

Name: _____ Date: _____ Class: _____






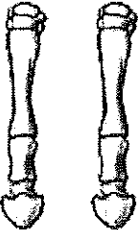


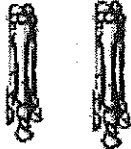
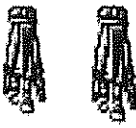
Evidence of Evolution

Background

When Charles Darwin first proposed the idea that all new species descend from an ancestor, he performed an exhaustive amount of research to provide as much evidence as possible. Today, the major pieces of evidence for this theory can be broken down into the fossil record, embryology, comparative anatomy, and molecular biology.

Fossils

This is a series of skulls and front leg fossils of organisms believed to be ancestors of the modern-day horse.

				
				
Equus (modern horse)	Pliohippus	Merychippus	Meshippus	Eohippus (Dawn Horse)

Source: <http://www.iq.poquoson.org>

1. Give two similarities between each of the skulls that might lead to the conclusion that these are all related species.

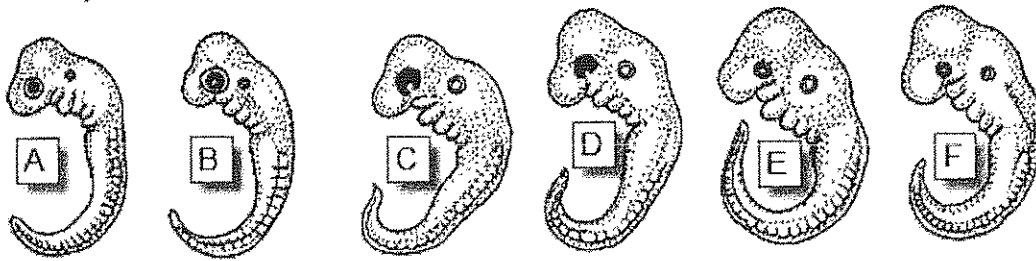
2. What is the biggest change in skull anatomy that occurred from the dawn horse to the modern horse?

3. What is the biggest change in leg anatomy that occurred from the dawn horse to the modern horse?

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Embryology

Organisms that are closely related may also have physical similarities before they are even born! Take a look at the six different embryos below:

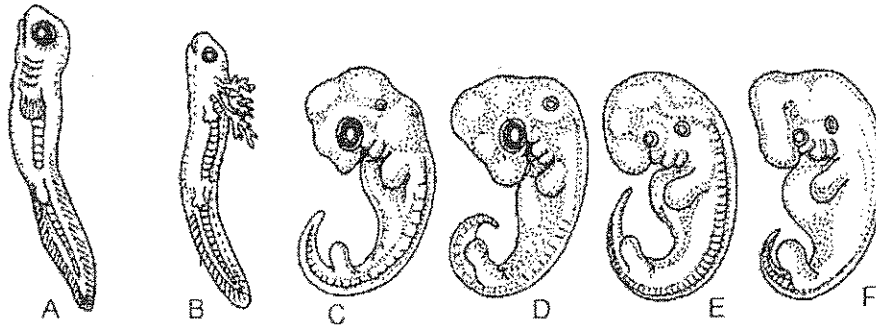


Source: <http://www.starlarvae.org>

Hypothesize which embryo is from each of the following organisms:

Species	Embryo
Human	
Chicken	
Rabbit	
Tortoise	
Salamander	
Fish	

These are older, more developed embryos from the same organisms.

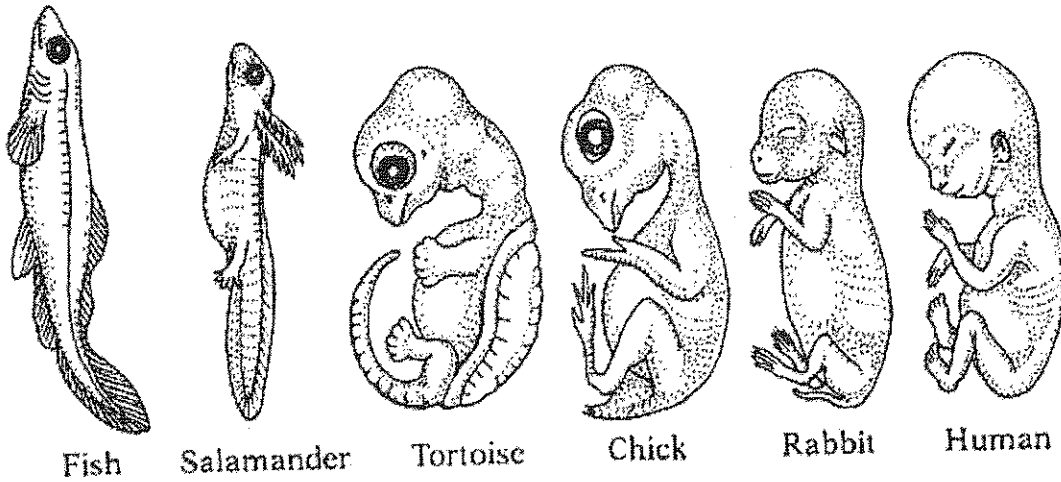


Hypothesize which embryo is from each of the following organisms:

Species	Embryo
Human	
Chicken	
Rabbit	
Tortoise	
Salamander	
Fish	

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These are embryos at their most advanced stage, shortly before birth.



Describe how the embryos changed for each of these organisms from their earliest to latest stages.

Species	Anatomical Changes From Early to Late Stages
Human	
Chicken	
Rabbit	
Tortoise	
Salamander	
Fish	

1. Look again at the six embryos in their earliest stages. Describe the patterns you see. What physical similarities exist between each of the embryos?

2. Does this suggest an evolutionary relationship? Explain how these embryos be used as evidence of a common ancestor between each of these six organisms?

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Molecular Biology

Cytochrome c is a protein found in mitochondria. It is used in the study of evolutionary relationships because most animals have this protein. Cytochrome c is made of 104 amino acids joined together.

Below is a list of the amino acids in part of a cytochrome protein molecule for 9 different animals. Any sequences exactly the same for all animals have been skipped.

For each non-human animal, take a highlighter and mark any amino acids that are different than the human sequence. When you finish, record how many differences you found in the table on the next page.

	42	43	44	46	47	49	50	53	54	55	56	57
Human	Q	A	P	Y	S	T	A	K	N	K	G	I
Chicken	Q	A	E	F	S	T	D	K	N	K	G	I
Horse	Q	A	P	F	T	T	D	K	N	K	G	I
Tuna	Q	A	E	Y	S	T	D	K	S	K	G	I
Frog	Q	A	A	F	S	T	D	K	N	K	G	I
Shark	Q	A	Q	F	S	T	D	K	S	K	G	I
Turtle	Q	A	E	F	S	T	E	K	N	K	G	I
Monkey	Q	A	P	Y	S	T	A	K	N	K	G	I
Rabbit	Q	A	V	F	S	T	D	K	N	K	G	I

	58	60	61	62	63	64	65	66	100	101	102	103	104
Human	I	G	E	D	T	L	M	E	K	A	T	N	E
Horse	T	K	E	E	T	L	M	E	K	A	T	N	E
Chicken	T	G	E	D	T	L	M	E	D	A	T	S	K
Tuna	V	N	N	D	T	L	M	E	S	A	T	S	-
Frog	T	G	E	D	T	L	M	E	S	A	C	S	K
Shark	T	Q	Q	E	T	L	R	I	K	T	A	A	S
Turtle	T	G	E	E	T	L	M	E	D	A	T	S	K
Monkey	T	G	E	D	T	L	M	E	K	A	T	N	E
Rabbit	T	G	E	D	T	L	M	E	K	A	T	N	E

Animal	Number of Amino Acid Differences Compared to Human Cytochrome C	Animal	Number of Amino Acid Differences Compared to Human Cytochrome C
Horse		Shark	
Chicken		Turtle	
Tuna		Monkey	
Frog		Rabbit	

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Molecular Biology – Summary Questions

1. Based on the Cytochrome C data, which organism is most closely related to humans?
2. Do any of the organisms have the same number of differences from human Cytochrome C? In situations like this, how would you decide which is more closely related to humans?

Conclusion

1. Charles Darwin published his book *On the Origin of Species* in 1859. Of the different types of evidence that you have examined, which do you think he relied upon the most, and why?
2. Given the amount of research and evidence available on evolution, why is it classified as a theory?