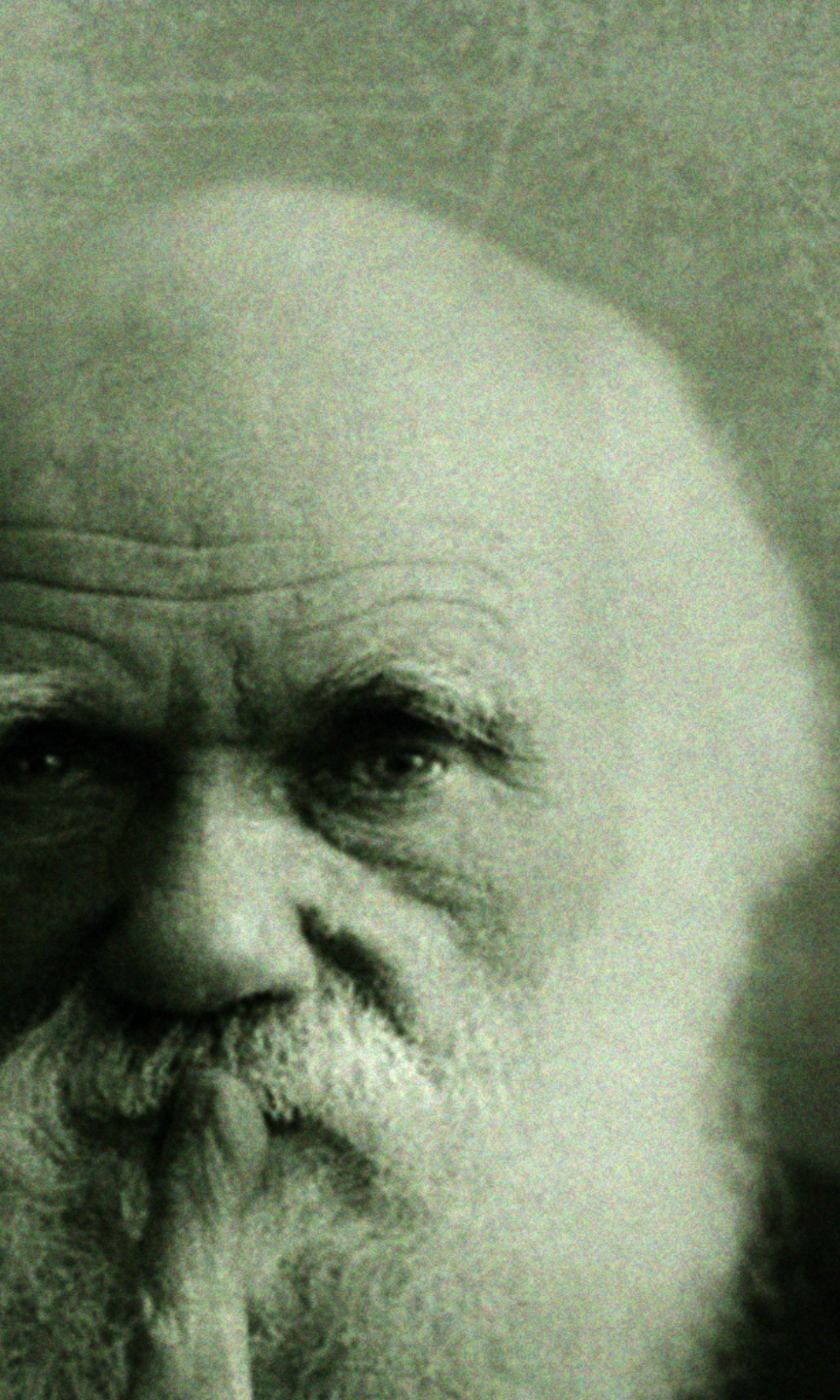




# EVOLUTION







“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

# My Space

*Little Giant*

**MY STUFF**

- View My Pics
- View My Blog
- Send Message
- Add Me
- Add to Group
- Forward
- Favorites
- Block
- Rate

**LINKS**

- Home
- Browse
- Search
- Invite
- Film
- Forum
- Groups
- Videos
- Music
- Comedy

**Little Giant**

Your blurb goes here.. Aliquam accumsan ullamcorper velit. Nulla facilisi. Nunc molestie ligula et turpis. Nulla quis felis non ante hendrerit eleifend. Sed volutpat cursus est.

Morbi dignissim laculis purus. Suspendisse dictum aliquam nisi. Fusce fringilla nonummy nisi. Fusce vehicula dapibus arcu. In mattis, ipsum ac imperdiet laoreet, nunc augue varius mi, ac interdum enim risus eu velit. Aliquam erat volutpat. Pellentesque ut ipsum placerat felis consectetur sagittis. Maecenas eu neque. Donec euismod. Curabitur nulla odio, aliquam id, auctor non, consequat eget, tortor. Nullam lectus. Nam eu elit.

**Bridge of Sighs** by Robin Trower

Little Giant has 111 friends.

**'D'**

**Vicki**

**BABY NEEDS NEW SHOES!**

**Matt**

**Laura Taylor Whitfield**

**Rex Bernard**

**nine inch nails**

**Laurie Anderson**

**Pearl Jam**

**Rob Thunder**

**Alice in Chains**


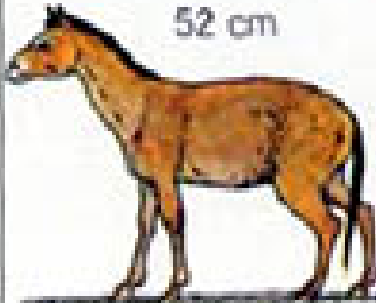
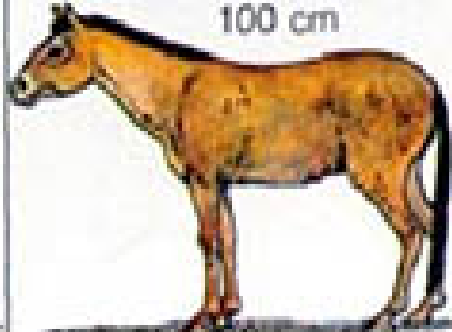
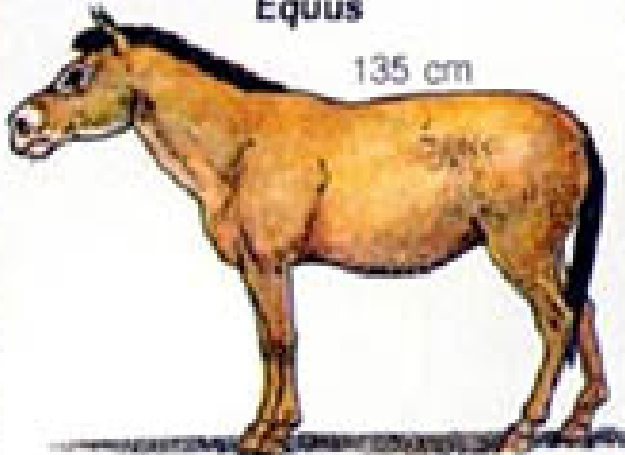







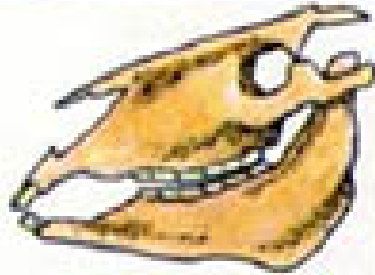
**Dread Zeppelin**

**YouTube**

View All of Little Giant's Friends



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

50 million years ago	35 million years ago	26 million years ago	3 million years ago
<b><i>Eohippus</i></b>  38 cm	<b><i>Mesohippus</i></b>  52 cm	<b><i>Merychippus</i></b>  100 cm	<b><i>Equus</i></b>  135 cm
 Forefoot  Skull	 Forefoot  Skull	 Forefoot  Skull	 Forefoot  Skull





**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.**

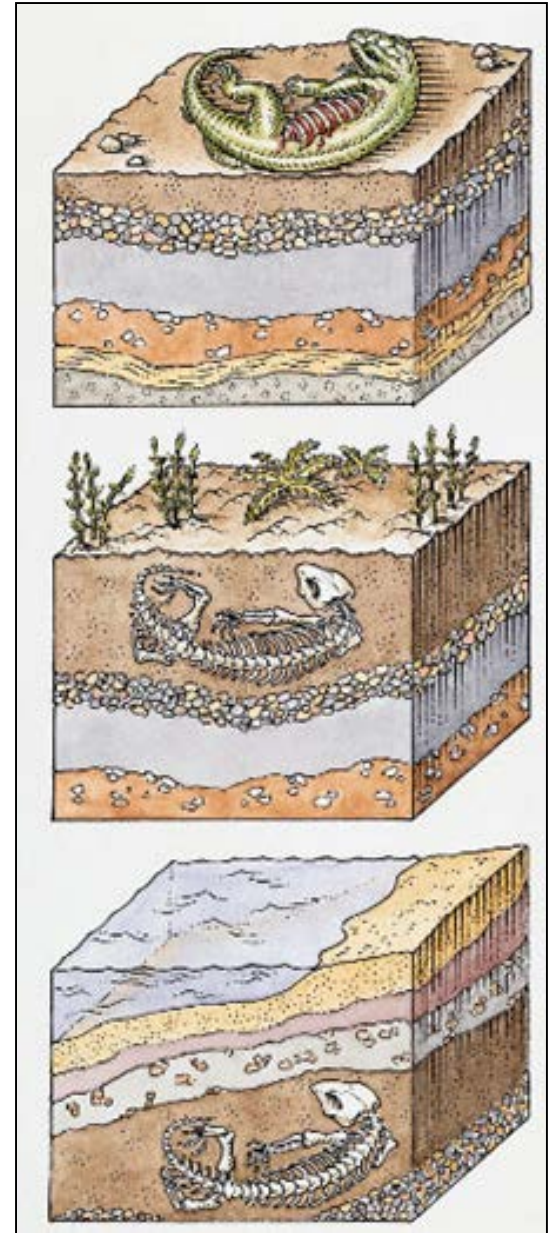




**Some organisms become fossilized in ice or amber.**

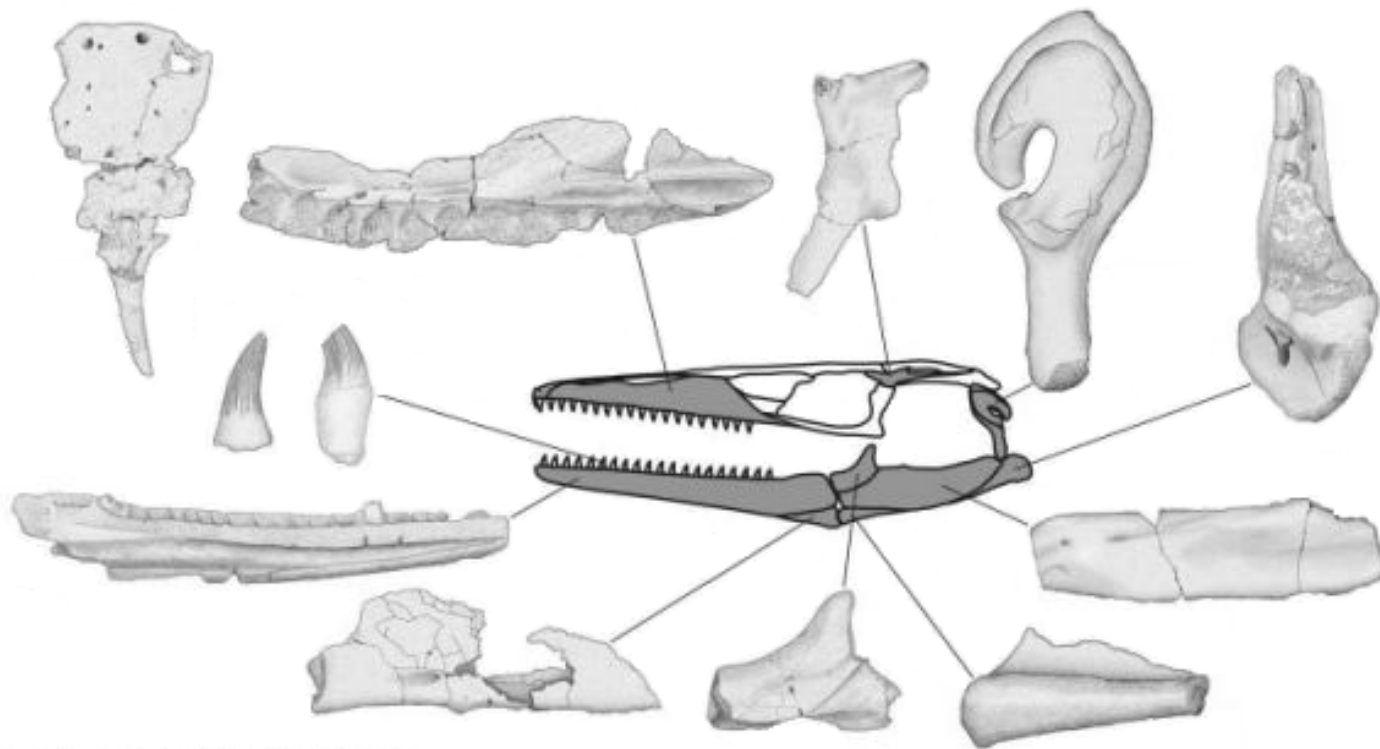


**Scientists observe fossil characteristics and make inferences concerning the life of the organism based on these observations.**





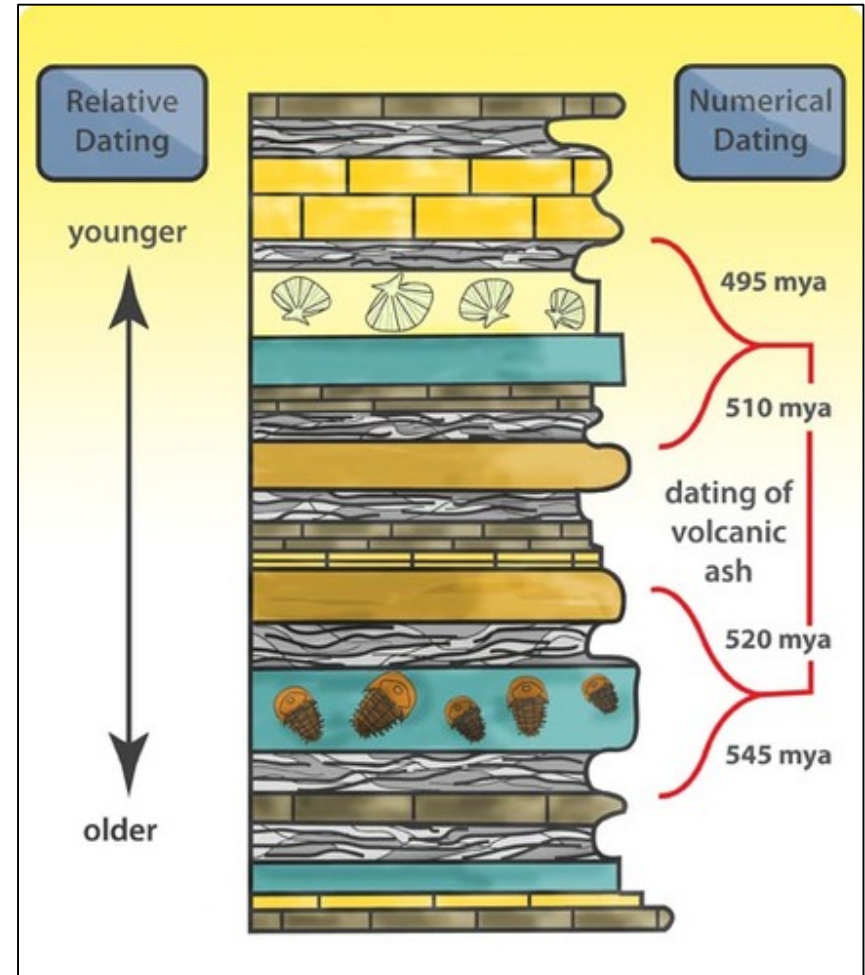
**Once scientists piece the fossil below together, what might they be able to know about the once living organism?**



**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?**

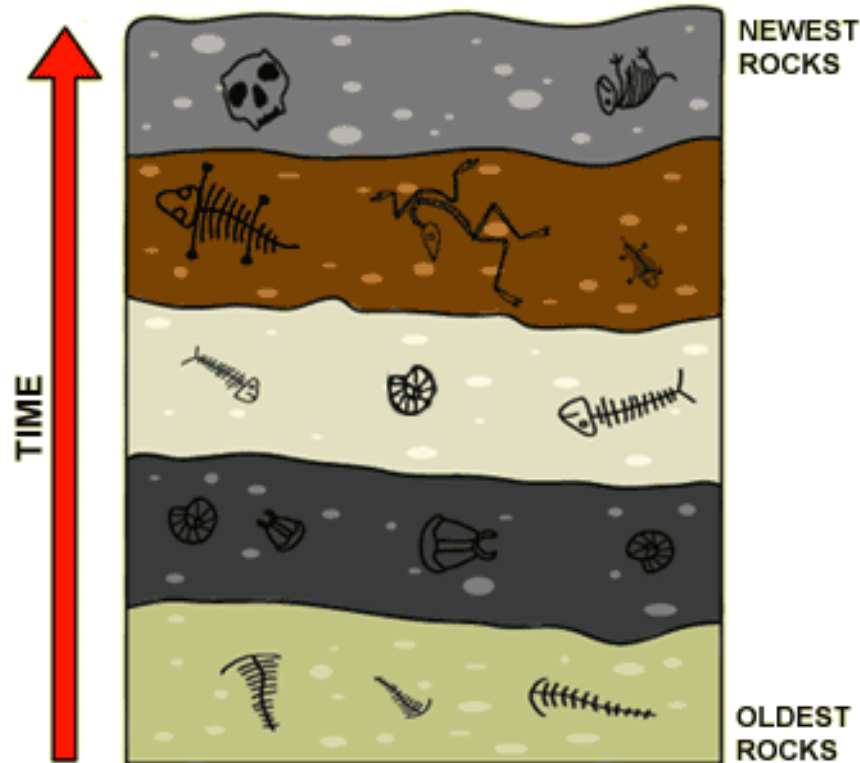
**These questions and others can be addressed by determining the age of fossils.**

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

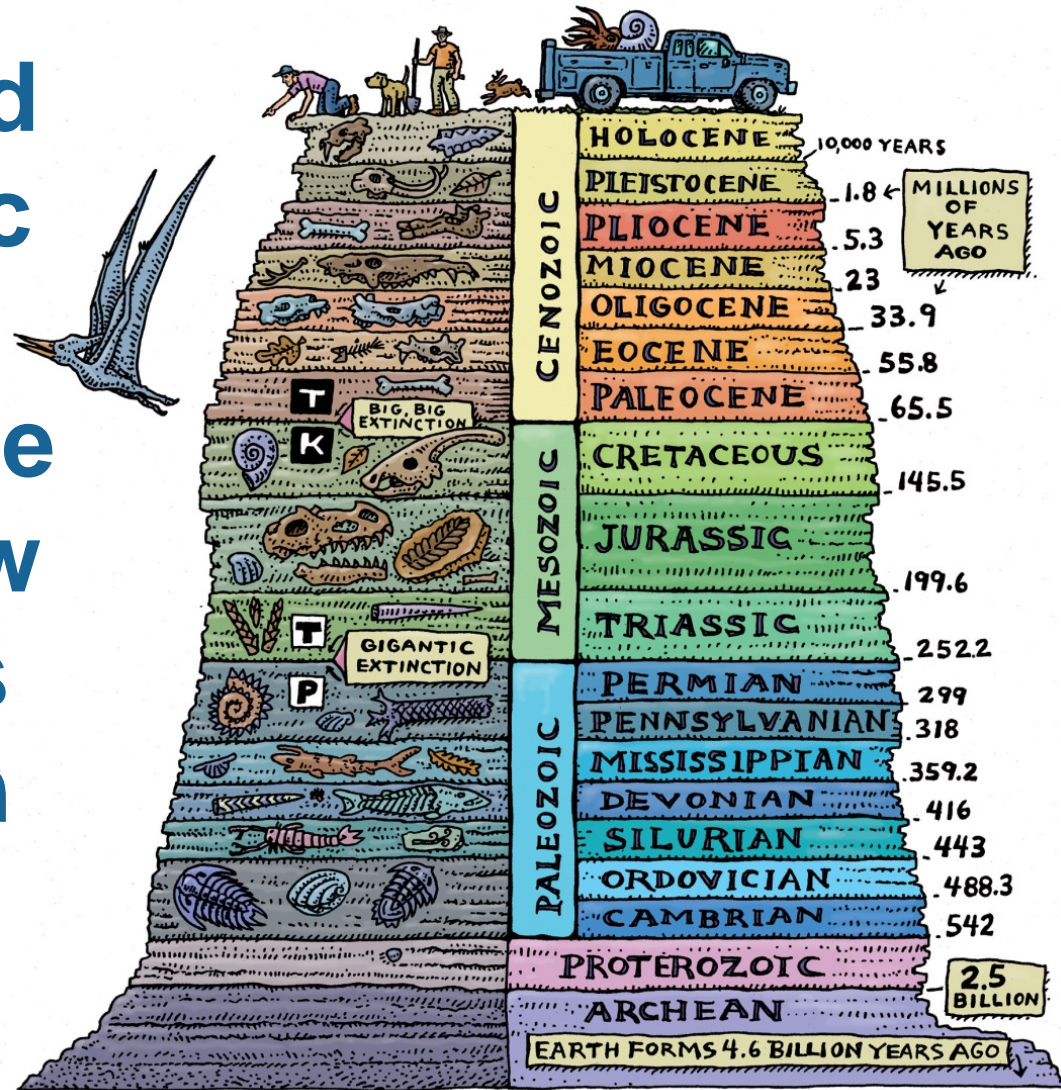




**Older fossils are found in deeper layers of the earth's sedimentary rock; younger fossils are found in the upper layers of the earth's sedimentary rock.**



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.**

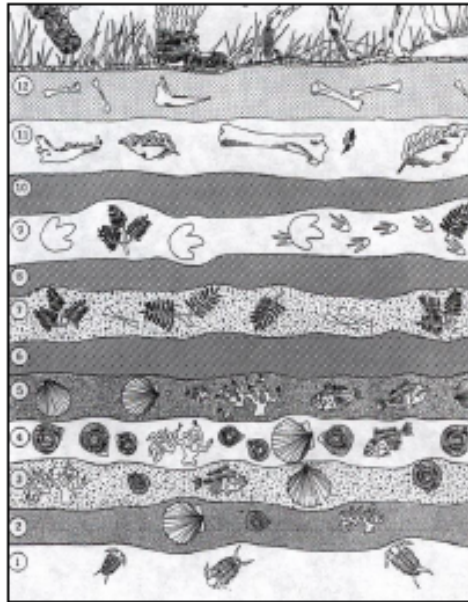


The geologic time scale is a system of chronological measurement that describes the timing and relationships between events that have occurred throughout Earth's history.

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

\*Millions Years Ago





# Using Fossils to Gather Evidence

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.

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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.

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

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

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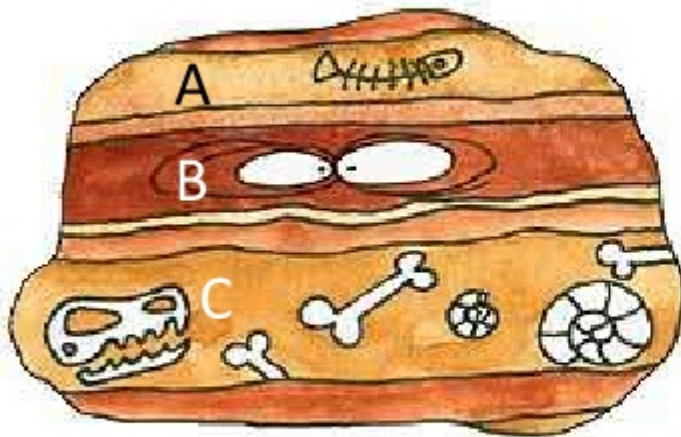
6. Why is the fossil record important?

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

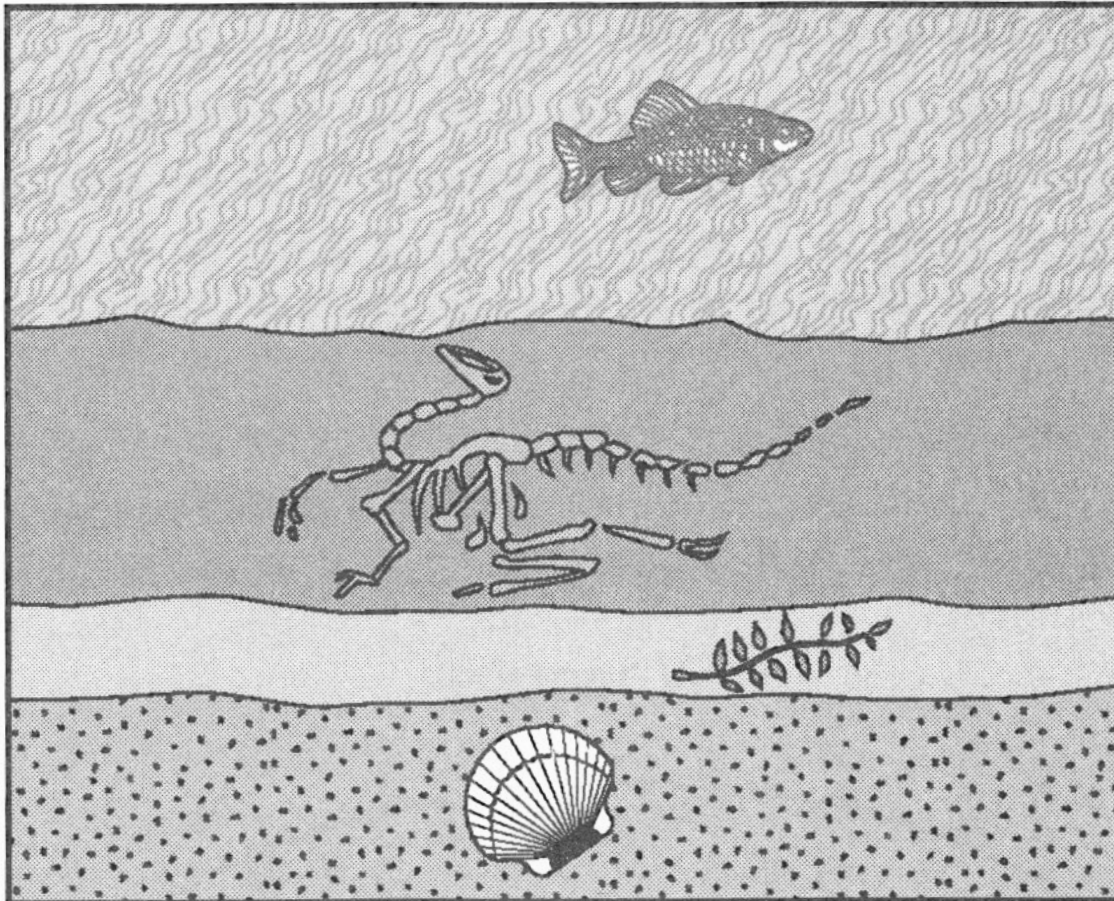


The fossils in layer C are the

- 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	1.8	
		Tertiary	Pliocene	Late	
				Early	
			Miocene	5.3	mammals diversify
				Late	
				Middle	
		Paleogene	Oligocene	Early	
				23.7	
			Eocene	Late	
				33.7	
			Paleocene	Early	
				54.8	
	Mesozoic	Cretaceous	Late	65.0	extinction of dinosaurs
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		Jurassic	Late	144	
			Early		first birds
		Triassic	Late	206	
			Early		dinosaurs diversify
Precambrian	Proterozoic	Permian	Late	248	
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		Pennsylvanian		290	
					first trees
		Mississippian		354	
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			Early		first vascular land plants
		Silurian	Late	443	
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	Archean	Ordovician	Late	490	
			Early		first fishes
		Cambrian		543	first chordates
					first soft-bodied metazoans
	Archean	Late		900	
					first animal traces
		Middle		1600	
	Archean	Early		2500	
	Archean	Late		3000	
	Archean	Middle		3400	
	Archean	Early		3800?	

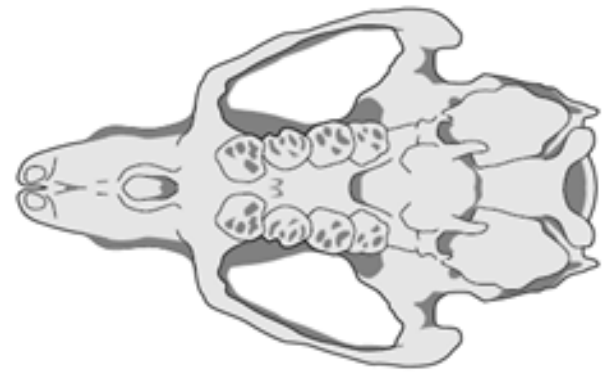
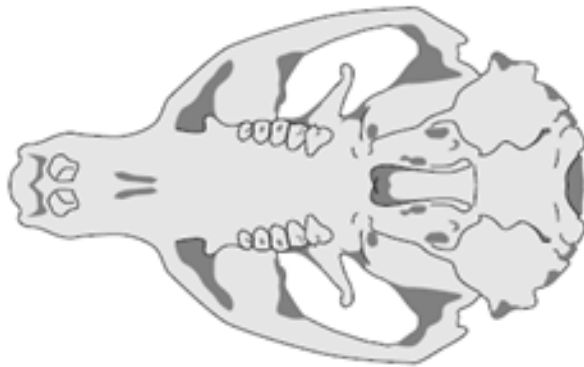
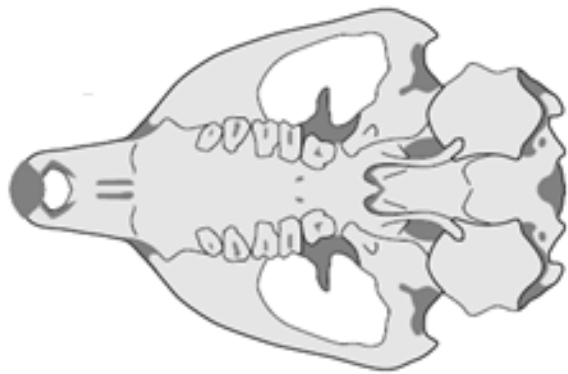
\*Millions Years Ago

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

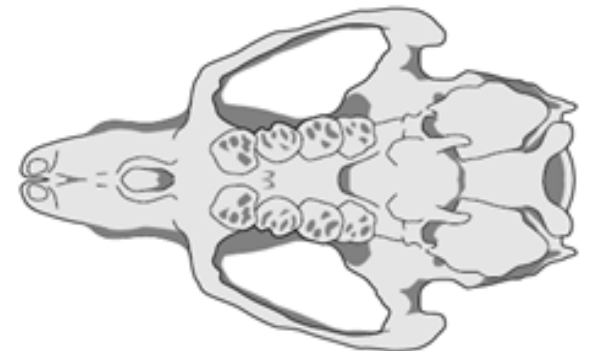
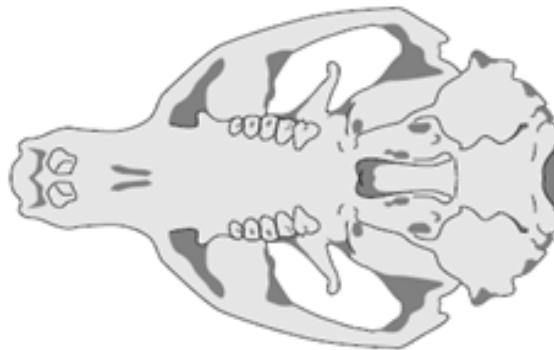
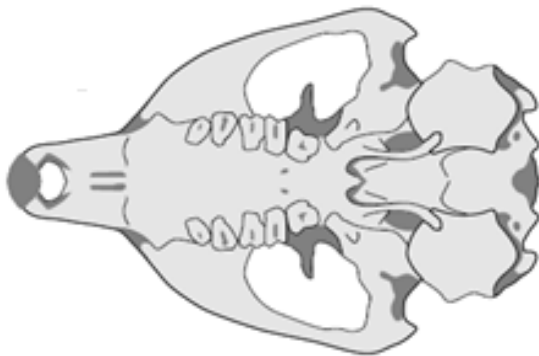




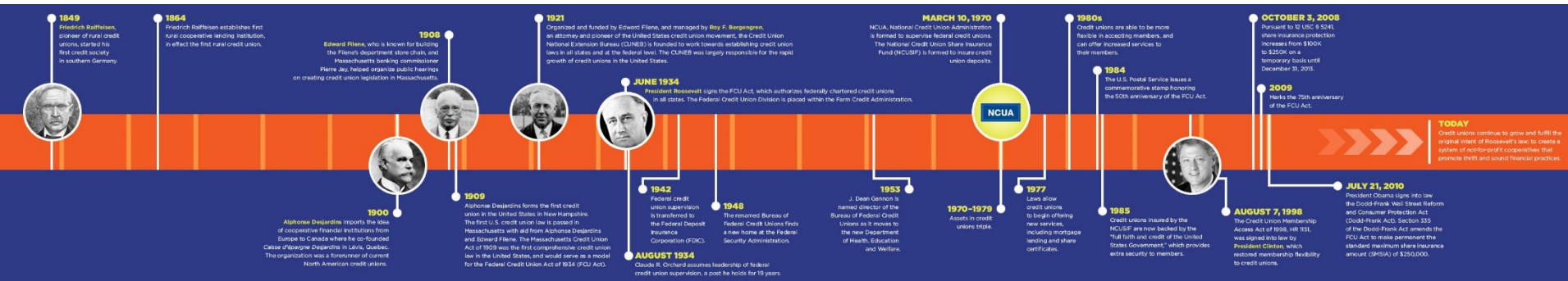
**Look at these three organisms.  
Each fossil comes from a  
different time on the Geologic  
Time Scale. Are they similar?  
How?**



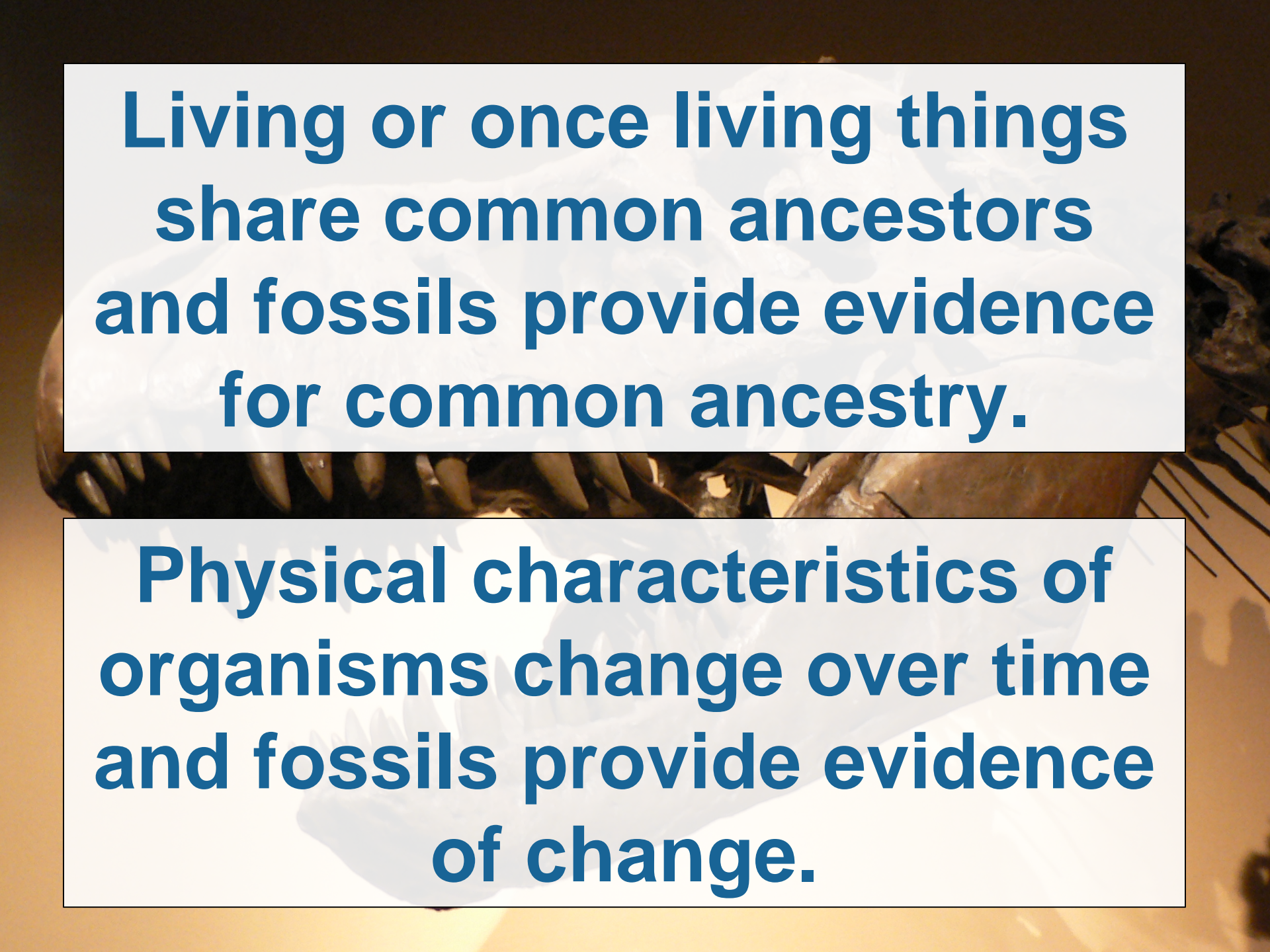
# What can we learn from these two fossil comparisons?



# Complete What Came First Timeline activity



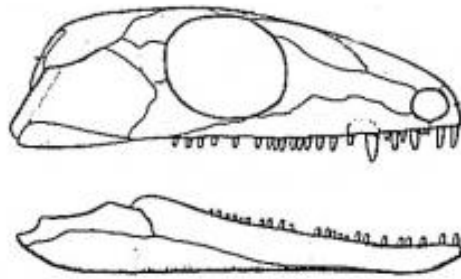


The background of the slide is a close-up photograph of a fossilized skull, likely from a prehistoric animal, showing a row of sharp, pointed teeth. The fossil is set against a dark, textured background.

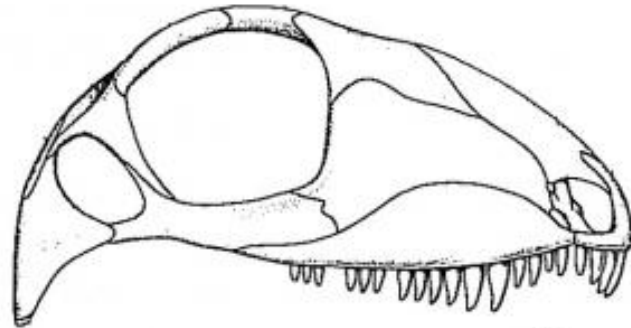
**Living or once living things  
share common ancestors  
and fossils provide evidence  
for common ancestry.**

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

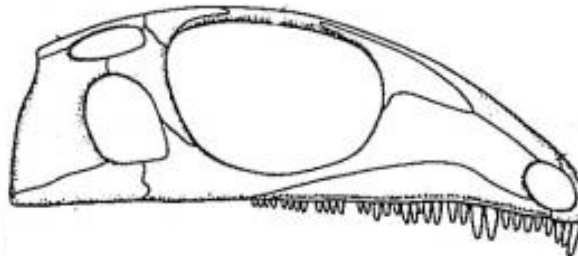
**Living or once living things  
share common ancestors and  
fossils provide evidence for  
common ancestry.**



**Early amniotes and modern turtles**



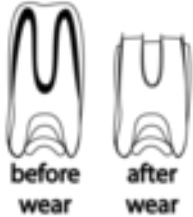










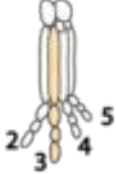



**Mammals and their ancestors**




**Most reptiles, dinosaurs and birds**

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

Whole Animal (height)	Forefeet	Molar teeth
 1.6 m modern horse ( <i>Equus</i> )		 before wear    after wear
 1.25 m <i>Pliohippus</i>		
 1.0 m <i>Merychippus</i>		 note complete covering of cement
 0.6 m <i>Mesohippus</i>		
 0.4 m <i>Hyracotherium</i>		 enamel dentine cement





# 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?**



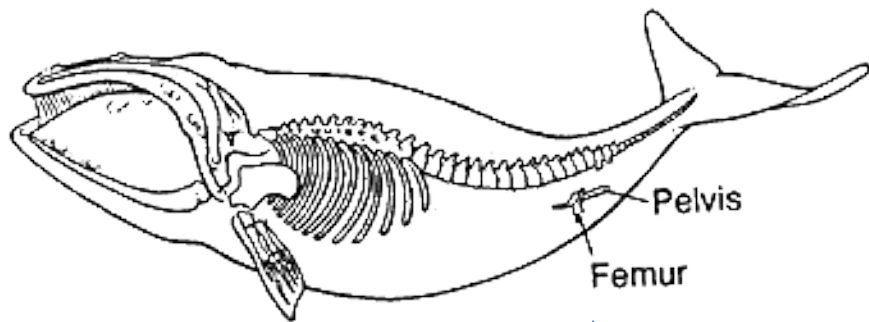
# **Similarities in Structure and Development provide evidence for the Theory of Evolution.**



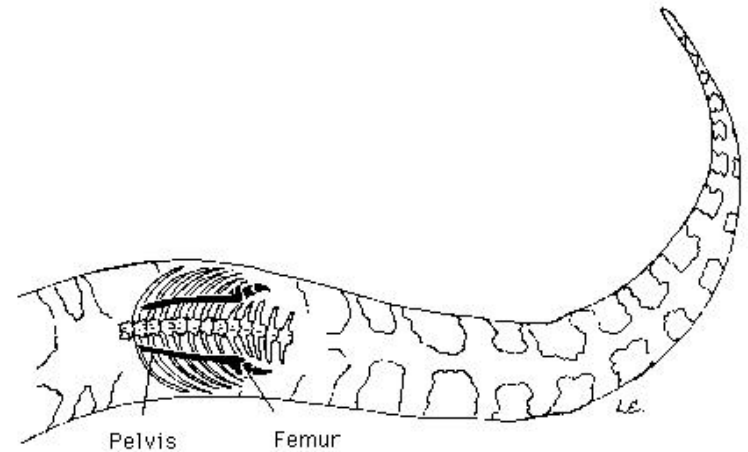


**Vestigial Structures are physical structures that were fully developed and functional in an ancestral group of organisms but are reduced and unused in later species.**

# Vestigial Structure Examples

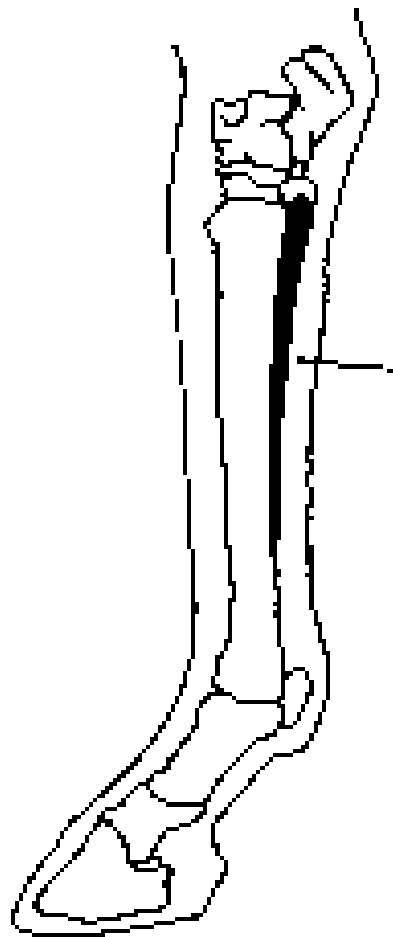


**In the bodies of  
whales there are small  
leg bones**



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

# Vestigial Structure Examples



Splint

rudiment of  
once-functional side toe

**Vestigial toe  
in the horse**

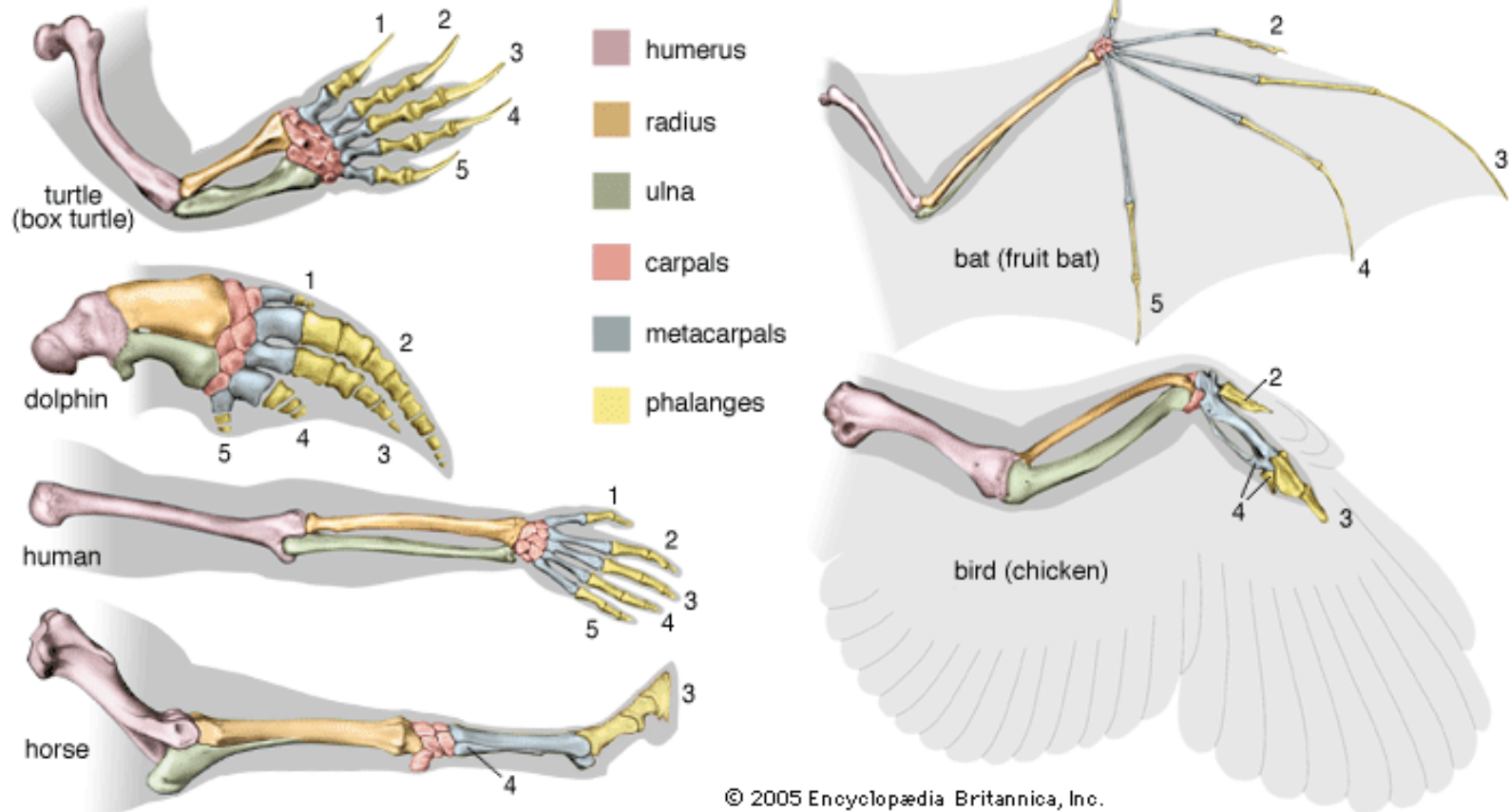




**What is a structure no longer needed by modern humans but we still have?**

# Similar Structures with Different Functions

Homologies of the forelimb in six vertebrates



# Similarities in Development





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

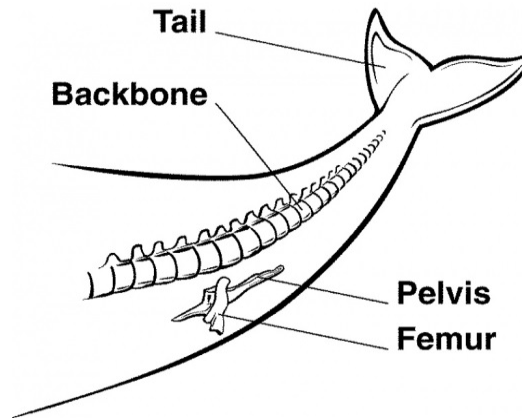




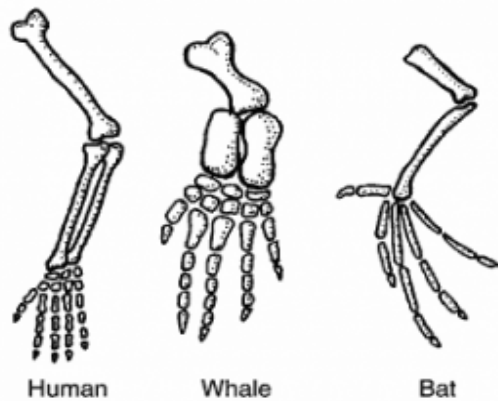
**In the previous slides we have identified the following evidence of evolution: Fossils, Similarities in Structure and Development, and DNA.**

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

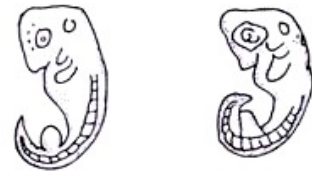
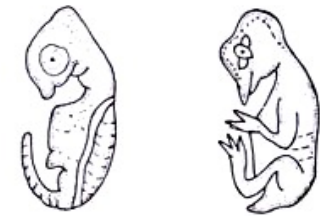
Describe  
how each  
figure  
above  
provides  
evidence  
for  
evolution.



**Figure 1**



**Figure 2**



REPTILE



BIRD

**Figure 3**





# The Great Fossil Activity