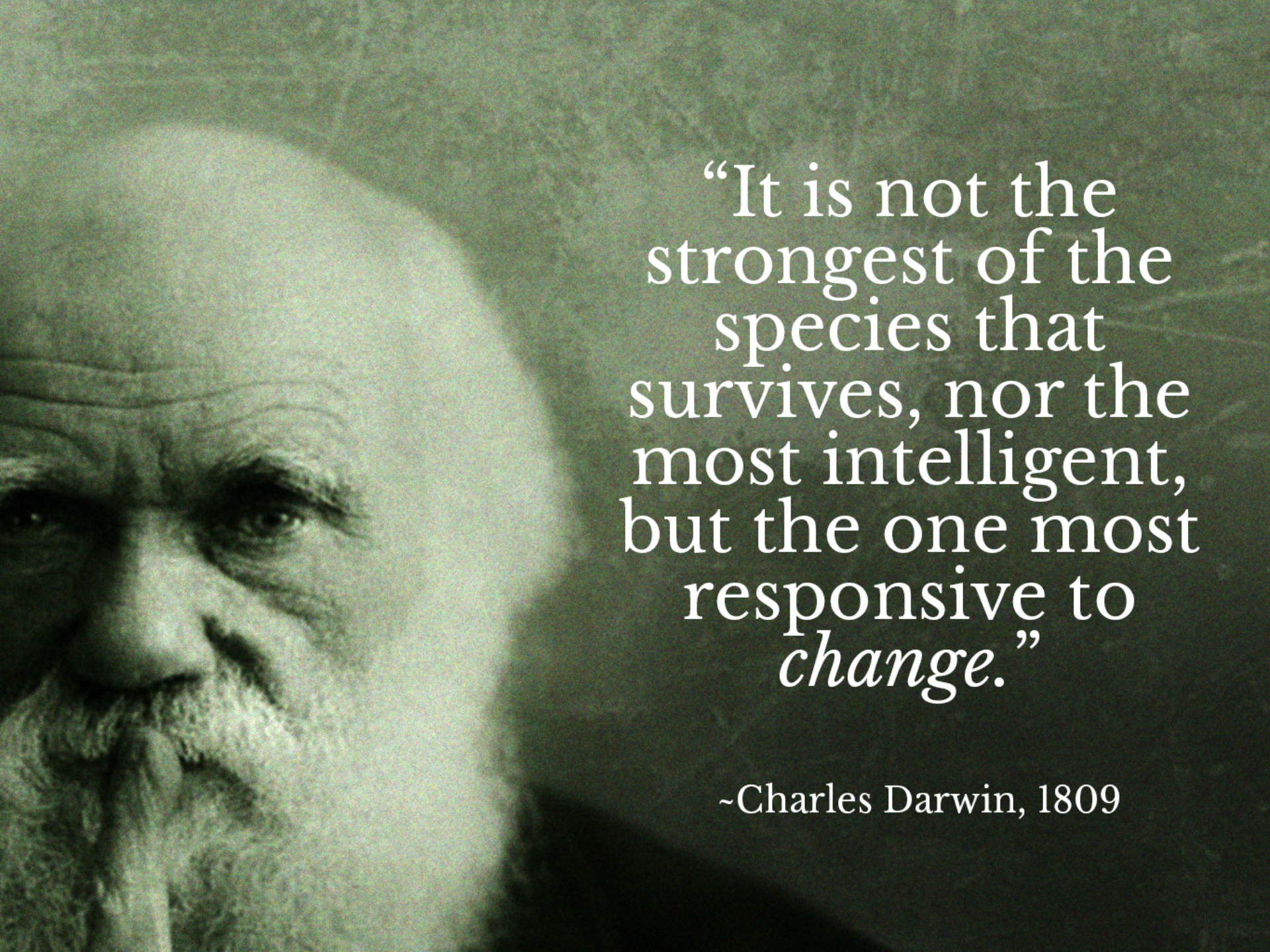


EVOLUTION




“It is not the strongest of the species that survives, nor the most intelligent, but the one most responsive to *change*.”
~Charles Darwin, 1809

What is evolution?

Think about human advances in our society over the last two thousand years…what creations revolutionized our culture?

Now, take those society-changing inventions/creations, and think about some examples where we saw those revolutionary ideas adapt and change themselves to meet the needs of society. Can you think of some that did not adapt and have disappeared?

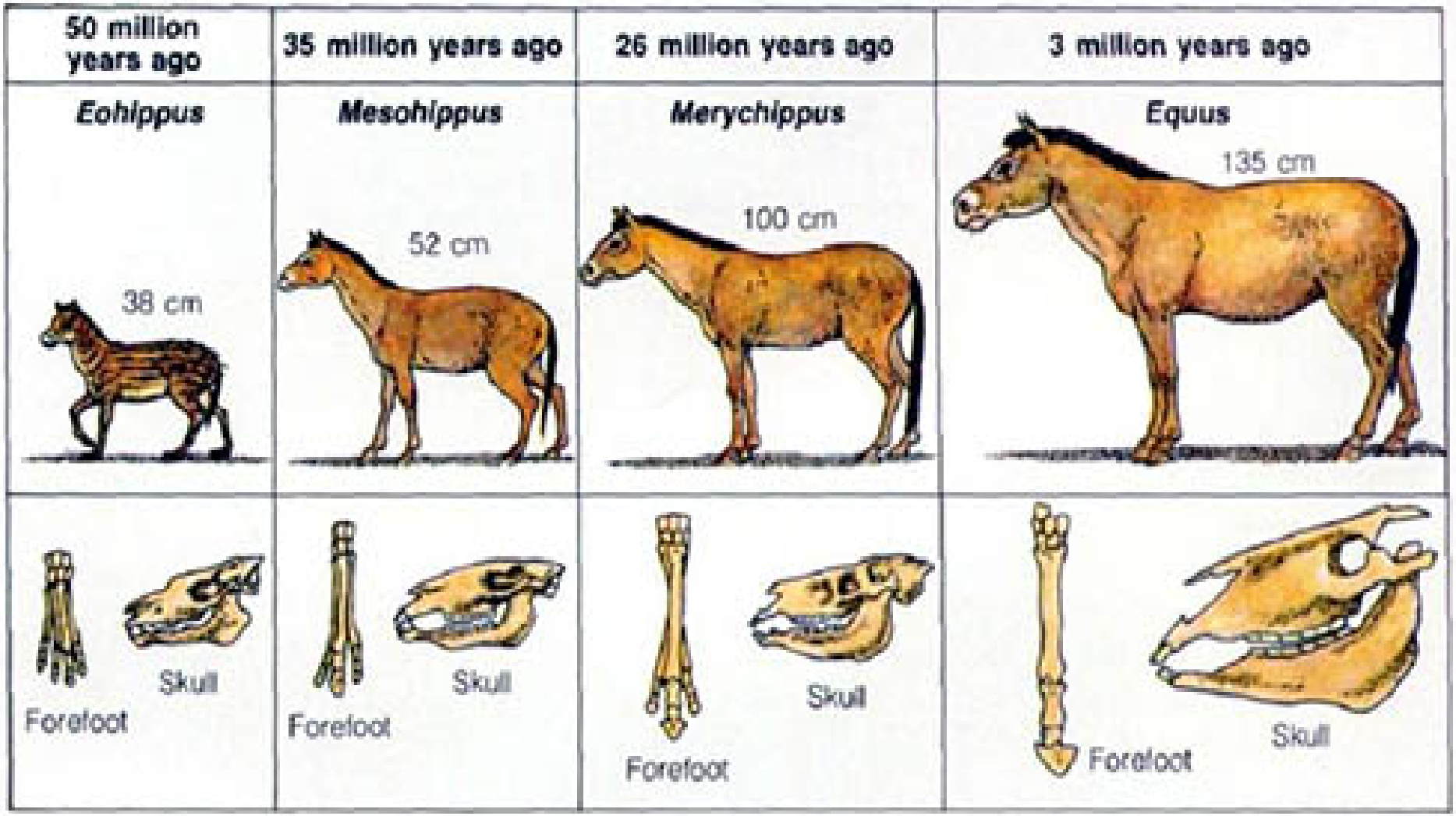
The Phone

The Plane

The Computer

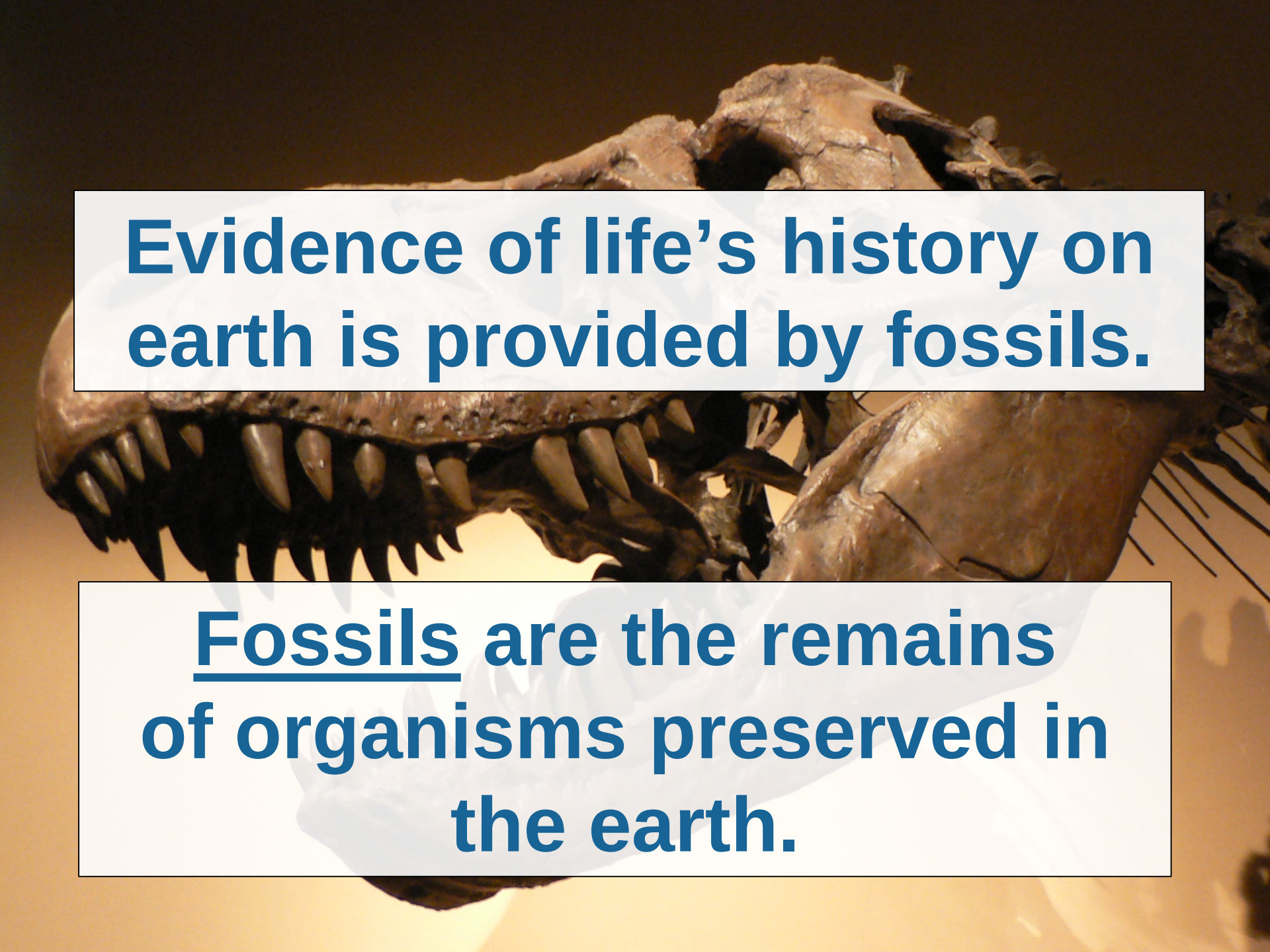
Adapted too late…Facebook became the new social giant

What does this evidence show us about the horse's development?



Describe the evidence scientists use to determine that Earth changes over time.

Give an example of how Earth has changed over time.

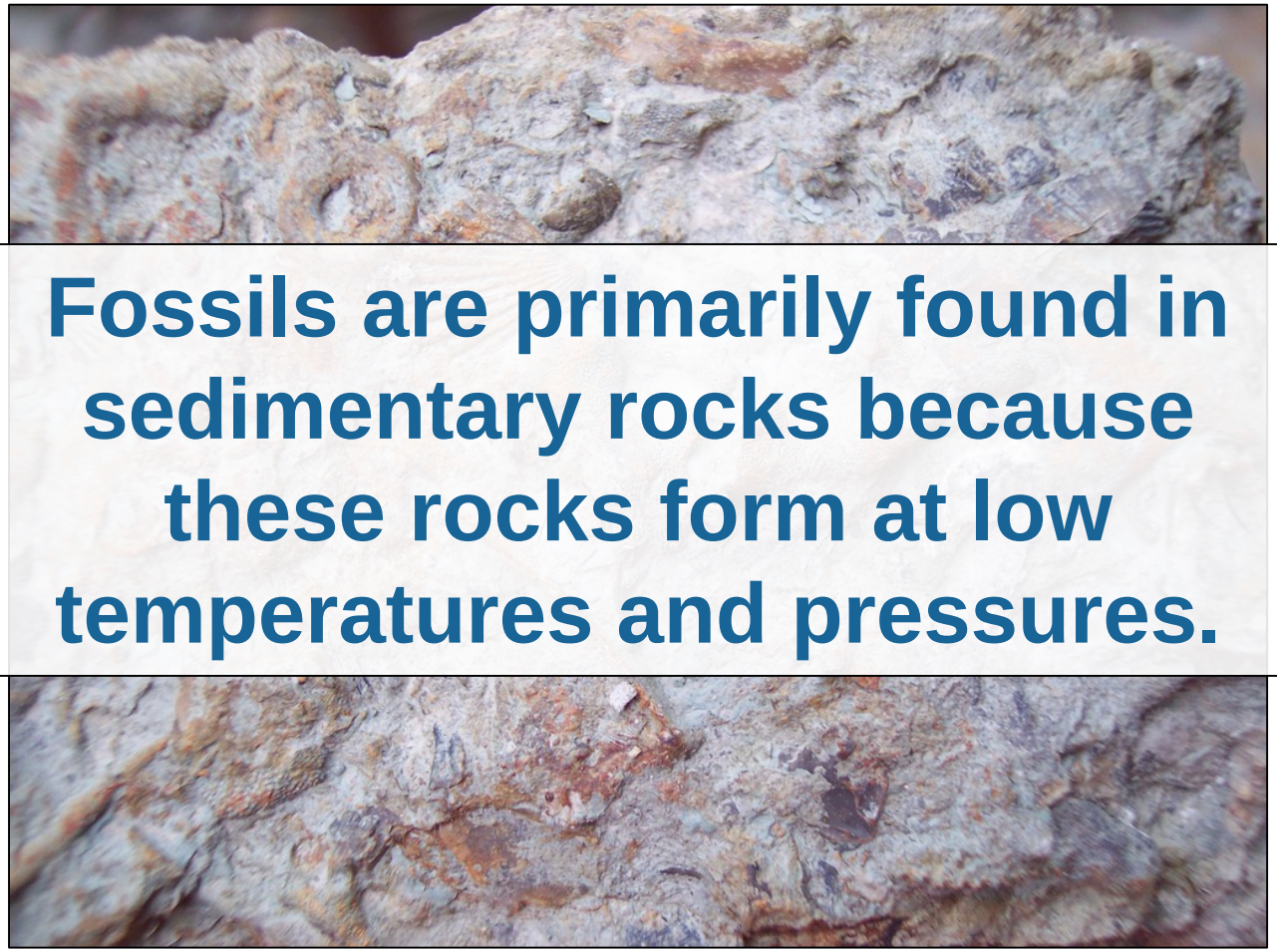


Evidence of life's history on earth is provided by fossils.

Fossils are the remains of organisms preserved in the earth.

Fossils can consist of bones, bone fragments, imprints, and preserved remains.

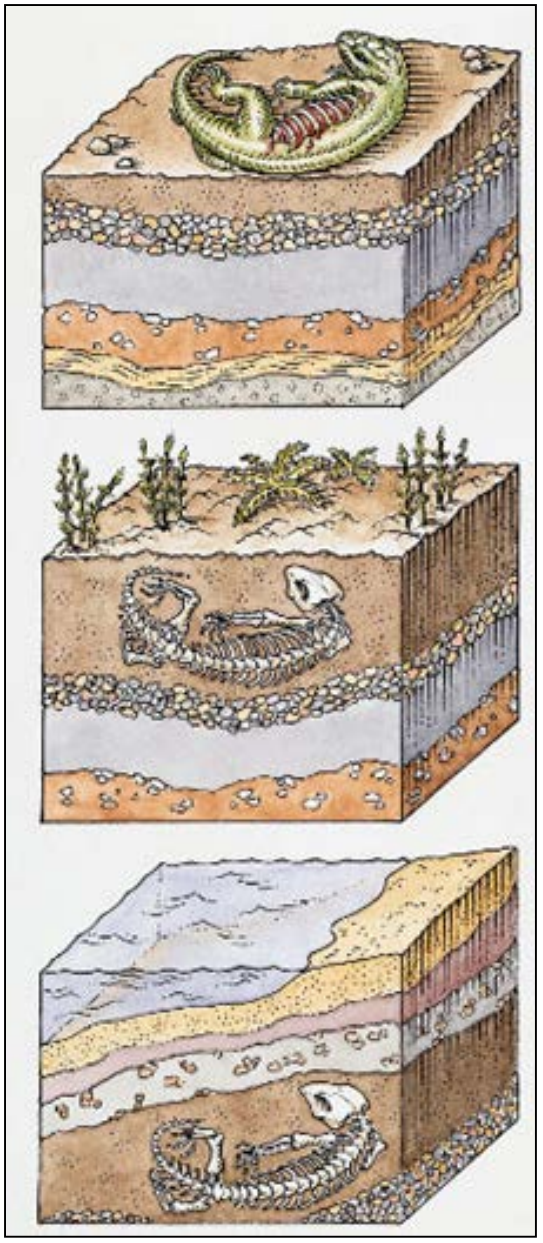
Most fossils are found in sedimentary rock. Why?



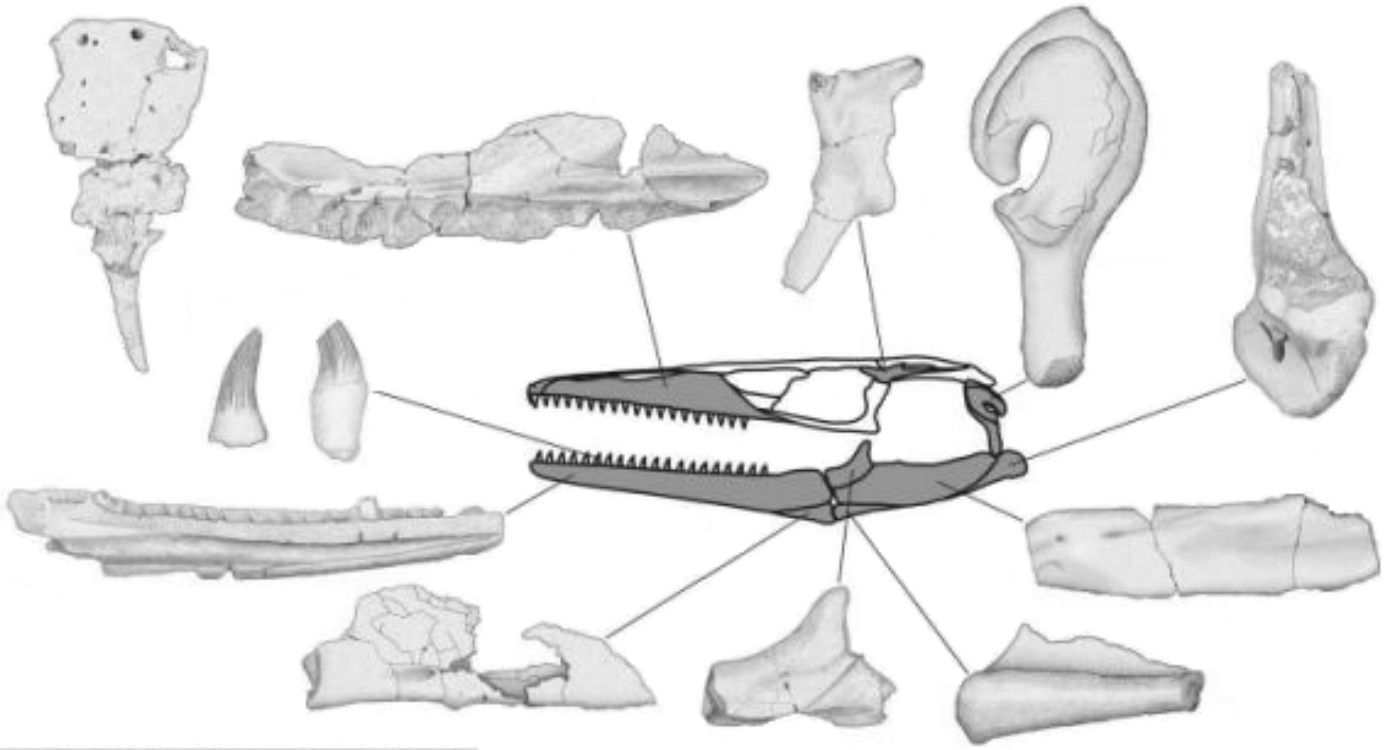
Fossils are primarily found in sedimentary rocks because these rocks form at low temperatures and pressures.

Some organisms become fossilized in ice or amber.

Scientists observe fossil characteristics and make inferences concerning the life of the organism based on these observations.



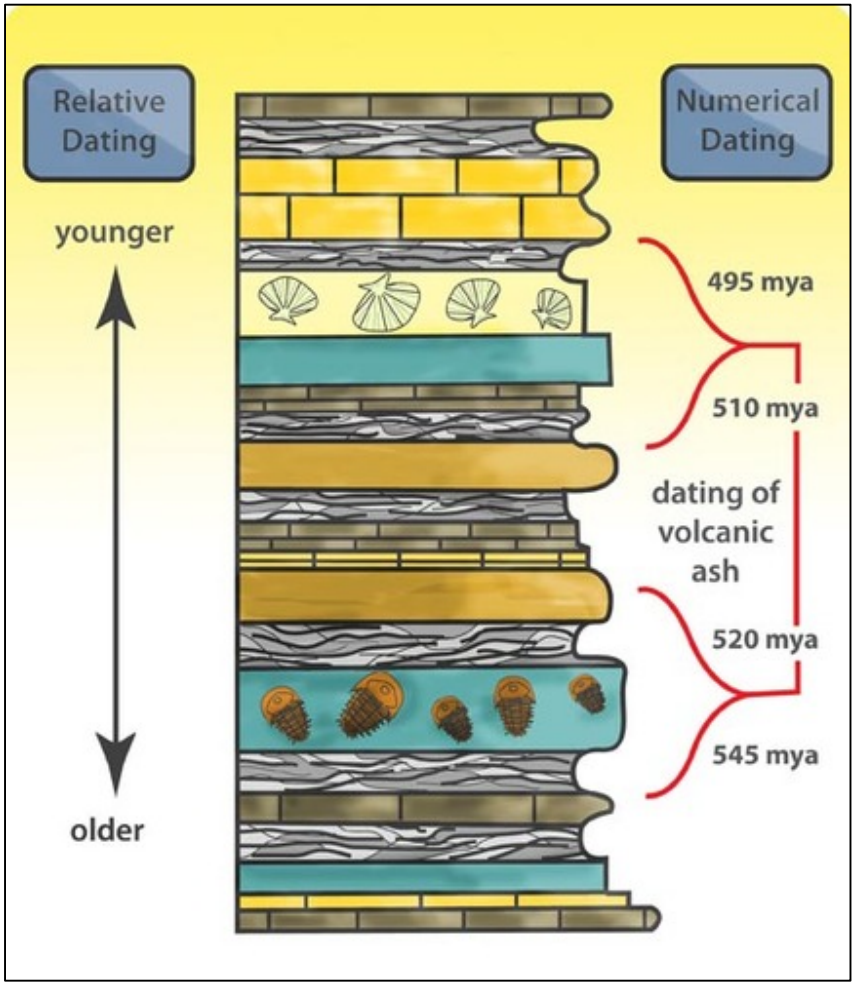
Once scientists piece the fossil below together, what might they be able to know about the once living organism?



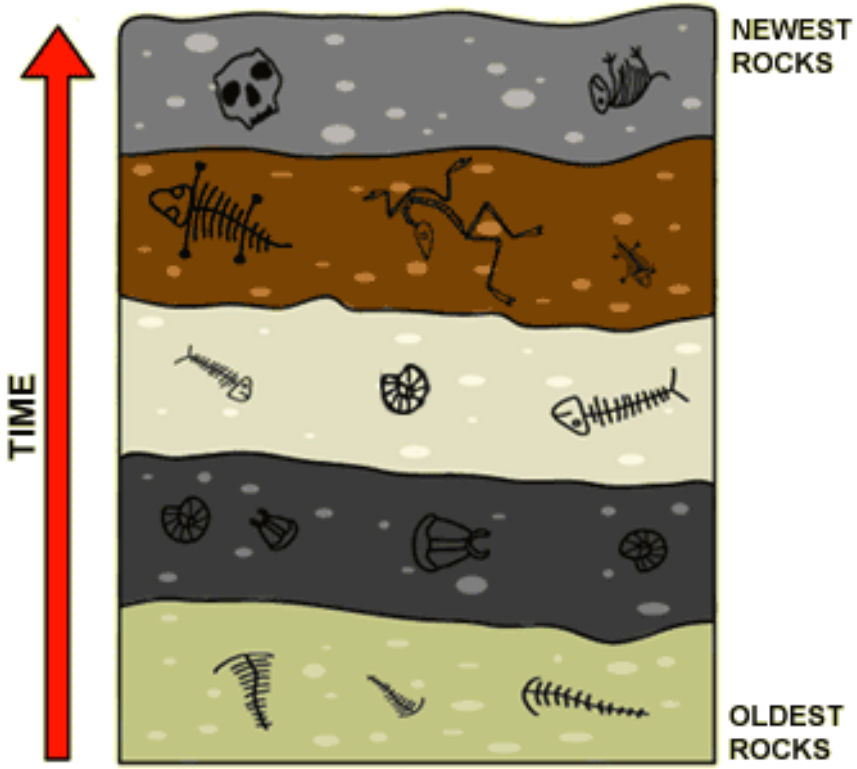
How can scientists tell that the first organisms lived in oceans, or that dinosaurs lived on land and that they disappeared 65 million years ago?

These questions and others can be addressed by determining the age of fossils.

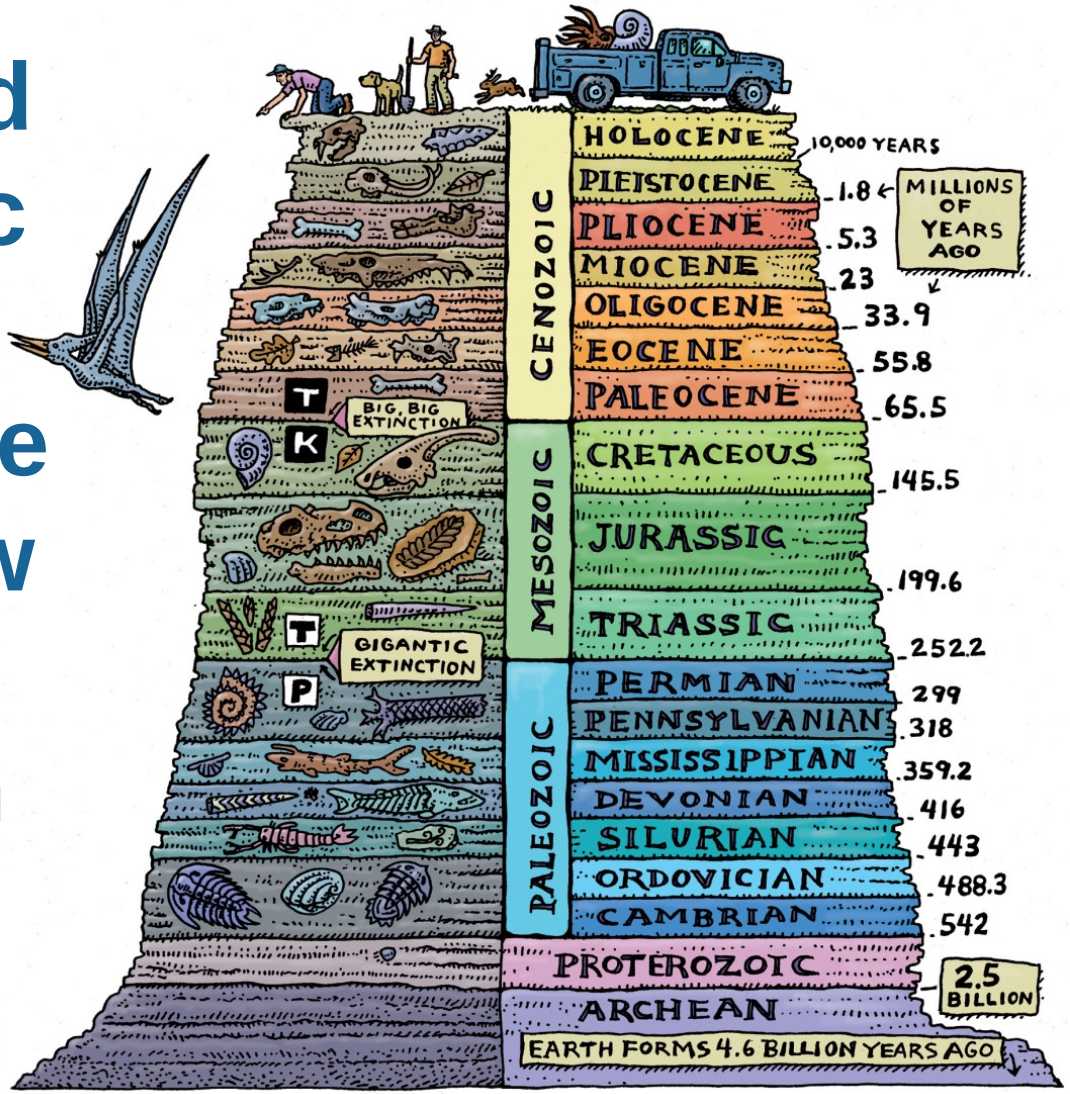
Scientists use relative dating and absolute dating to describe the age of fossils.



Older fossils are found in deeper layers of the earth's sedimentary rock; younger fossils are found in the upper layers of the earth's sedimentary rock.

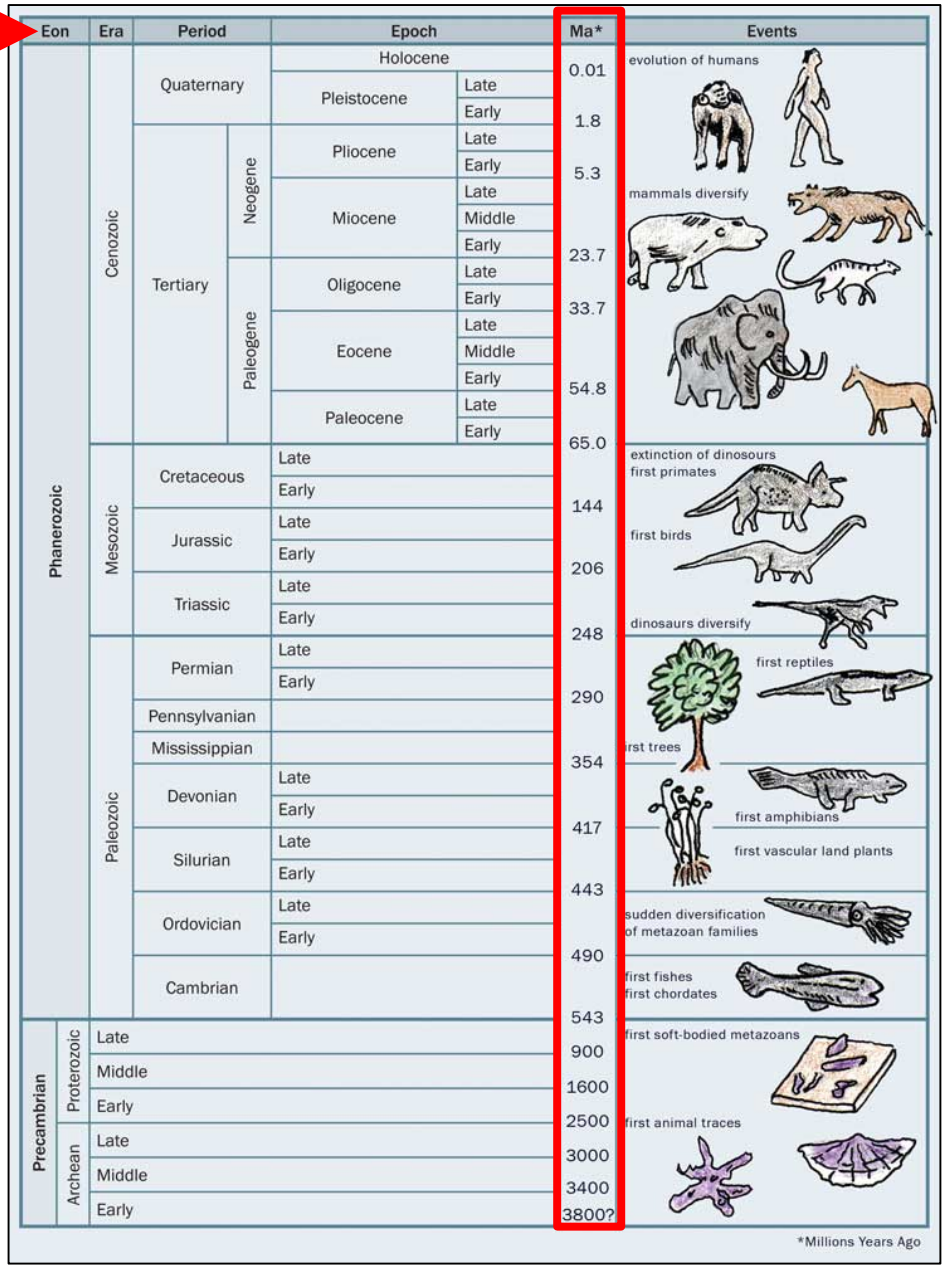


The fossil record and the geologic time scale provide reference to when and how long organisms have existed on planet Earth.

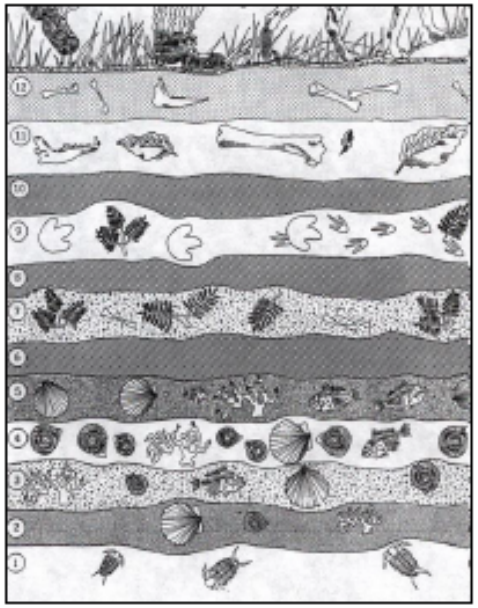


The fossil record is the total number of fossils that have been discovered, as well as the information gained from them.

The geologic time scale is a system of chronological measurement that describes the timing and relationships between events that have occurred throughout Earth's history.



Using Fossils to Gather Evidence of Once Living Organisms



1. Which layer is the oldest? How do you know? _____

2. Select a layer from 1-5. Identify some characteristics of the time period and the organisms which lived during the time period based on the fossils in the layer.

_____
_____
_____

3. Select a layer from 7-12. Identify some characteristics of the time period and the organisms which lived during the time period based on the fossils in the layer.

_____
_____
_____

4. Select a layer from 1-5 and 7-12 to compare.

_____
_____
_____

5. What could have caused the changes you described in question 3.

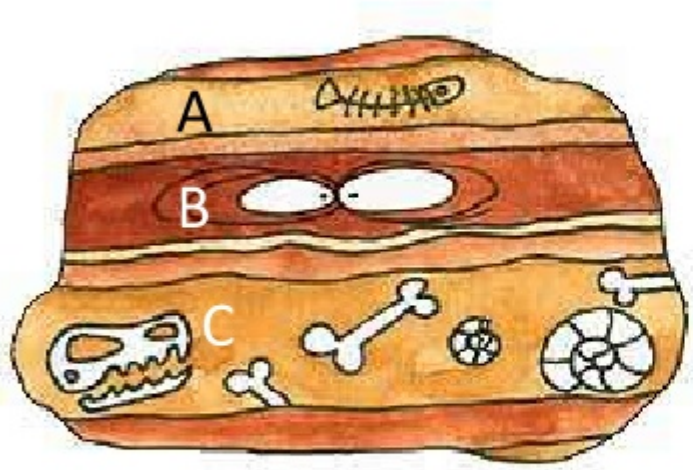
_____
_____
_____

6. Why is the fossil record important?

_____
_____

Using Fossils to Gather Evidence

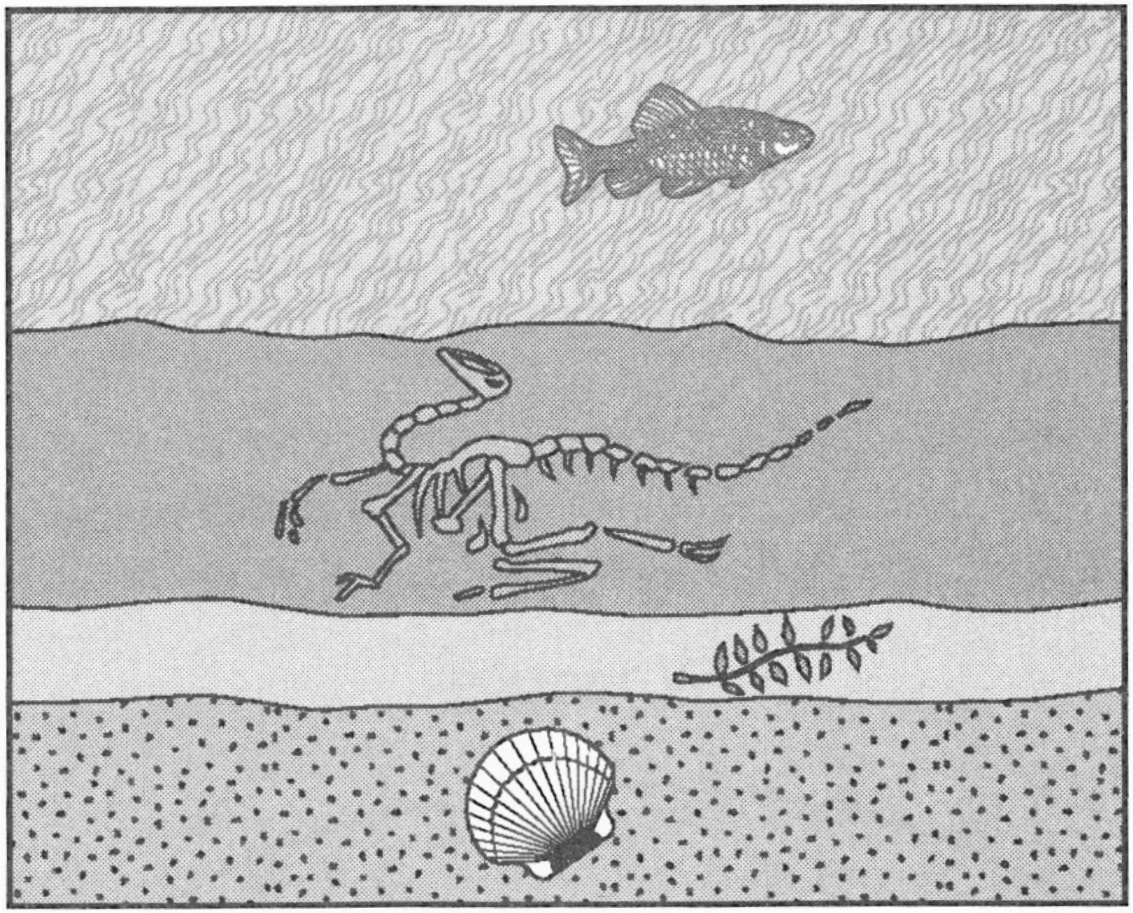
Turn to an elbow partner and answer the question below. Discuss how to determine the correct answer.



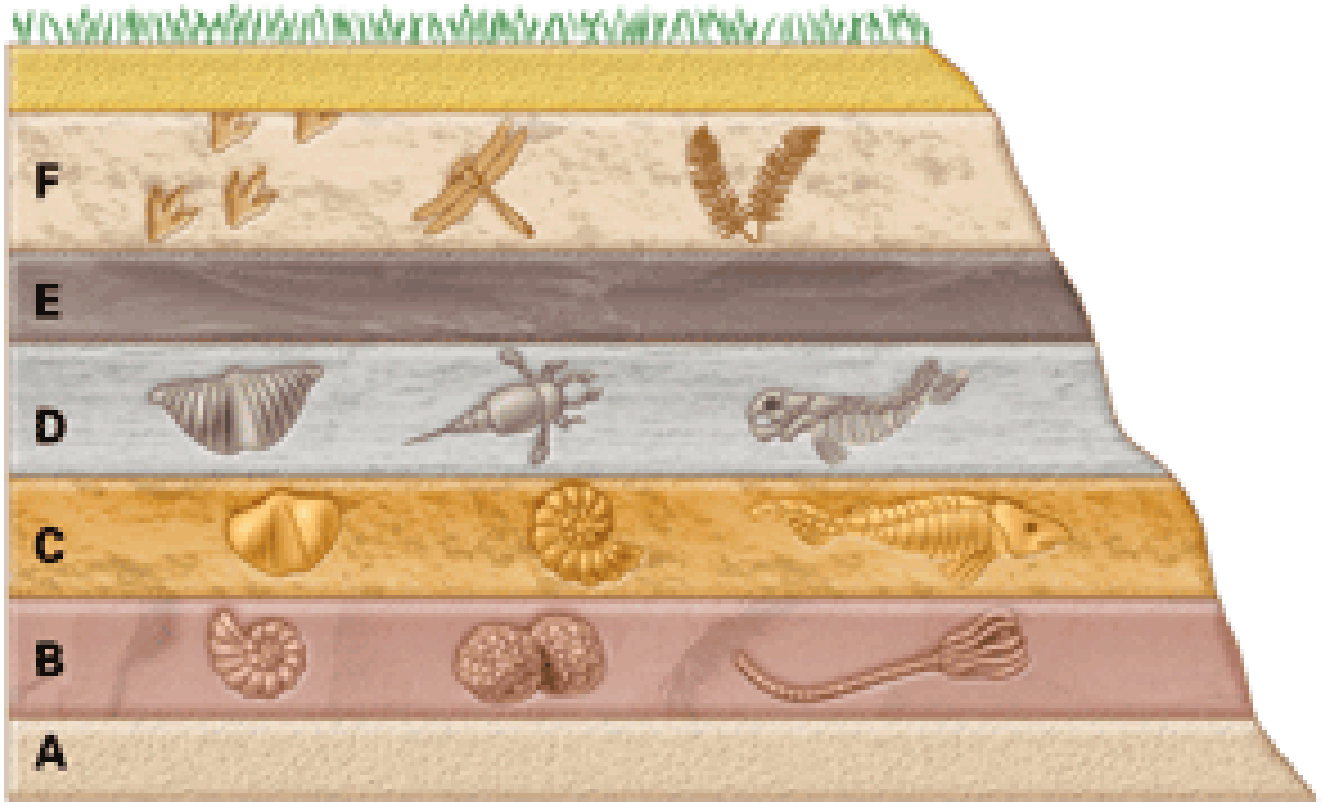
The fossils in layer C are the

a. the youngest
b. the oldest
c. the same age as the fossils in layer A

With the same elbow partner describe the changes in the fossils you see in each layer and what they tell you about that time period.



Turn to a different partner. Compare layer C to layer F in the diagram below. What evidence do these fossils provide of changes on earth?



Evolution is the process through which species change over time.

What is the difference between a scientific theory and a scientific law?

Evolution is a scientific theory.

A scientific theory is a statement based on observation and experiment. If continued observation and experiment support the statement, it may become widely accepted.

Look at the two images below. The image on the left shows the skull of a fossil, the Swift Fox (*Vulpes velox*), compared to the same view of a modern Kit Fox (*Vulpes macrotis*). With a partner, identify the similarities.

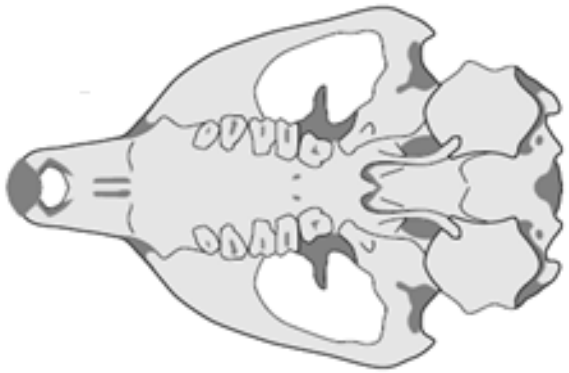
The Swift Fox (on the left) was alive during the Pleistocene Epoch. Find the Pleistocene Epoch on the Geologic Time Scale diagram to the right.

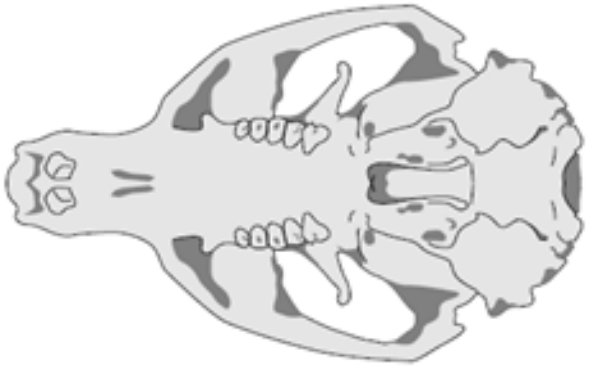
Eon	Era	Period	Epoch		Ma*	Events
Phanerozoic	Cenozoic	Quaternary	Holocene		0.01	evolution of humans
			Pleistocene	Late		
				Early	1.8	
		Tertiary – Neogene	Pliocene	Late		
				Early	5.3	
			Miocene	Late		mammals diversify
				Middle		
				Early	23.7	
		Tertiary – Paleogene	Oligocene	Late		
				Early	33.7	
			Eocene	Late		
				Middle		
				Early	54.8	
			Paleocene	Late		
				Early	65.0	
	Mesozoic	Cretaceous	Late			extinction of dinosours first primates
			Early		144	
		Jurassic	Late			first birds
			Early		206	
		Triassic	Late			
			Early		248	dinosaurs diversify
	Paleozoic	Permian	Late			first reptiles
			Early		290	
		Pennsylvanian				first trees
		Mississippian			354	
		Devonian	Late			first amphibians
			Early		417	first vascular land plants
		Silurian	Late			
			Early		443	
		Ordovician	Late			sudden diversification of metazoan families
			Early		490	
		Cambrian				first fishes first chordates
					543	
Precambrian	Proterozoic	Late			900	first soft-bodied metazoans
		Middle			1600	
		Early			2500	
	Archean	Late			3000	first animal traces
		Middle			3400	
		Early			3800?	

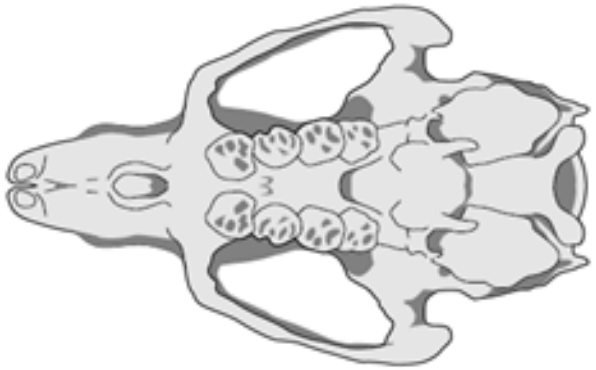
*Millions Years Ago

If the Swift Fox was alive about 1 million years ago, why is it so similar to the modern Kit Fox?

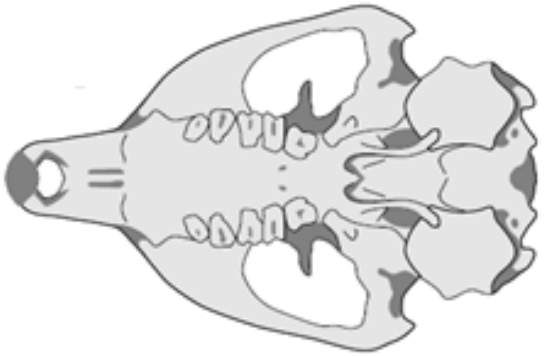
Look at these three organisms. Each fossil comes from a different time on the Geologic Time Scale. Are they similar? How?

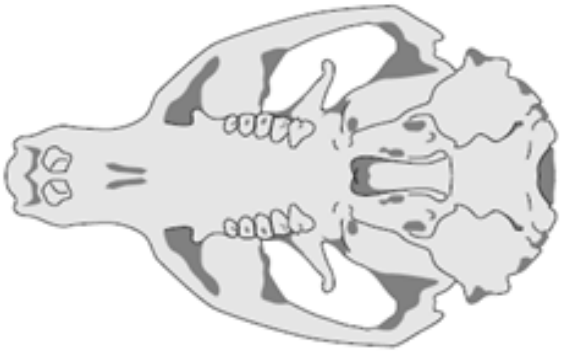


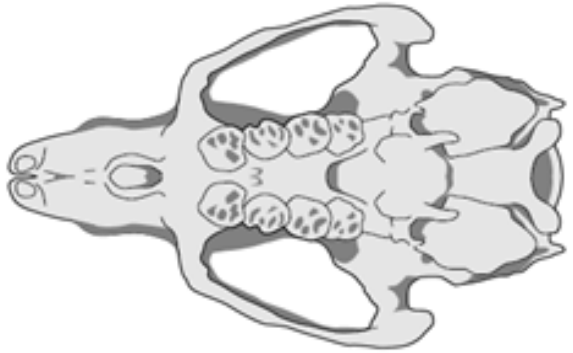




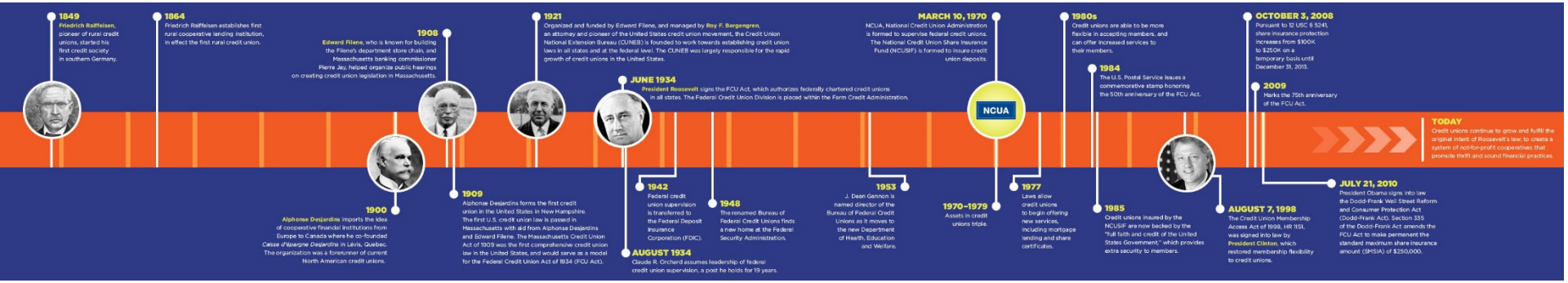
What can we learn from these two fossil comparisons?







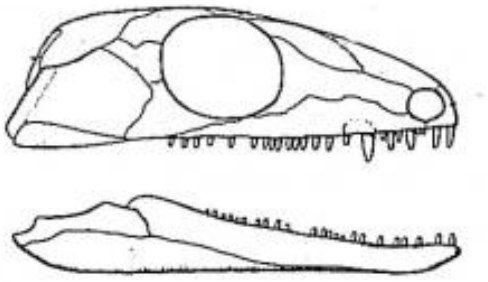
Complete What Came First Timeline activity



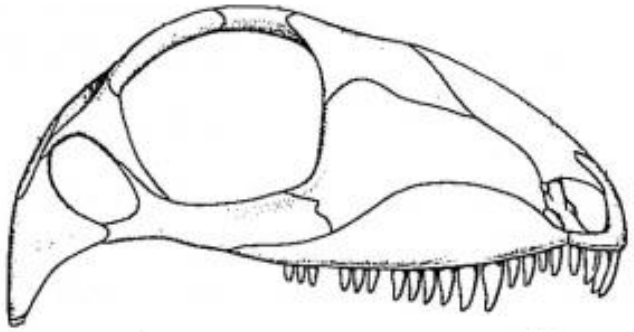
Living or once living things share common ancestors and fossils provide evidence for common ancestry.

Physical characteristics of organisms change over time and fossils provide evidence of change.

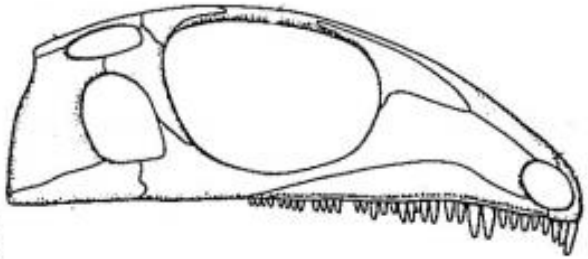
Living or once living things share common ancestors and fossils provide evidence for common ancestry.



Early aminotes and modern turtles

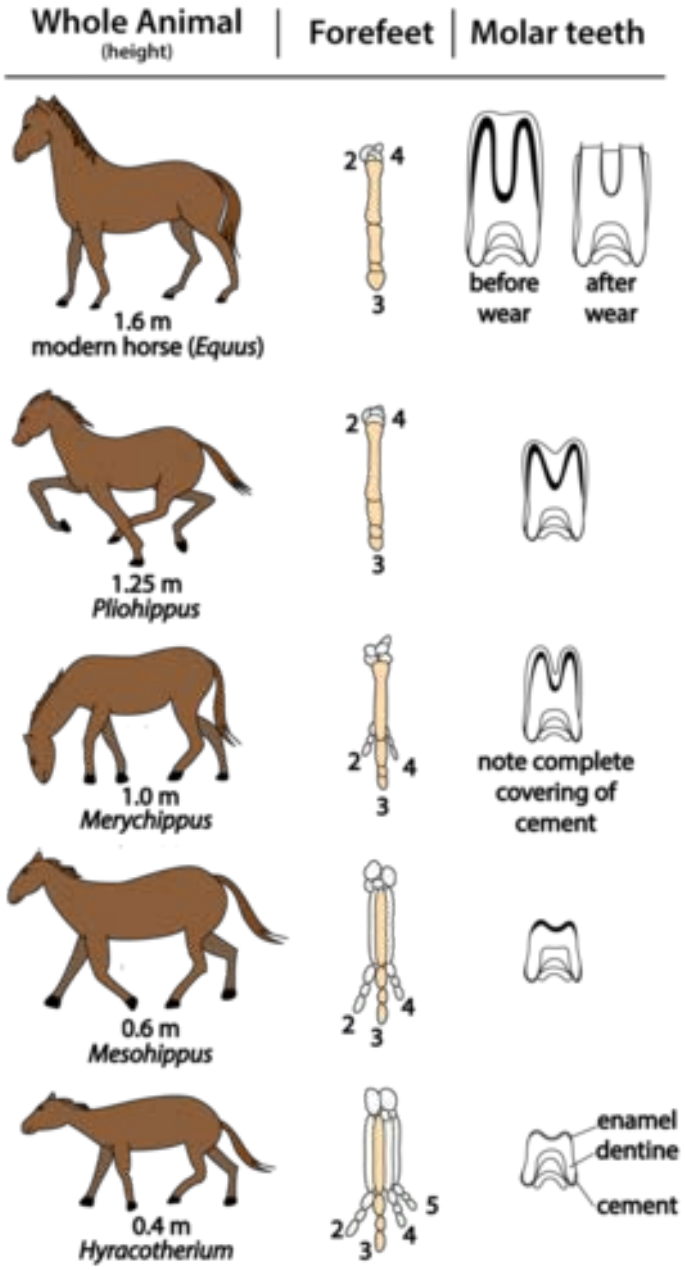


Mammals and their ancestors



Most reptiles, dinosaurs and birds

Physical characteristics of organisms change over time and fossils provide evidence of change.



D and T Sentence Activity

Evidence to support the Theory of Evolution…

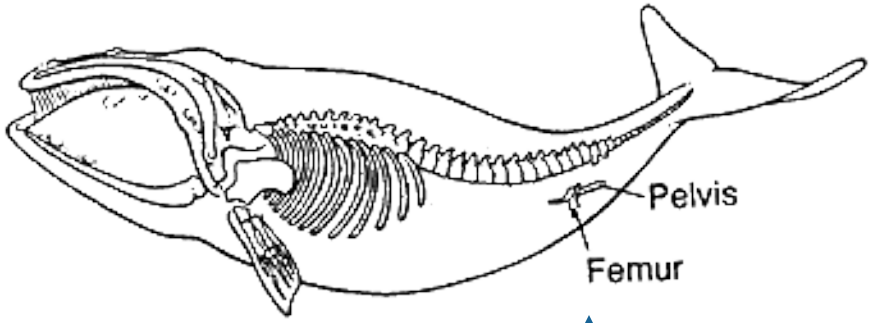
Fossils provide evidence of evolution as the previous slides demonstrated.

What other evidence might support evolution?

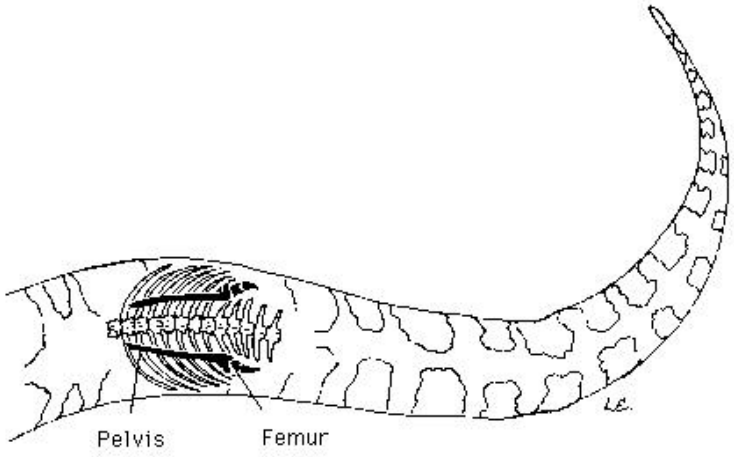
Similarities in Structure and Development provide evidence for the Theory of Evolution.

Vestigial Structures are physical structures that were fully developed and functional in an ancestral group of organisms but are reduced and unused in later species.

Vestigial Structure Examples

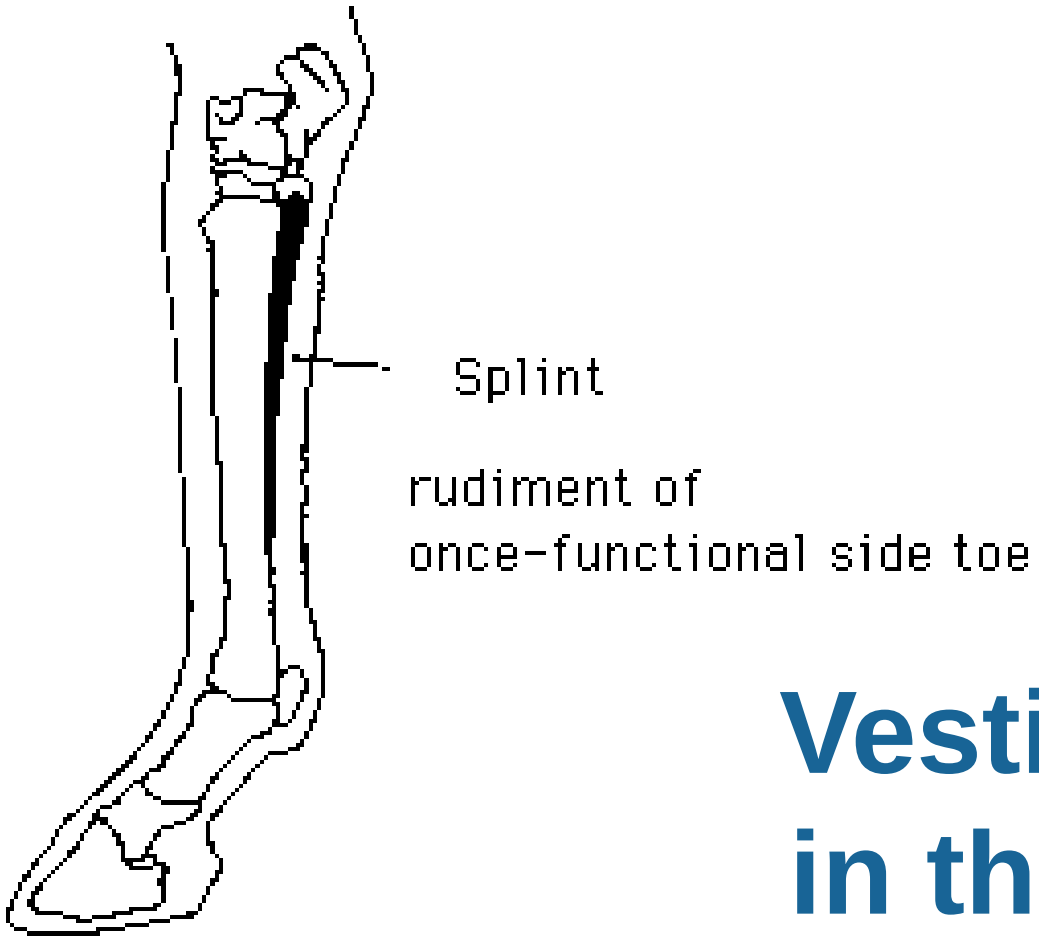


In the bodies of whales there are small leg bones



The skeletons of snakes also have traces of leg-like structures that are not used

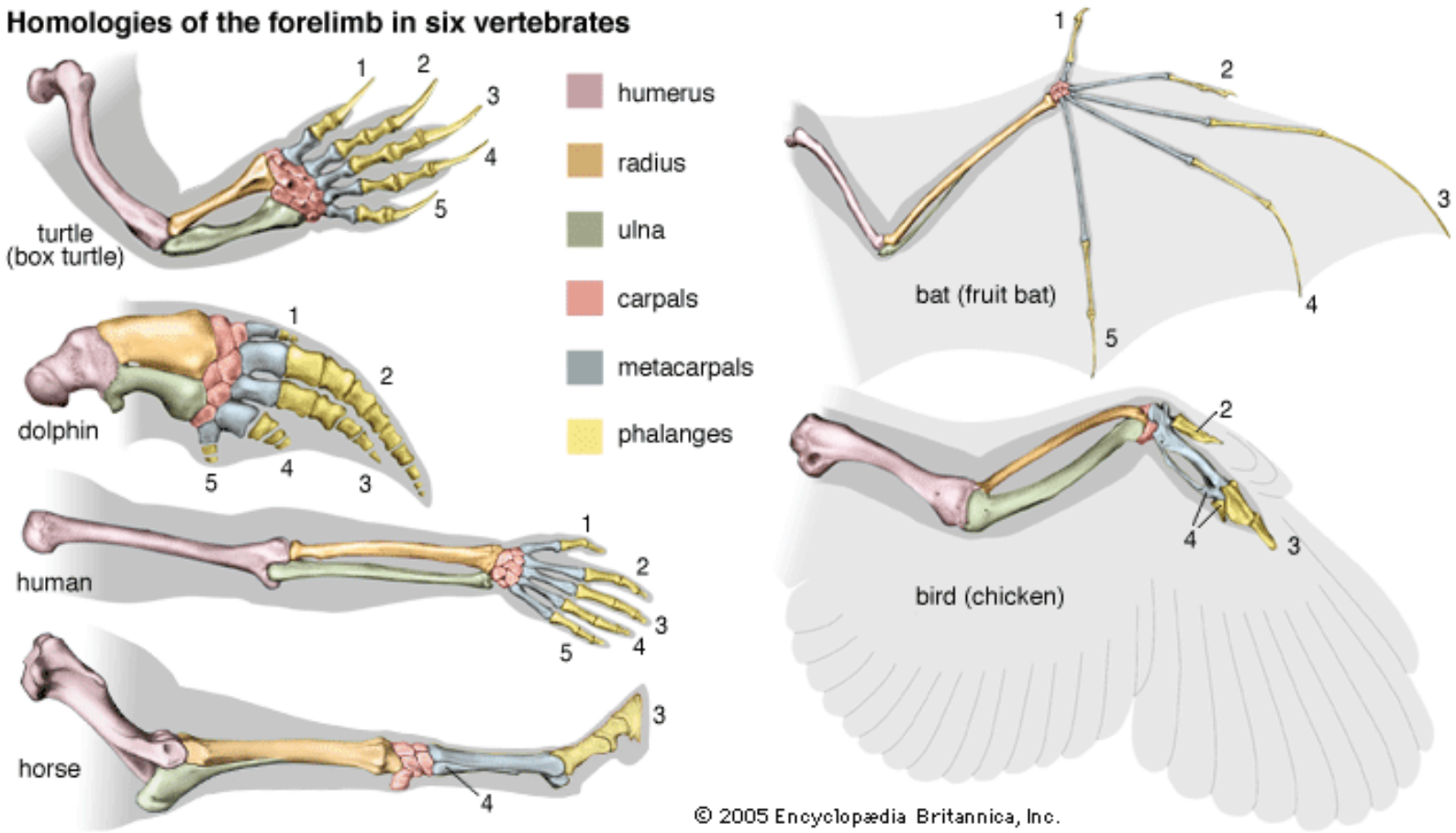
Vestigial Structure Examples



Vestigial toe in the horse

What is a structure no longer needed by modern humans but we still have?

Similar Structures with Different Functions



Similarities in Development

Organisms that appear to be very different as adults are similar during early development.

Scientists can also tell how closely organisms are related by comparing their genetic material (DNA).

In the previous slides we have identified the following evidence of evolution: Fossils, Similarities in Structure and Development, and DNA.

Which of the these three main types of evidence do you think would best help scientists prove the relationships among the organisms?

Describe how each figure above provides evidence for evolution.

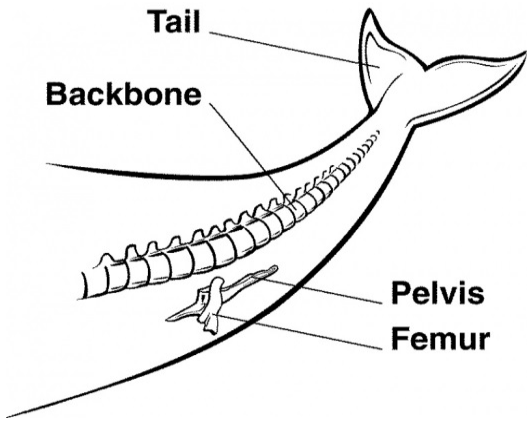


Figure 1

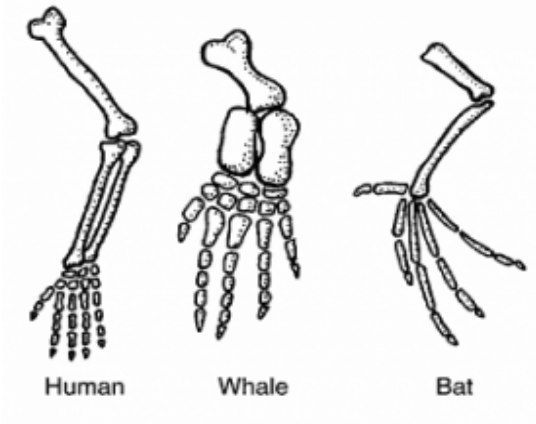


Figure 2

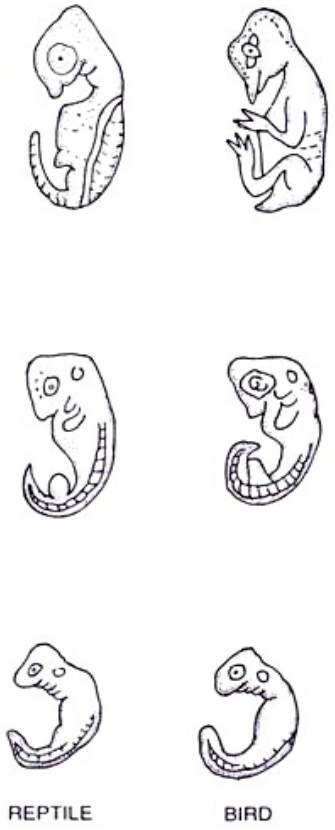


Figure 3

The Great Fossil Activity