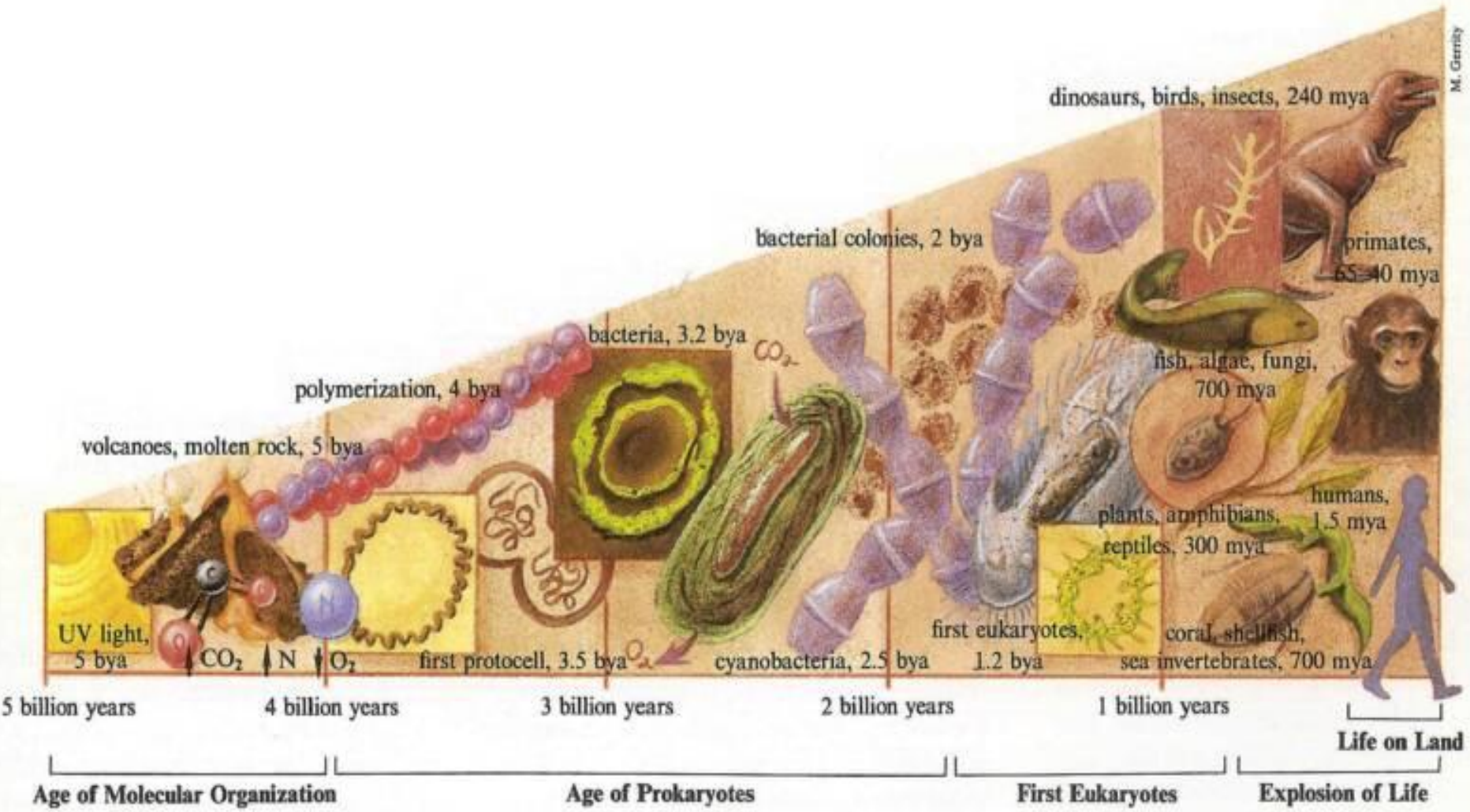
Sexual reproduction increased genetic variability, hastening evolution.

Evidence of Change Over Time?



CHANGE OVER TIME?

M. Garrity



Key
 millions of years ago = mya
 billions of years ago = bya

Evolution

- * The Theory of Evolution shows that today's species descended from more ancient forms of life.
- * There are many different evidences of this change:
 - Fossils
 - DNA analysis
 - Similar body parts
 - Developmental Similarities
 - Location similarities



Evidence from Fossils

* Fossil: the remains or traces of a once-living organism

Water carries small rock particles to lakes and seas.

1



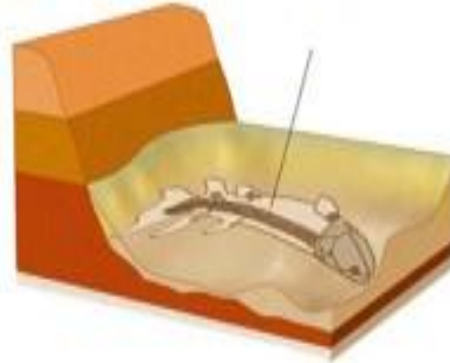
Dead organisms are buried by layers of sediment, which forms new rock.

2

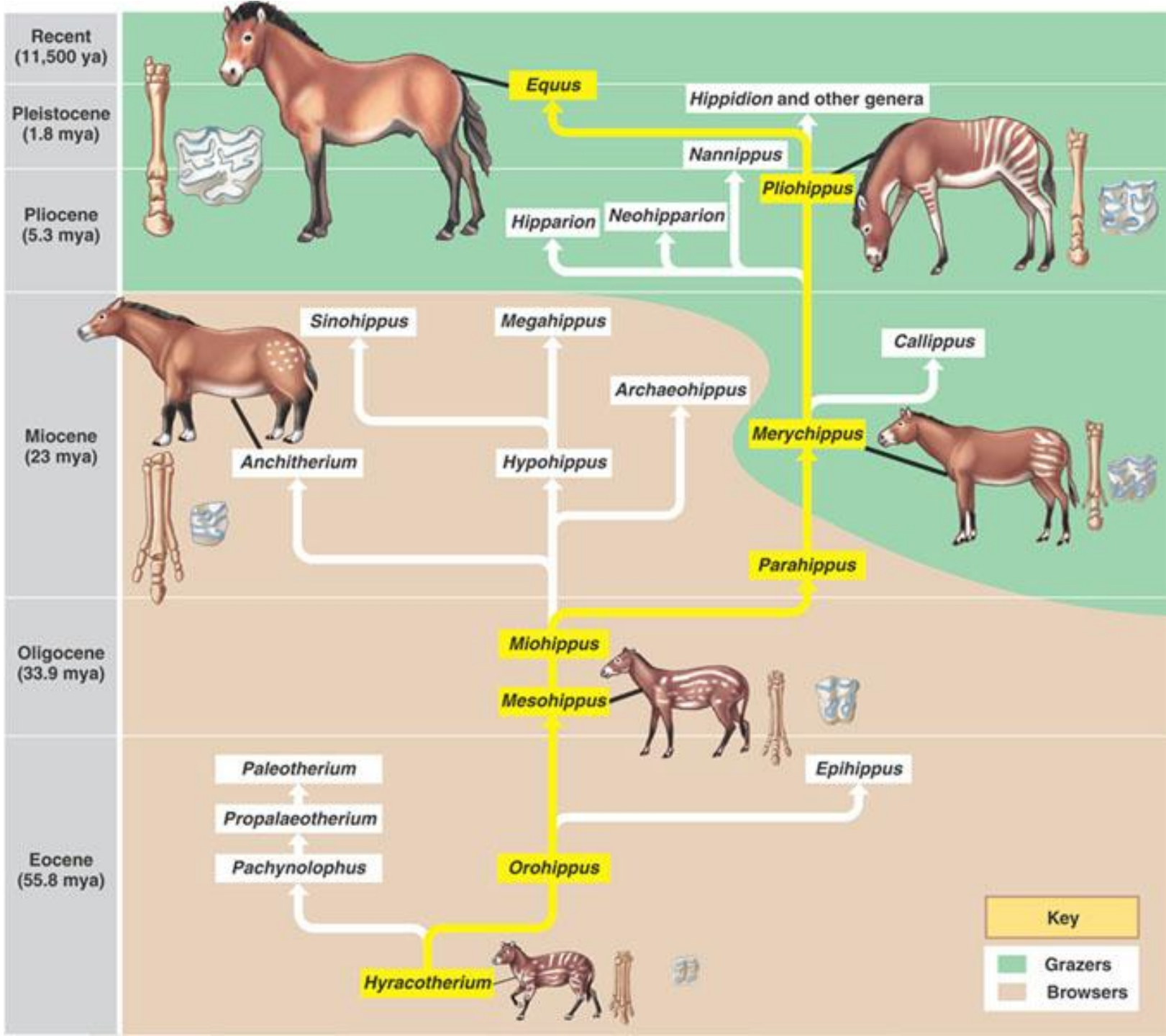


The preserved remains may later be discovered and studied.

3



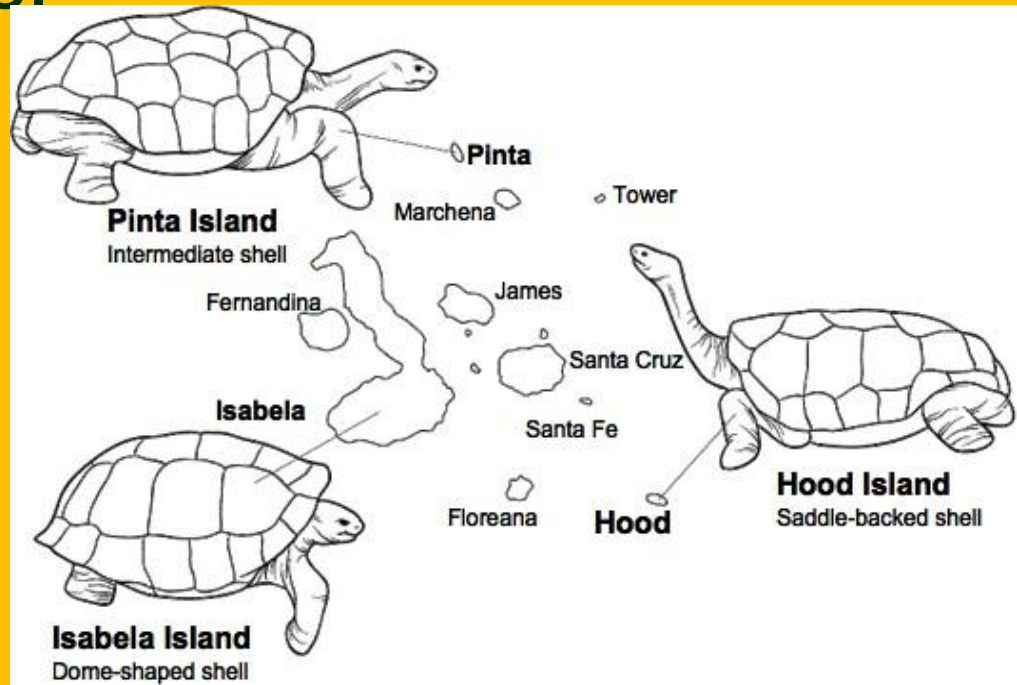
Evolution of Horses



Locational Similarities

* Biogeographical – organisms living in similar places.

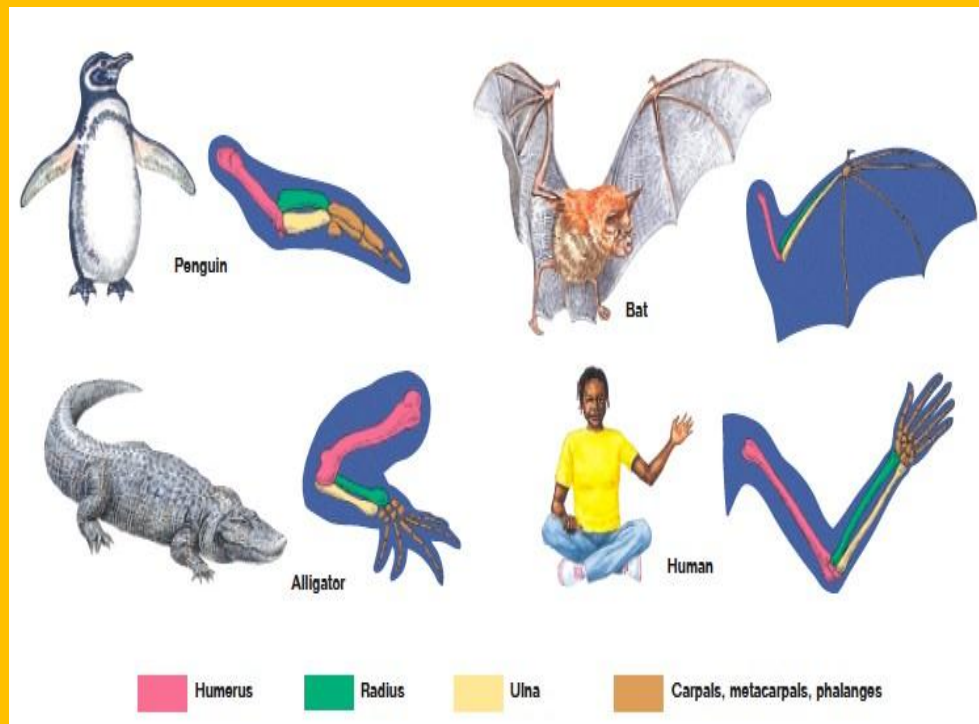
Where are all these tortoises living?



Homologous Structures

✳ What bones do all these animals have in common?

Common bones might mean common

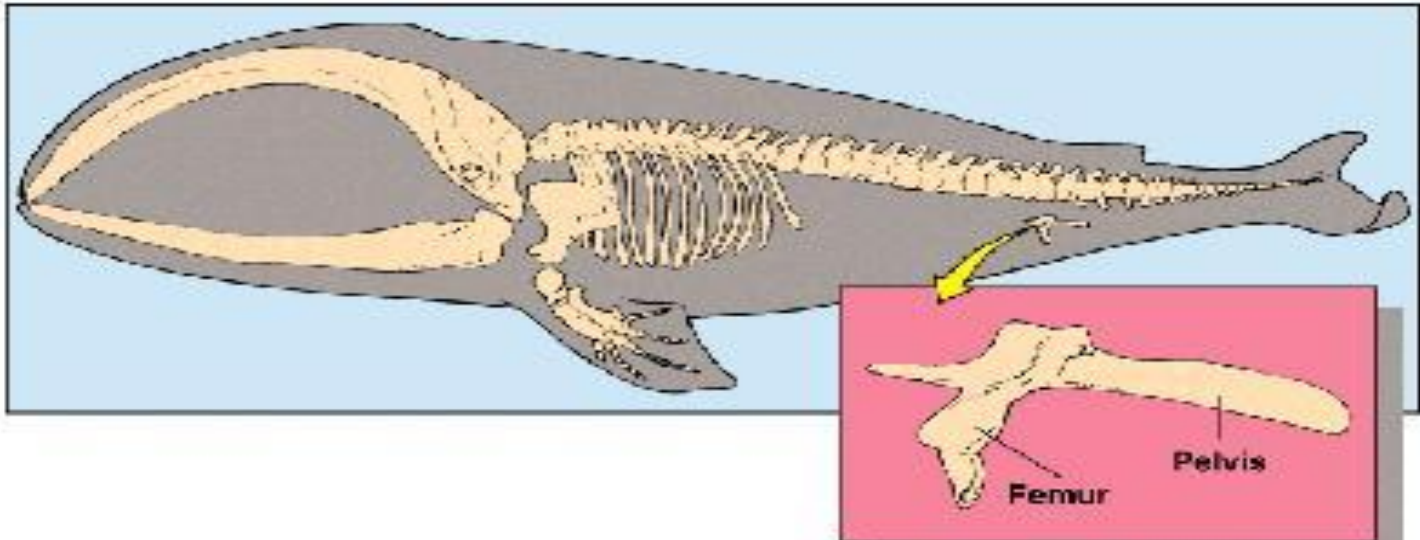


Vestigial Organs

✳ These organisms have hip bones... do they have legs?



Image partially based on National Geographic Magazine, February 1991 "Fossil Whale Feet. Not Made for Walking"

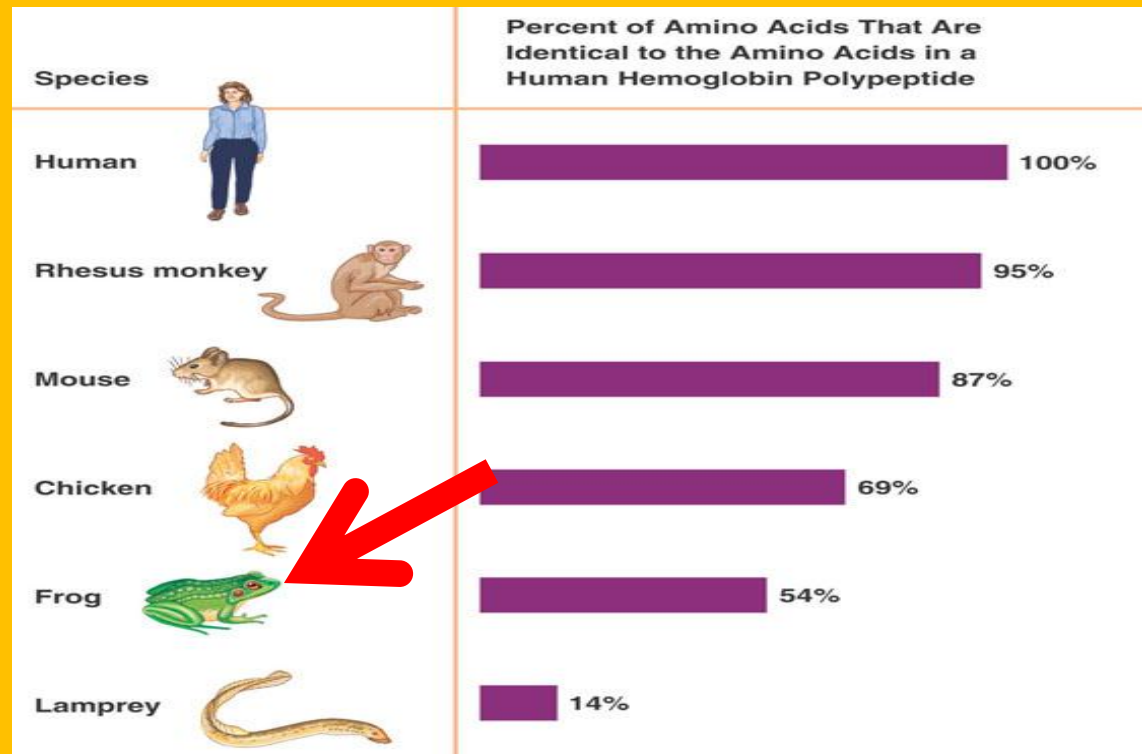


Biochemistry

✳ Based on this Amino acid analysis, what organism is most related to the chicken?

$$87 - 69 = 18$$

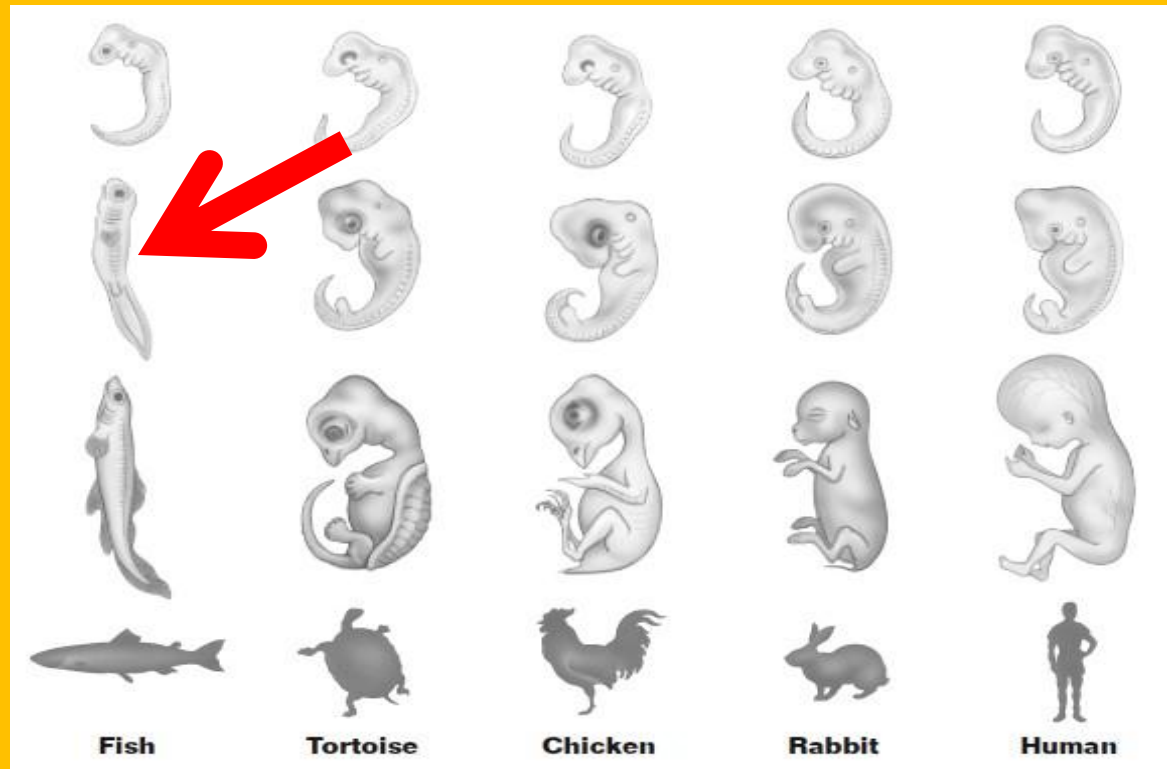
$$69 - 54 = 15$$



Developmental Similarities

- ✦ These embryos show how organisms look during development.

Which one is least like the others



CHECKPOINT

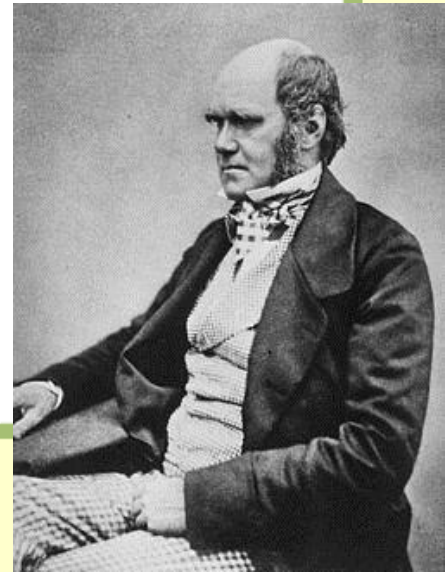


* Which of these is a type of evidence for the Theory of Evolution?

- Fossils ←
- Embryos ←
- Biogeography ←

Theoretical Processes on Earth

- * Theories not only show evidence for support but can show why it happens.
- * Charles Darwin is the scientist credited for the major discoveries that are the basis of why evolution happens.



Processes that cause evolution

- * Mutation – changes in the DNA
- * Recombination – sexual reproduction
- * Natural Selection – traits that are better suited to the environment survive and reproduce
- * Artificial Selection – humans select for desirable traits
- * Gene Flow – migration causes traits of population to change
- * Genetic Drift – random change in traits of a population

How many different processes cause evolution?
More than



Evolution Causes Speciation

- * The accumulation of changes in the traits of populations over time can lead to speciation.
- * Speciation means a new species is created.
- * The processes that cause evolution can lead to speciation.





CHECKPOINT

✳ You pick Evidence or Cause of Evolution?

1. Fossils		
2. DNA		EVIDENCE
3. Natural Selection		
4. Mutations		CAUSE
5. Biogeography		
6. Gene Flow		

Diagram illustrating the classification of evolutionary concepts into Evidence or Cause:

- EVIDENCE:** 1. Fossils, 2. DNA
- CAUSE:** 3. Natural Selection, 4. Mutations, 5. Biogeography, 6. Gene Flow

QUESTIONS

?

