4/10/19 HW: Activity Evidence of Evolution due 4/11/19

DO NOW: Copy the following:

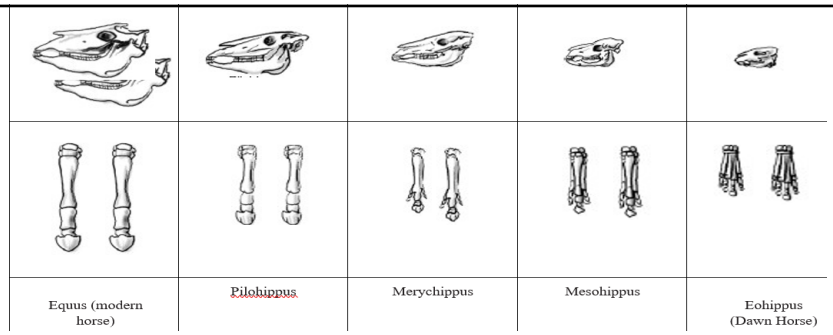
- **F** - Evidence from **F**ossil records - horse
- **A** - Analysis of body structures (**Anatomy**) - Homologous
- **M** - Analysis of biochemical material (**Molecular**) (DNA)
- **E** - **Embryonic similarities**

Quiz: Friday Evidence of Evolution

				
Now Equus (modern horse) (most recent)	Pilohippus	Merychippus	Mesohippus	Eohippus (Dawn Horse) oldest

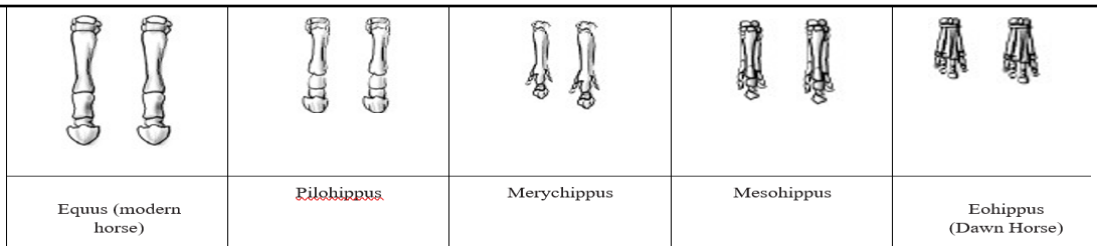
Give two similarities between each of the skulls that might lead to the conclusion that these are all related species.

the pointy bone on top of the muzzle of the horse and the triangular shape of the head and the gap between front and rear teeth



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

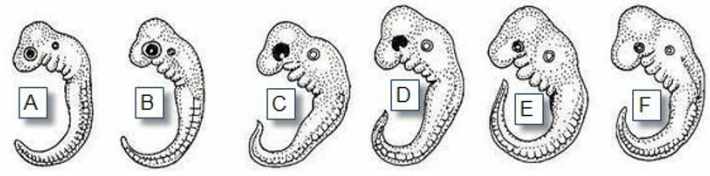
Increase in the size of the skull; a shift from cusps to complex ridges on the grinding surface of the premolars and molars; elongation of the face and of the space between the incisors and cheek teeth; an anterior shift of the cheek teeth so they lie forward of the eye; a deep lower jaw bone;



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

Fifty five million years ago, there was an animal the size of a small dog, called *Hyracotherium* (sometimes called *Eohippus*). Its front feet had four toes, and its back feet had three. Modern horse feet have a single hoof. We see the reduction and loss of the side toes and the modern horse's single toe.

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

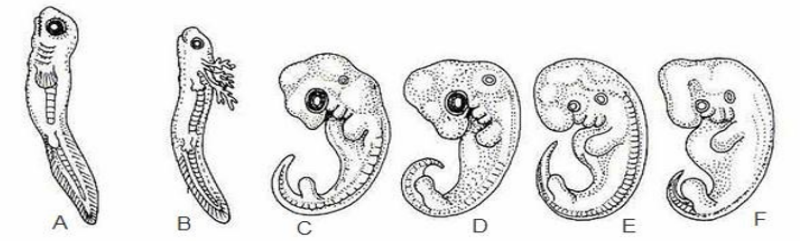


Source: http://www.starlarvae.org

Hypothesize which embryo is from each of the following organisms:

Species	Embryo
Human	
Chicken	
Rabbit	
Tortoise	
Salamander	
Fish	

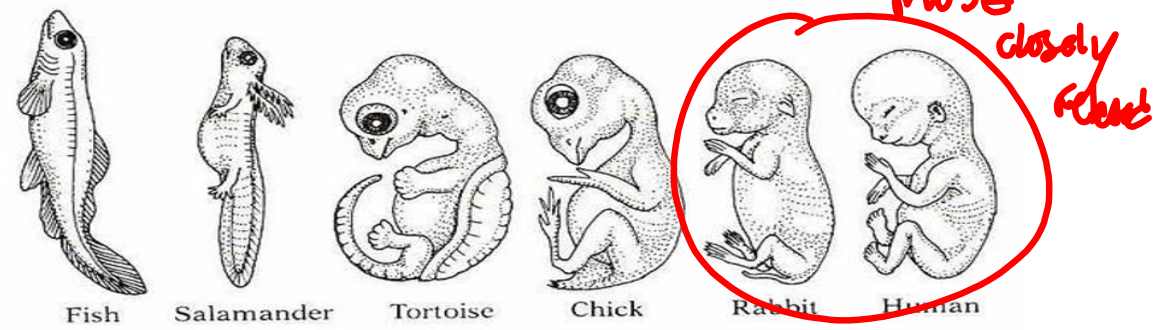
These are older, more developed embryos from the same organisms.



Hypothesize which embryo is from each of the following organisms:

Species	Embryo
Human	F
Chicken	D
Rabbit	E
Tortoise	C
Salamander	B
Fish	A

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.

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

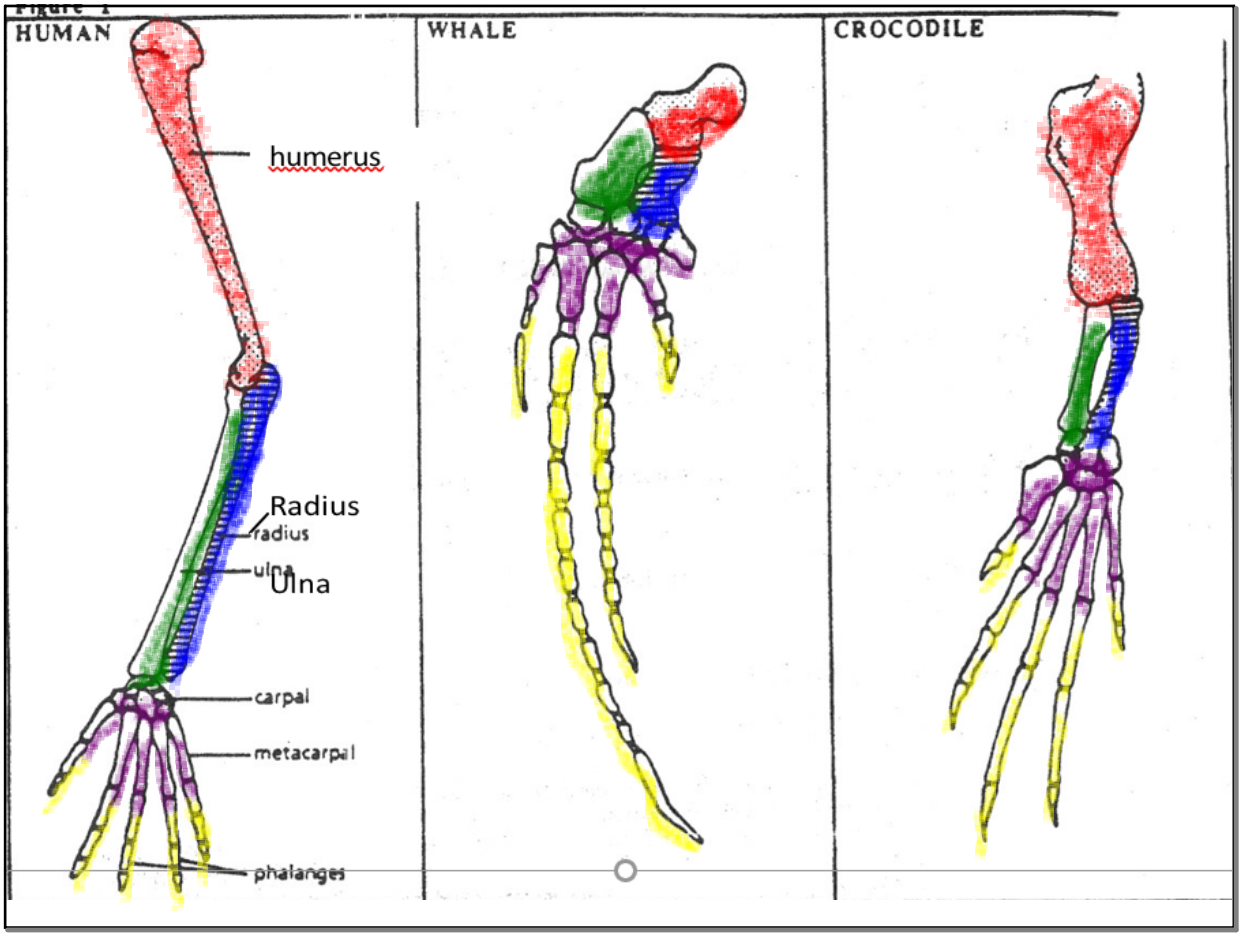
Species	Anatomical Changes From Early to Late Stages
Human	Developed limbs, defined features in face, neck, ears, loss of tail, tiny fingers present
Chicken	Developed beak, tail shorter, wings and legs developed, head quite large
Rabbit	Tail gone, developed limbs, detailed features in ears and mouth
Tortoise	Shell developed, limbs have developed, tail is thinner, large belly, long tail, beak
Salamander	Has gills, tail and large underbelly
Fish	fins developed, gills, tail and scales

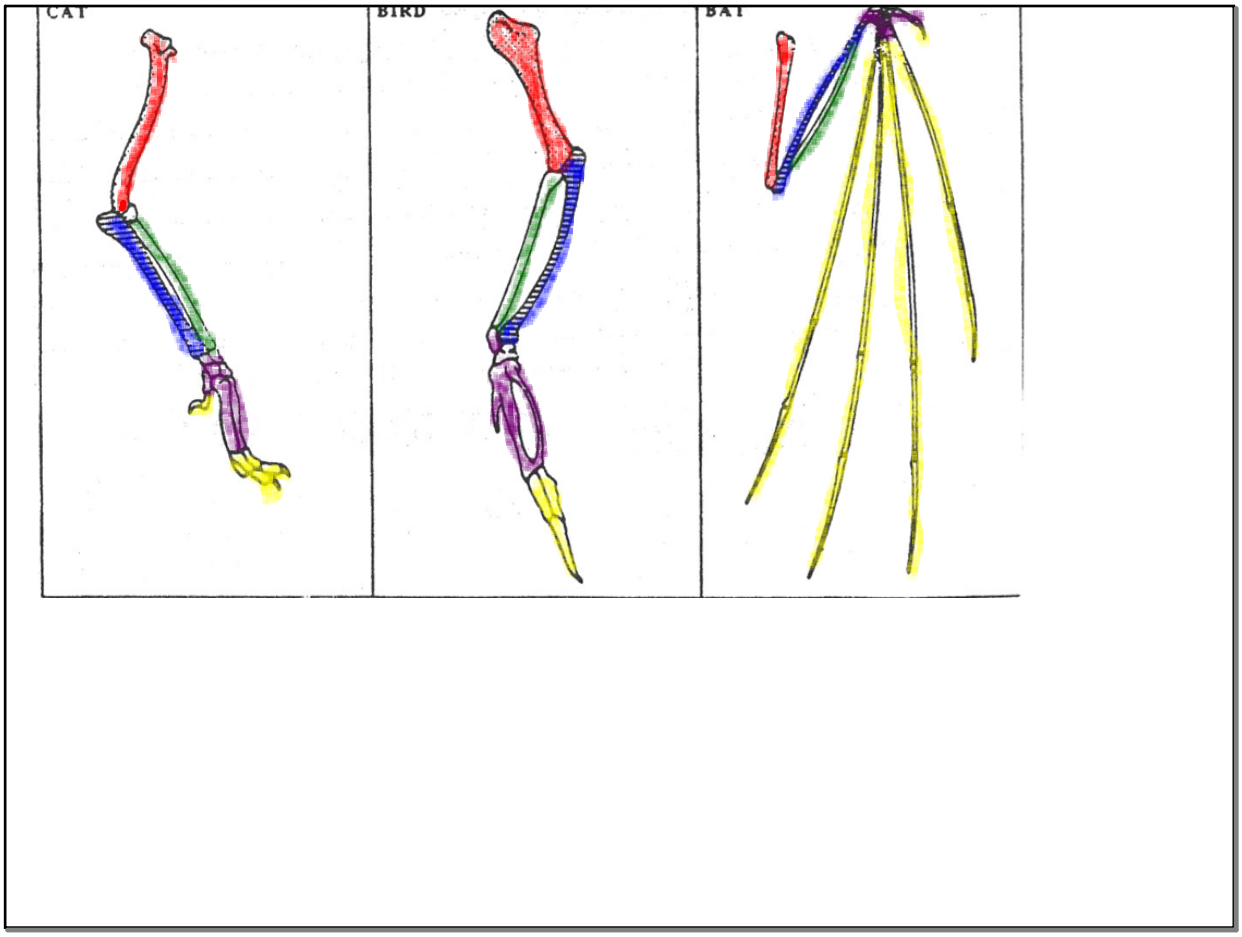
1. **Look again at the six embryos in their earliest stages. Describe the patterns you see. What physical similarities exist between each of the embryos?**

Same basic shape, circular spots (eyes) and underbelly, all have tails, tiny bumps on underside, hole for ear

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

Examination of vertebrate embryos reveals that during corresponding stages of early development, the embryos appear to be very similar. For example, all vertebrate embryos pass through stages in which they have gill pouches. The pouches eventually develop into the gill apparatus in fish; in laterevolving vertebrates that do not have gills, the gill pouches undergo further refinement and develop into structures associated with the head and neck. Similarly, all early vertebrate embryos have tails, which persist in some animals but regress during the later stages of development of humans. Thus, the individual development of an animal occurs through a series of stages that paint a broad picture of the evolutionary stages (phylogeny) of the species to which it belongs. "Ontogeny recapitulates Phylogeny", Haeckel


HUMAN
WHALE
CROCODILE
humerus
Radius
radius
ulna
Ulna
carpal
metacarpal
phalanges


CAT
BIRD
BAT

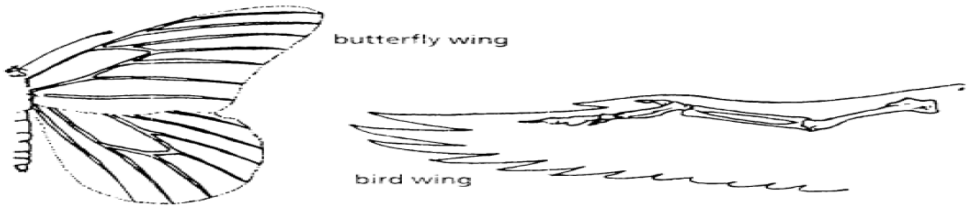
PART I. HOMOLOGOUS STRUCTURES (definition): similar structures that related organisms share from a common ancestor.

ANIMAL	FUNCTION OF STRUCTURE
HUMAN	Using tools, picking up and holding objects
WHALE	swimming
CAT	running, walking, jumping
BAT	flying, flapping wings
BIRD	Flying, flapping wings
CROCODILE	swimming, walking/crawling

c. Are the bones arranged in a similar way in each animal? The bones are not arranged exactly the same way, but all of the bones are the same in each of the animals.

Analogous structures have very different anatomies but similar functions. These are seen in organisms that are not necessarily closely related, but live in similar environments and have similar adaptations

Compare the anatomy of the butterfly and bird wing below.



1. What is the function of each of these structures?
flying and gliding

2. How are theses structures different? .

There are 2 pieces of the wing in butterfly. There are feathers on a bird's wing. There are bones in a bird's wing and none in the butterfly.

1. Do birds and insects share any structural (elements inside the wing) similarities that would suggest they are closely related taxonomically? No, the bird has bones inside of its wing the butterfly does not. They are not closely related.

Vestigial Structures: Gradual changes have occurred through time that have in some cases reduced or removed the function of some body structures and organs. The penguin's wings and the leg bones of snakes are examples of this phenomenon.

1. **The cavefish and minnow shown in Figure 3 are related, but the cavefish is blind.**

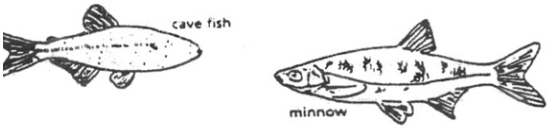


Figure 3.

1. **Explain why eyesight is not an important adaptation to life in a cave.** **There is NO light in a cave. All living things need light to see. Eyesight is not a sense that the cave fish can use in darkness.**

b. What do you think has become the most important adaptation of the cave fish (think about senses)? (explain your answer) **Developing their other senses such as sensitivity to vibrations, sounds, smells, taste and electrical impulses.**

1. **What about the internal structure of the cavefish and minnow suggest common ancestry?** **The arrangement of bones, muscles and other internal organs.**

Below are some vestigial structures found in humans. For each, hypothesize what its function may have been.

Structure	Possible function
Wisdom teeth	Extra grinding ability for vegetation
Appendix	Store "good" bacteria to fight infections or digest cellulose like the caecum in rabbits
Muscles for moving the ear	Better hearing by changing direction of ears
Body hair	Keeping warm Stop pathogens from getting to mucous membranes Trap pheromones/oil on body
Little toe	Balance/clinging on rocks/trees
Tailbone	Rear stabilizing limb, balance

1. Explain why the homologous structures in Part I are evidence of evolutionary relationships. The homologous structures all have the same bones, humerus, raidus, ulna, carpals, meta carpals and phalanges. This suggests that all of the organisms had a common ancestor, even though a bat's wing and human's arm have different functions.

2. Explain the evolutionary relationship between the fin of a fish and the flipper of a whale.

The fin of a fish and the filpper of a whale are analogous structures. They have the same job (function) but different internal structures. This suggests that the DO NOT share a recent common ancestor.

1. List two structures (not from Table 1) that you think are vestigial and explain why.

1. Human eyebrows: they are getting less and less bushy over time.

2. Pinky toe in humans: it is getting smaller and smaller in modern humans. It does not help us to walk climb etc.

1. HOMOLOGOUS STRUCTURES - structures such as bones that are similar in many different ortganisms that have shared a recent common ancestor. The more alike the structures are the more closely related the organisms are to one another.

2. ANALOGOUS STRUCTURES - Structures that have the same function, but NOT the same structure. A bird's wing and the wing of an insect.

3. VESTIGIAL ORGANS - sturctures that are small in size are no longer have a function or use in modern species. They are " left overs" from earlier times where they did have a use in our ancestors. Appendix, ear muscles, cocyx (tail) bone.