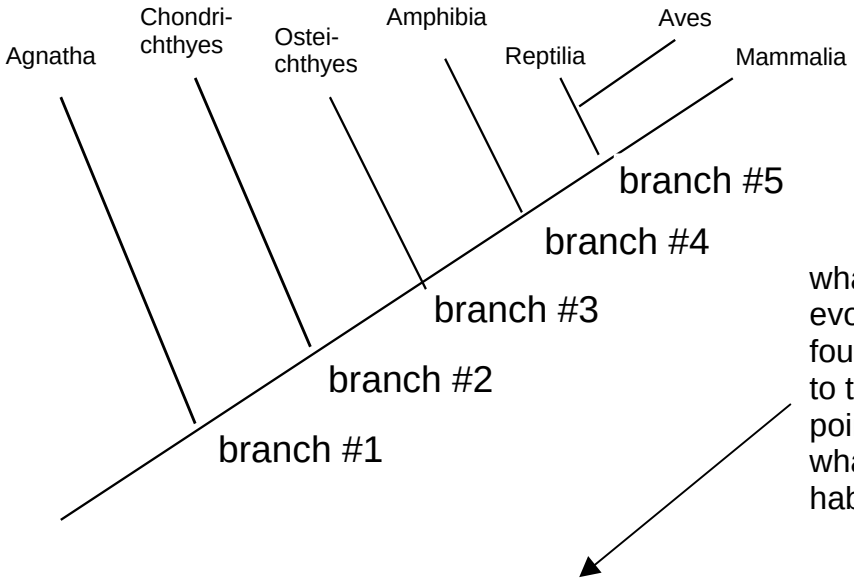
Question Set 1: Animal EVOLUTIONARY BIODIVERSITY

(a). We have mentioned several times in class that the concepts of "Developed" and "Evolved" are NOT the same. Please explain the principal differences between these terms and use a simple example to explain the correct uses of each term.

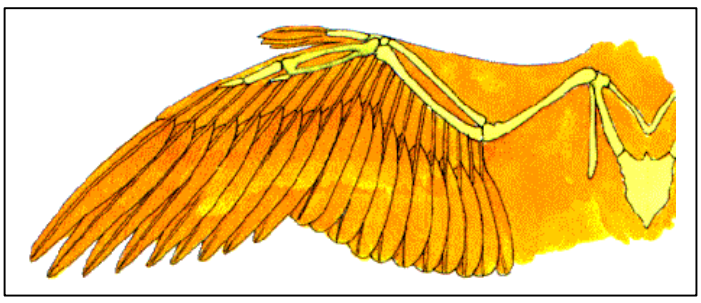
(5 pts)

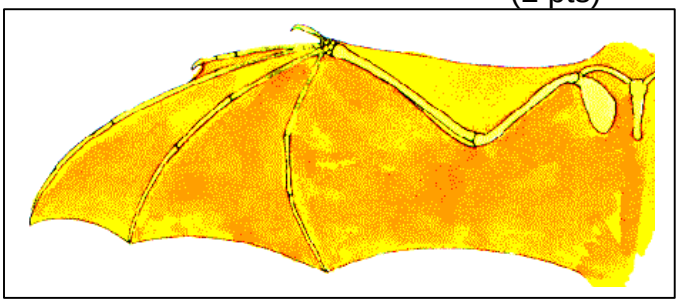
(b). Question 1, Consider the diagram below showing the evolutionary relationships (and 6 branch points) among the major groups of the chordate sub-phylum vertebrata:



In the spaces below, please list what major new characteristic(s) evolved and was/were subsequently found among animals who derived to the RIGHT at each numbered point #1-#5, and in addition state what major change(s) resulted in habitat and/or way of life

branch #1 - (2 pts)
branch #2 - (2 pts)
branch #3 - (2 pts)
branch #4 - (2 pts)
branch #5 - (2 pts)





Question 1 (c).

The figures show the structure of the wings of a bird (left) and bat (right). Note the form and function of the arm and hand bones in these two "wings". Are these "wings" homologous or analogous?

Please state your choice and write a brief essay including a definition of the terms homologous and analogous and refer to specific details visible in the figures above to support your choice.

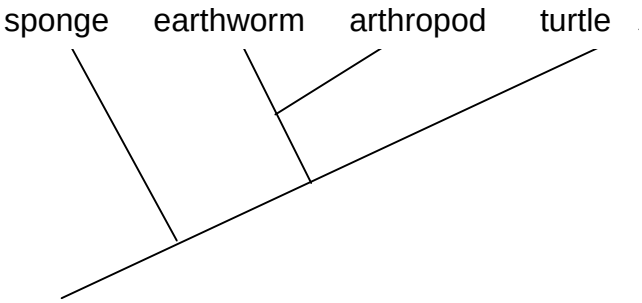
(10 pts)

Question Set 2: Skeletal Muscular.

(a). Please briefly explain the principal ecological problem(s) that the **skeletal muscular** system evolved to solve (hint: you must use the terms "evolution of complexity", "colonization of land" and "gravity" in your answer).

(5 pts)

(b). Please briefly explain the major trends in the evolution of the structure and function of the **skeletal** system among the four taxa depicted at right. (sponge, earthworm, arthropod, turtle)

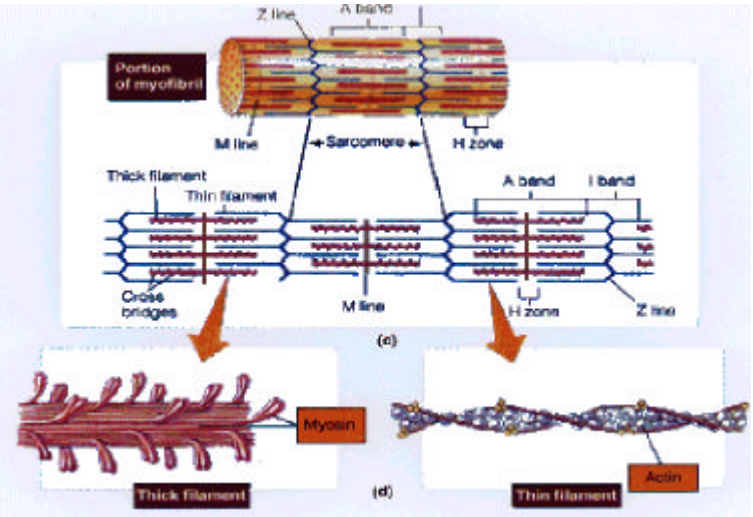


(5 pts)

(c). Please explain what cartilage is, and why it was replaced by bone in the evolution of the chordates.

(4 pts)

(d). Briefly explain how does a muscle contract. In your explanation please include the terms: myosin thick filaments, actin thin filaments, Z-lines, ATP (extra credit for tropomyosin, troponin, calcium).



(6 pts)

Question Set 3: Circulatory System.

(a). Please briefly explain the principal ecological problem(s) that the **circulatory** system evolved to solve (hint: you must use the terms “diffusion” and “metabolic rate” in your answer).

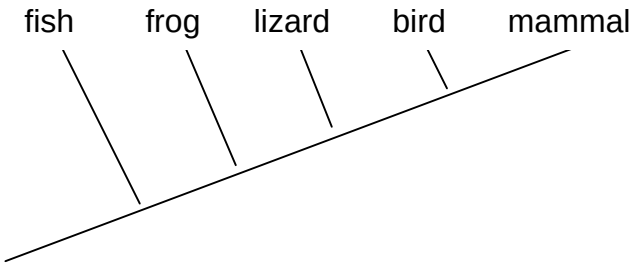
(5 pts)

(b). What are the two main types of circulatory system in the animal kingdom? Briefly describe how each works.

system 1 - (3 pts)

system 2 - (3 pts)

(c). Please briefly explain the major trends in the evolution of the structure and function of the **circulatory** system among the five depicted at right. (fish, frog, lizard, bird, and mammal) (hint you must include the term “metabolic rate” in your answer)



(5 pts)

(d). What is “vasodilation” and explain one important function that vasodilation serves.

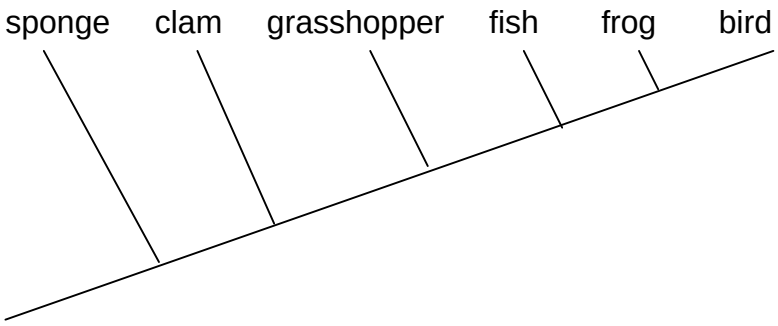
(2 pts)

Question Set 4: Respiratory System.

(a). Please briefly explain the principal ecological problem(s) that the **respiratory** system evolved to solve (hint: you must use the terms “diffusion” and “metabolic rate” in your answer).

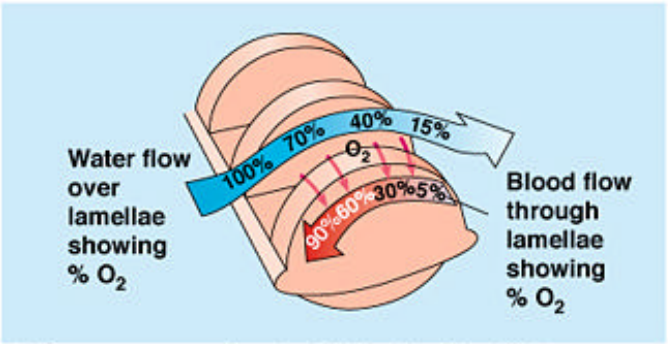
(5 pts)

(b) Please briefly explain the major trends in the evolution of the structure and function of the **respiratory** system among the six taxa depicted at right. (sponge, clam, grasshopper, fish, frog, bird)



(5 pts)

(c). In a counter current gas exchanger (such as in the gill of a fish at right), use the diagram and explain why the direction of <u>OXYGEN flow</u> is always from the water to the blood.



(a) Countercurrent flow (exhibited in fish gills)

(6 pts)

(d). List one advantage and one disadvantage of living in water regarding oxygen uptake.

(2 pts)

(e). List one advantage and one disadvantage of living in land regarding oxygen uptake.

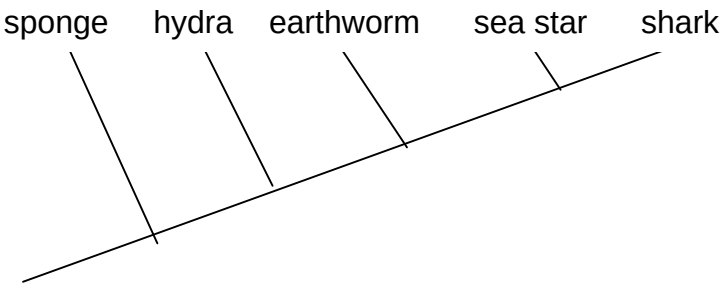
(2 pts)

Question Set 5: Digestive System.

(a). Please briefly explain the principal ecological problem(s) that the **digestive** system evolved to solve.

(5 pts)

(b). Please briefly explain the major trends in the evolution of the structure and function of the **digestive** system among the five taxa depicted at right. (sponge, hydra, earthworm, sea star, and shark)



(5 pts)

(c). List and briefly explain 3 specialized feeding adaptations

(5 pts)

(d). Explain the differences in the digestive systems of herbivores and carnivores

(5 pts)

Question Set 6: Reproductive System.

(a). The trend from asexual to sexual reproduction has been cited as a major evolutionary trend in reproduction among animals. Why might sexual reproduction be advantageous?

(5 pts)

(b).. Please list AND briefly explain 3 major evolutionary innovations in the evolution of sexual reproduction:

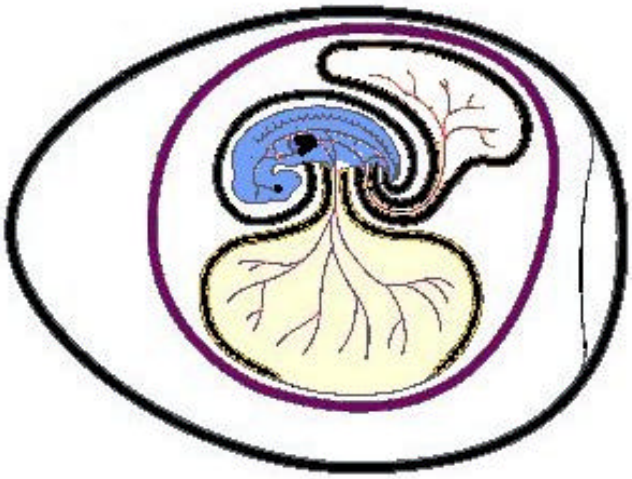
1 - (2 pts)
2 - (2 pts)
3 - (2 pts)

(c). What were the principal ecological challenges and evolved solutions to the evolution of the reproductive system as vertebrate animals colonized land?

(5 pts)

(d). On the diagram below of an amniotic egg, label the following (neatly connect an arrow from the word at left to the correct feature in the graphic at right):

(4 pts)



allantois

amnion

chorion

yolk sac

(e). Please briefly explain the function of the extra-embryo membranes (such as the amnion, chorion, and allantios) in the adaptation of the amniotic egg to terrestrial life. How did these design features enable embryos to survive in relatively dry soil.

(5 pts)

Question Set 7: Neuro Endocrine Systems.

(a). Please explain what are the major ecological challenges and functions of the nervous system?

(5 pts)

(b). Please list four of the major components of the nervous system of vertebrate animals.

(4 pts)

(c). Please BRIEFLY explain what are the major evolutionary trends in nervous system design among chordates?

(4 pts)

(d). How do nerves conduct impulses?

(4 pts)

(e). How do the nervous and endocrine systems work together? Please cite specific examples.

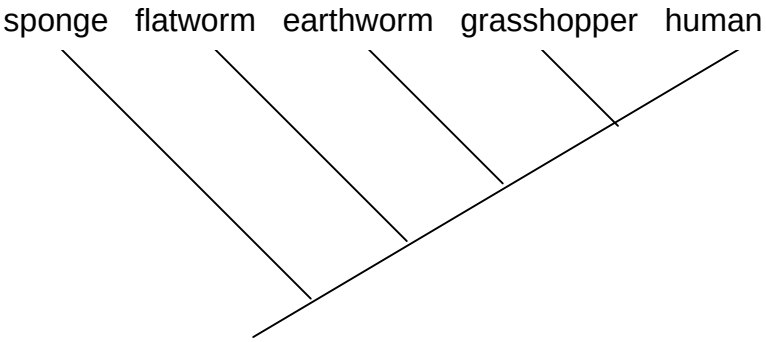
(4 pts)

Question Set 8: Excretory System.

(a). Please briefly explain the two principal ecological problem(s) that the **excretory** system evolved to solve.

(5 pts)

(b). Please briefly explain the major trends in **excretory** system evolution among the taxa depicted at right. (sponge, flatworm, earthworm, grasshopper, human)



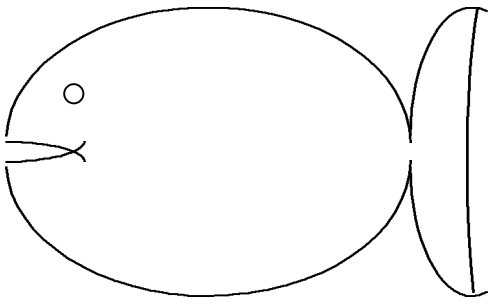
(5 pts)

(c). What are some of the major advantages and disadvantages of excreting ammonia, urea, versus uric acid. Name one animal or taxa that excrete each

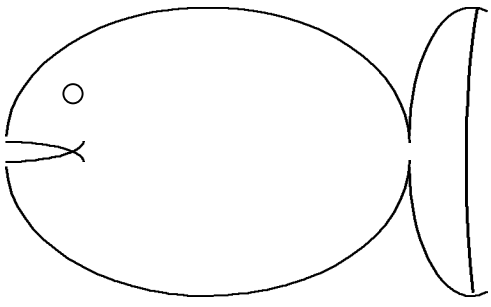
(5 pts)

(d). Please compare and contrast the osmoregulatory challenges and adaptations of a marine vs. a freshwater bony fish. Please use the sketches below in your explanation.

(8 pts)



Marine fish



Freshwater fish

Question 10: WHAT SYSTEM DID YOU STUDY? _____

What is the one really good question ON YOUR SYSTEM that you w ere prepared to answer that we did not ask you? And, what is the answer to that question?

(a). the ESSAY question we didn't ask ON YOUR SYSTEM -

(note: think carefully about what question you put down here – it must be a question that warrants a detailed response of at least ½ a page. Your maximum score for part (b) will depend on the degree of difficulty of the question you ask here [just like diving!])

(5 pts)

(b). its answer - (10 pts)

Question 10 (con.): What is the one really good question ON A SYSTEM **OTHER THAN** YOUR STUDY SYSTEM that you were prepared to answer that we did not ask you? And, what is the answer to that question?

(c). the ESSAY question we didn't ask on a DIFFERENT SYSTEM –

(note: think carefully about what question you put down here – it must be a question that warrants a fairly detailed response of at least ½ a page. Your maximum score for part (b) will depend on the degree of difficulty of the question you ask here [just like diving!]))

(5 pts)

(d). its answer - (10 pts)