Biology

FOSSIL EVIDENCE FOR EVOLUTION

You are responsible for knowing all the information contained below. Read the passage before completing the assignment.

Scientists have good evidence that the earth is very old, approximately four and one-half billion years old. Scientists use radiometric dating on rocks to help determine their age. Scientists also use direct evidence from observations of the rock layers themselves to help determine the relative age of rock layers. Specific rock formations are indicative of a particular type of environment existing when the rock was being formed. For example, most limestones represent marine environments, whereas, sandstones with ripple marks might indicate a shoreline habitat or a riverbed.

Why is it important to note the type of sediment surrounding found fossils? _____

_____

Scientists proposed that rock layers could be correlated (connected) from place to place. Locally, physical characteristics of rocks can be compared. On a larger scale, even between continents, fossil evidence can help in connect rock layers. The Law of Superposition, which states that the oldest rock layers will be on the bottom and the younger rocks on top, helps geologists connect rock layers around the world. This also means that fossils found in the lowest levels in a sequence of layered rocks represent the oldest record of life there. By matching partial sequences, the oldest layers with fossils can be worked out.

Explain the Law of Superposition in <u>your own</u> words: _____

_____

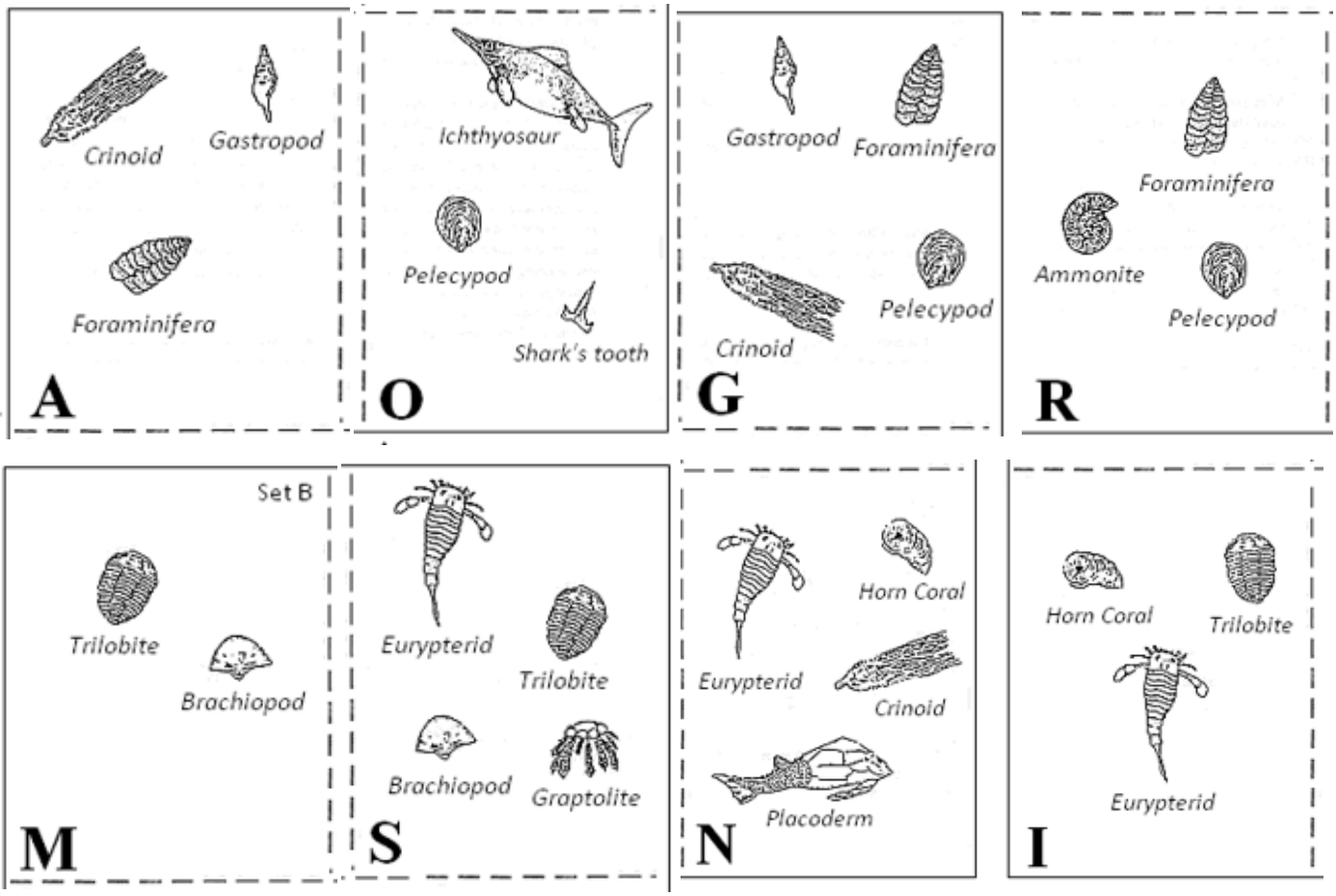
By correlating (connecting) fossils from various parts of the world, scientists are able to give relative ages to different rock layers. This is called relative dating. Relative dating tells scientists if a rock layer is "older" or "younger" than another. This would also mean that fossils found in the deepest layer of rocks in an area would represent the oldest forms of life in that particular rock formation. In reading earth history, these layers would be "read" from bottom to top or oldest to most recent. By using this information from rock formations in various parts of the world and correlating the studies, scientists have been able to establish the geologic time scale. This relative time scale divides the vast amount of earth history into various sections based on geological events (sea encroachments, mountain-building, and depositional events), and notable biological events (appearance, relative abundance, or extinction of certain life forms).

What is the geological time scale? _____

_____

***<u>Instructions</u>*: Look at your fossil cards. You will place them in order from oldest to youngest. Use the types of fossils found on each layer to help you. Look for similar fossils to layer your cards one on top of the other. The OLDEST layer is the letter M. Once you have completed your fossil layers complete the Interpreting Fossils Worksheet.**

Cut cards out and put in order from oldest fossils (on the bottom) to youngest fossils (on the top). There should be fossils in common between layers touching each other.



INTERPRETING FOSSILS IN ROCK LAYERS

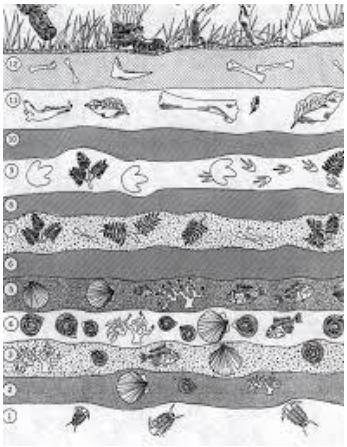
Interpretation Questions:

1) Using the letters printed in the lower left-hand corner of each card, write the sequence of letters from the youngest layer to the oldest layer (i.e., from the top of the vertical stack to the bottom). This will enable your teacher to quickly check whether you have the correct sequence.

Youngest ⟶ Oldest

2) Fossils in an area allow a scientist to infer what type of environment was present in the area at the time of the fossil. In the desserts of West Texas you can find fossils of seashells. What type of environment once covered West Texas?

3) Based on the fossil layer below answer the questions.

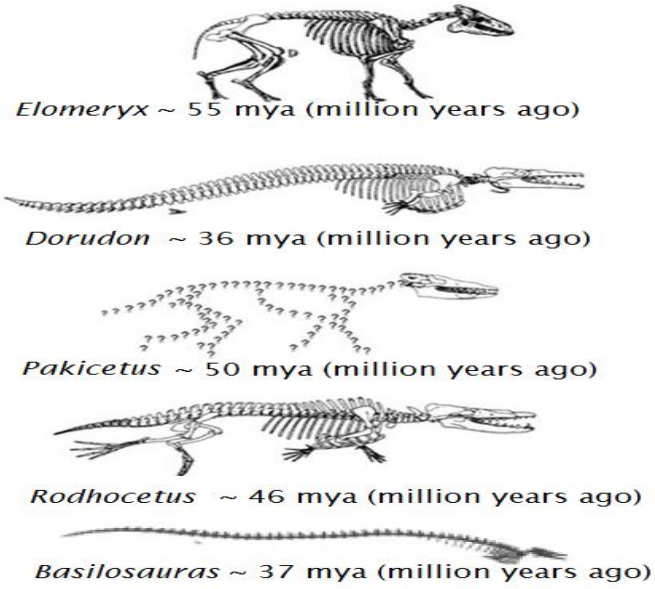


Which rock layer would be the oldest?

Which rock layer would be youngest?

Explain how the environment has changed in this particular area. Refer to the fossil layers as evidence.

4) Below are fossils of whale ancestors. Number them 1 – 5. #1 being the oldest.



Amino Acid Sequences and Evolutionary Relationships

Another technique used to determine evolutionary relationships is to study the biochemical similarity of organisms. Though molds, aardvarks, and humans appear to have little in common physically, a study of their proteins reveals certain similarities. Biologists have perfected techniques for determining the sequence of amino acids in proteins. By comparing the amino acid sequences in homologous proteins of similar organisms and of diverse organisms, evolutionary relationships that might otherwise go undetected can be determined. Biologists believe that the greater the similarity between the amino acid sequences of two organisms, the closer their relationship. Conversely, the greater the differences, the more distant the relationship. Further, biologists have found that such biochemical evidence compares favorably with other lines of evidence for evolutionary relationships.

In this investigation, you will compare amino acid sequences in proteins of several vertebrates. You will also study amino acid differences and infer evolutionary relationships among some diverse organisms.

1. **What is compared among organisms in biochemical similarity studies for evolution?**

2. **How do Biologists use DNA sequencing to explain the evolutionary relationships among organisms?**

In the image below, highlight the HUMAN amino acids from 87 to 101 then from 102 to 116. Using the human amino acids for comparison, highlight any amino acids that differ from the human on the other organisms.

	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101
Human	THR	LEU	SER	GLU	LEU	HIS	CYS	ASP	LYS	LEU	HIS	VAL	ASP	PRO	GLU
Chimpanzee	THR	LEU	SER	GLU	LEU	HIS	CYS	ASP	LYS	LEU	HIS	VAL	ASP	PRO	GLU
Gorilla	THR	LEU	SER	GLU	LEU	HIS	CYS	ASP	LYS	LEU	HIS	VAL	ASP	PRO	GLU
Rhesus monkey	GLN	LEU	SER	GLU	LEU	HIS	CYS	ASP	LYS	LEU	HIS	VAL	ASP	PRO	GLU
Horse	ALA	LEU	SER	GLU	LEU	HIS	CYS	ASP	LYS	LEU	HIS	VAL	ASP	PRO	GLU
Kangaroo	LYS	LEU	SER	GLU	LEU	HIS	CYS	ASP	LYS	LEU	HIS	VAL	ASP	PRO	GLU

	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116
Human	ASN	PHE	ARG	LEU	LEU	GLY	ASN	VAL	LEU	VAL	CYS	VAL	LEU	ALA	HIS
Chimpanzee	ASN	PHE	ARG	LEU	LEU	GLY	ASN	VAL	LEU	VAL	CYS	VAL	LEU	ALA	HIS
Gorilla	ASN	PHE	LYS	LEU	LEU	GLY	ASN	VAL	LEU	VAL	CYS	VAL	LEU	ALA	HIS
Rhesus monkey	ASN	PHE	LYS	LEU	LEU	GLY	ASN	VAL	LEU	VAL	CYS	VAL	LEU	ALA	HIS
Horse	ASN	PHE	ARG	LEU	LEU	GLY	ASN	VAL	LEU	ALA	LEU	VAL	VAL	ALA	ARG
Kangaroo	ASN	PHE	LYS	LEU	LEU	GLY	ASN	ILE	ILE	VAL	ILE	CYS	LEU	ALA	GLU

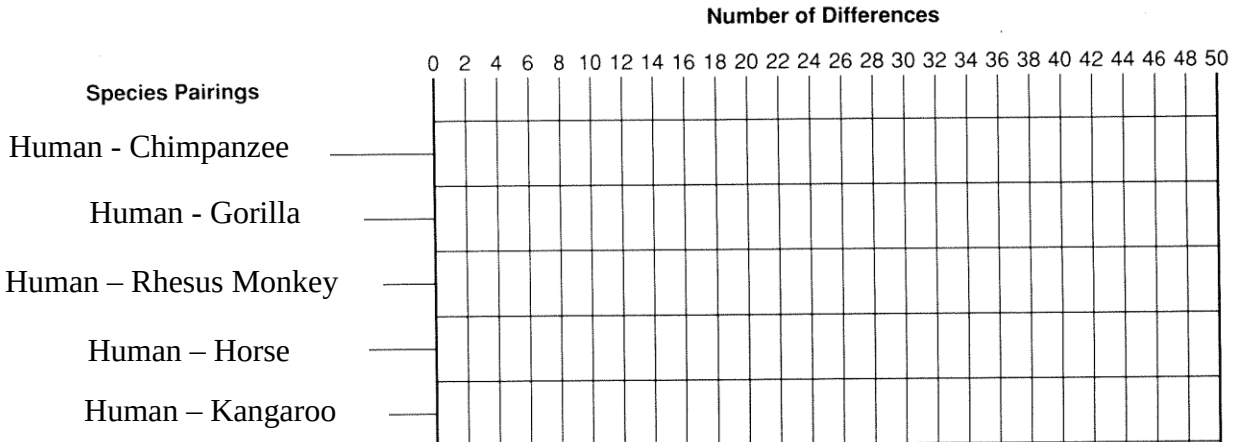
3. **Count the number of differences you highlighted for each organism and record them in the table below.**

Organisms	Number of Amino Acid Differences
Human and Chimpanzee	
Human and Gorilla	
Human and Rhesus monkey	
Human and Horse	
Human and Kangaroo	

4. **According to the number of differences in amino acids of this protein, which of the animals tested is the human the closest related to? _____ How do you know this?**

5. **According to the number of differences in amino acids of this protein, which of the animals tested is the human the least related to? _____ How do you know this?**

6. **Graph the data from the table above below:**



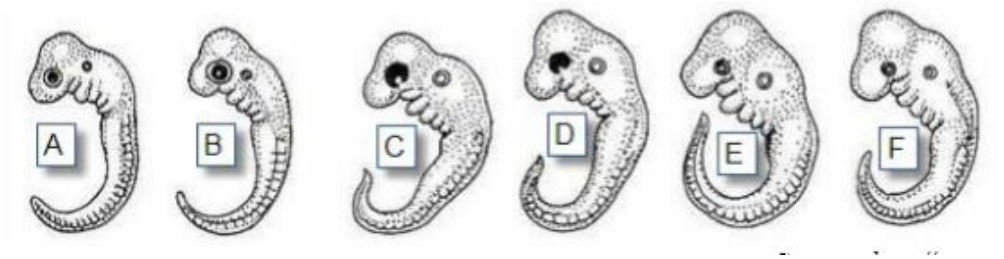
7. **There is a difference of only 1 amino acid between humans and gorillas for this one protein. What might have caused this difference?**

8. **If the amino acid sequences are similar between two organisms, why will the DNA also be in a similar sequence?**

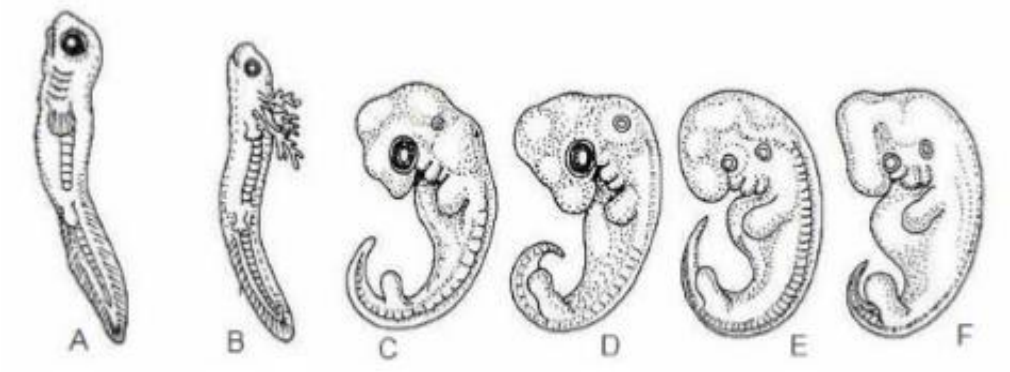
Embryology

Organisms that are closely related may also have physical similarities before they are even born. Take a look at the six vertebrate embryos below as they progress through the stages of gestation.

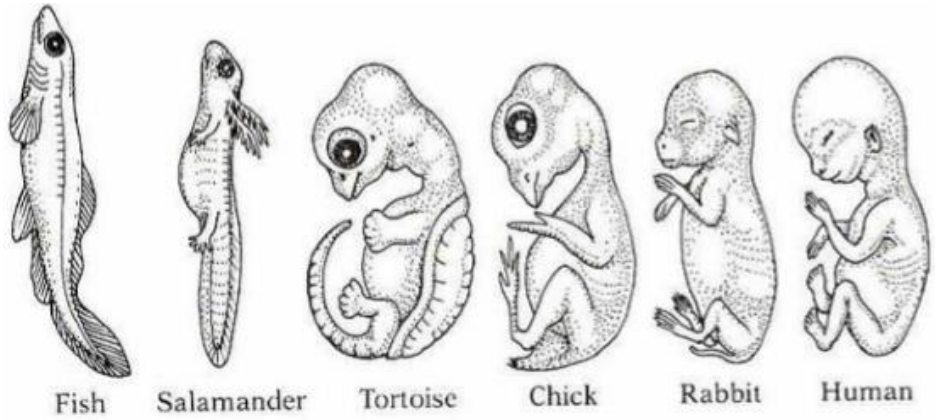
4 weeks gestation



10 weeks gestation



20 weeks gestation



1. Can you easily identify which embryo is the human and which is the salamander just by observing the embryos at 4 weeks gestation? Explain why or why not.

2. Look at the embryos at 4 weeks gestation, how do they compare?

3. ALL vertebrate embryos have gill slits and tails. Circle all the gill slits at 10 weeks. Circle all the tails at 4 weeks.

4. What other physical similarities do you observe between the embryos?

5. Explain how these embryos can be used as evidence of a common ancestor between each of these six organisms.

Get signed off before moving on _____