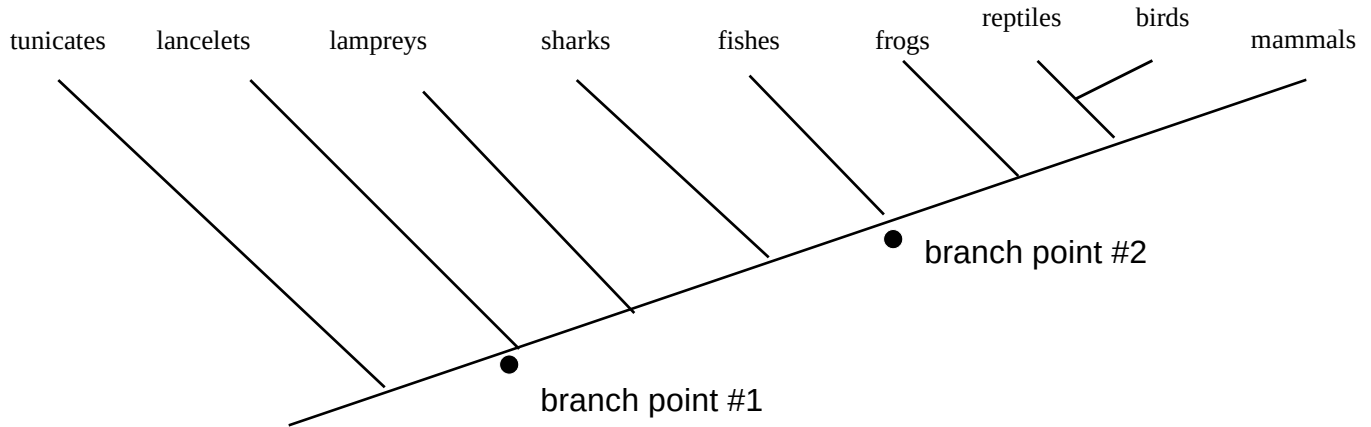


Biology 154 Practical Exam 2, Wed 22 April 1998

Question 1. Skeletal-Muscular System. This question will assess your understanding of the evolution of the skeletal muscular system. Consider the diagram below showing the evolutionary relationships among the major groups of chordates:



- 1a. Branch point #1 marks the evolution of what major aspect of the skeletal-muscular system? This characteristic is found in all animals that derive to the RIGHT (lampreys and up) and is lacking in animals that derive to the LEFT (lancelets). (4 pts)
- 1b. What is the adaptive significance (i.e. evolutionary advantage) of this character to the evolution of larger bodied organisms? (4 pts)
- 1c. Branch point #2 marks the evolution of what major aspect of the skeletal-muscular system? This characteristic is found in all animals that derive to the RIGHT (frogs and up) and is lacking in animals that derive to the LEFT (fishes). (4 pts)
- 1d. Briefly explain the major ecological factors and anatomical innovations that led to the evolution of the trait(s) listed in 1c. Please be specific. (4 pts)

Question 2. Skeletal-Muscular System.

- 2a. Name and describe the type of muscle and its important properties that you would find in:
 - the heart of a frog - (3 pts)
 - in a major artery of a human - (3 pts)
 - a leg of a kangaroo - (3 pts)
- 2b. Why is the theory of the action of muscle contraction described as a "sliding filament theory"? Please explain this theory. Include in your answer all the following terms: thin filaments, thick filaments, myosin, actin, cross bridges, ATP, and Calcium. (7 pts)

Question 3. Circulatory System.

3a. What are the two main types of circulatory system in the animal kingdom? Briefly describe how each works.

system 1 - (5 pts)

system 2 - (5 pts)

3b. Describe the main features of the heart in each of the organisms below.

fishes - (2 pts)

amphibians - (2 pts)

birds (Aves) - (2 pts)

Question 4. Respiratory System.

Describe the mode of oxygen uptake in the following animals. Include a description of the structure and function of the major organs involved in respiration where appropriate.

flatworm – (4 pts)

insect – (4 pts)

fish – (4 pts)

bird – (4 pts)

Question 5. Digestive System.

Describe the structure and function of the digestive system of the animals listed below. Include in your answer the following terms where appropriate: filter feeders, acoelomates, pseudocoelomates, coelomates, ruminants, cecal digestors, herbivores, omnivores, and/or carnivores.

sponges – (3 pts)

cnidarians – (3 pts)

cows – (4 pts)

rabbits – (3 pts)

humans – (3 pts)

Question 6. Excretory System.

6a. Each of the following taxa uses a different type of structure or organ for excretion of nitrogenous waste. Briefly describe this structure or organ and briefly explain how it works.

Platyhelminthes Class tubelaria- flat worms (3pts)

Annelida – Class Oligochaeta- Segmented worm (3pts)

Arthropods Class insecta – insects (3pts)

Vertebrata Class mammalia - mammals (3pts)

6b. Ammonia is highly toxic. Yet in spite of this fact, some fishes secrete their nitrogenous waste in the form of ammonia. How can they do this? (4 pts)

Question 7. Reproductive System.

7a. Please list AND briefly explain 3 major evolutionary innovations in the evolution of sexual reproduction:

- 1 - (4 pts)
- 2 - (3 pts)
- 3 - (3 pts)

7b. Please list and briefly explain two modes of asexual reproduction

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

Question 8. Sensory System.

8a. How is the sense of hearing similar and how is it different between humans and fishes?

- similarities - (2 pts)
- differences - (2 pts)

8b. How is the sense of vision similar and how is it different between humans and insects?

- similarities - (2 pts)
- differences - (2 pts)

8c. Name two different types of sensory stimuli (other than vision and hearing) and briefly describe the structure and function of the sensory receptors responsible for each type of sensation.

- Stimulus 1 – (2 pts)
 - Receptor for Stimulus 1 - (2 pts)
 - Stimulus 2 – (2 pts)
 - Receptor for Stimulus 2 - (2 pts)
-

Question 9.

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

WHAT SYSTEM DID YOU STUDY? _____

- the ESSAY question we didn't ask - (6 pts)
 - its answer - (10 pts)
-

Question 10.

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?

WHAT SYSTEM DID YOU STUDY? _____

- the ESSAY question we didn't ask on a DIFFERENT SYSTEM – (6 pts)
 - its answer - (10 pts)
-

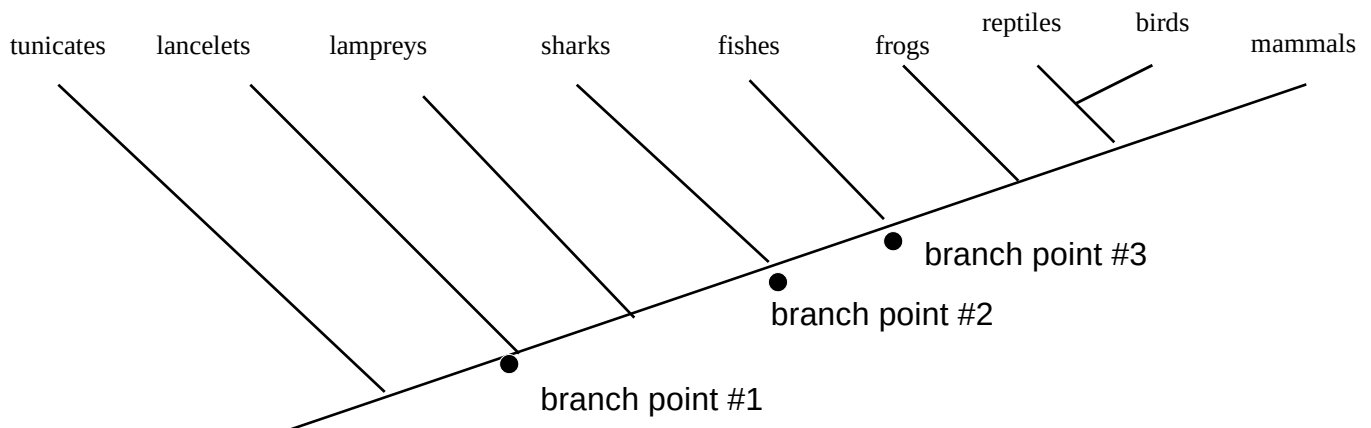
Biology 154 Practical Exam 2, Thursday, April 17, 1997

Question 1. This question will assess your understanding of the skeletal muscular system.

1. The three principal types of skeletal system found in animals are: (3 pts.)
 2. The three functions of the skeletal system are: (3 pts.)
 3. What type of skeletal system is possessed by:

A.	Squid	(1.5 pts.)
B.	Beetle	(1.5pts.)
C.	Cat	(1.5 pts.)
D.	Clam	(1.5 pts.)
E.	Earthworm	(1.5 pts.)
-

Question 2. This question will assess your understanding of the evolution of the skeletal muscular system. Consider the diagram below showing the evolutionary relationships among the major groups of chordates:

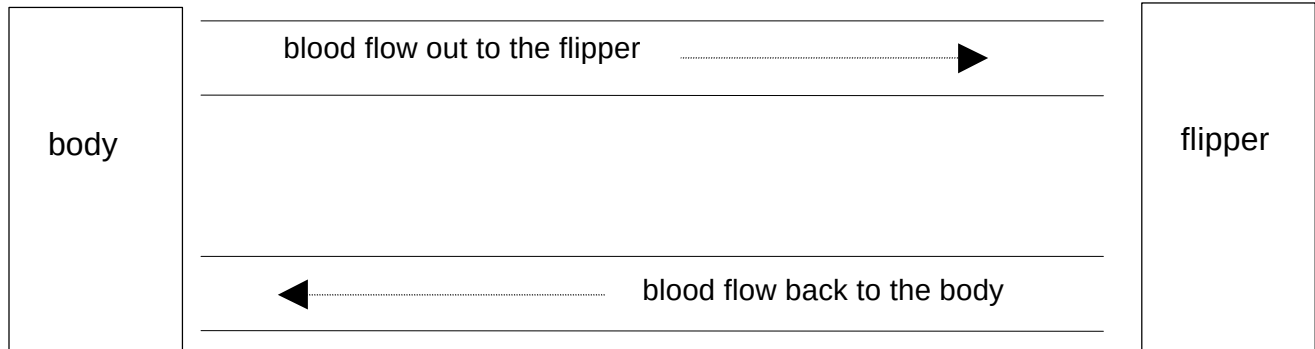


- 1a. Branch point #1 marks the evolution of what aspect of the skeletal-muscular system?
This characteristic is found in all animals that derive to the RIGHT (lampreys and up) and is lacking in animals that derive to the LEFT (lancelets). (2 pts)
 - 1b. What is the adaptive significance of this character to the evolution of larger bodied organisms? (3 pts)
 - 2a. Branch point #2 marks the evolution of what aspect of the skeletal-muscular system?
This characteristic is found in all animals that derive to the RIGHT (fishes and up) and is lacking in animals that derive to the LEFT (sharks). (2 pts)
 - 2b. Why did this character enable the evolution of rapid locomotion using the tail and other fins in the fishes versus the swaying undulating motion of the sharks? (3 pts)
 - 3a. Branch point #3 marks the evolution of what aspect of the skeletal-muscular system?
This characteristic is found in all animals that derive to the RIGHT (frogs and up) and is lacking in animals that derive to the LEFT (fishes). (2 pts)
 - 3b. How did this character enable the evolution of locomotion despite the huge effects of gravity on land? (3 pts)
-

Question 3. This question will assess your understanding of the circulatory system.

- Briefly list three key differences between an "open" versus a "closed" circulatory system. (6 pts)
- What kind of circulatory system is possessed by a: {circle the correct choice}

A. clam	open	closed	neither	(1 pt)
B. grasshopper	open	closed	neither	(1 pt)
C. rat	open	closed	neither	(1 pt)
D. earthworm	open	closed	neither	(1 pt)
E. sponge	open	closed	neither	(1 pt)
- In a counter current heat exchanger (such as in the flipper of a seal diagrammed below), indicate the direction of HEAT flow by writing little arrows directly on the sketch below. (4pts)



Question 4. This question will assess your understanding of the circulatory system.

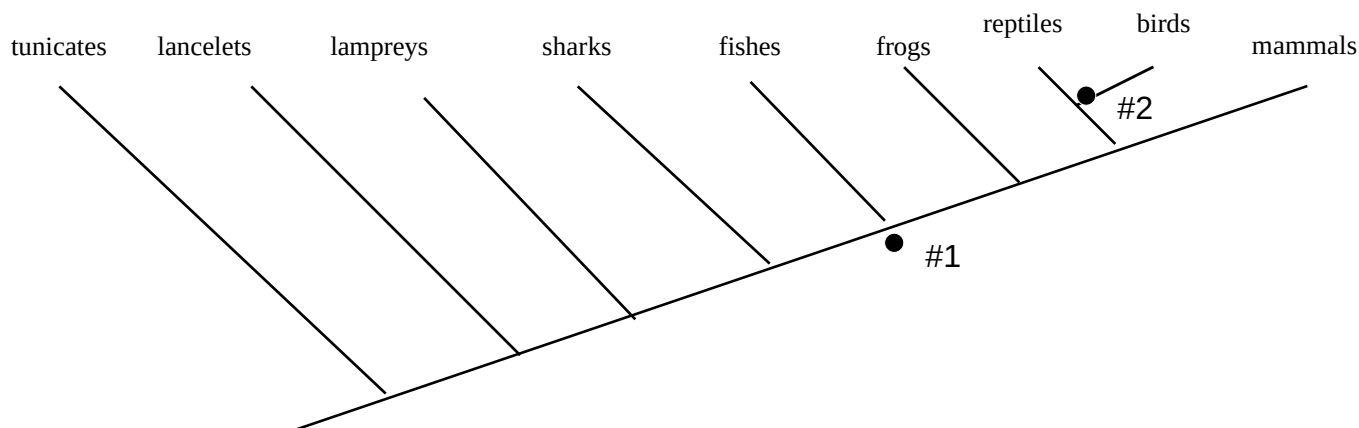
- Why did the colonization of land by chordates require the evolutionary transition from a two chambered to a three chambered heart? Also, briefly describe what major modifications in blood flow were necessary due to this change in the number of chambers in the heart. (7 pts)
- Using a RED PEN for oxygenated blood and a BLUE PEN for deoxygenated blood, trace the flow of blood through the diagram of a mammalian 4 chambered heart below. Write little arrows directly on your exam ONLY using the colored pens provided to show the flow of blood WITHIN the heart as well as the direction of flow INTO OR OUT OF ALL OF THE MAJOR ARTERIES AND VEINS labeled in the diagram.. (8 pts)

Question 5. This question will assess your understanding of the respiratory system.

- Briefly describe the key features of the respiratory system of a:

A. flatworm -	(2 pts)
B. fish -	(2 pts)
C. grasshopper -	(2 pts)
D. rat -	(2 pts)
E. clam -	(2 pts)
- What is the difference between the positive pressure breathing of a frog versus the negative pressure breathing of a rat? Explain how each breathe. (5 pts)

Question 6. This question will assess your understanding of the evolution of the respiratory system. Consider the diagram below showing the evolutionary relationships among the major groups of chordates.



Describe the major evolutionary trend in the respiratory system of chordates (refer to phylogenetic tree in this Question). Address specifically branching points 1 and 2.

(10 pts)

Question 7. This question will assess your understanding of the reproductive system.

1. What internal and external reproductive structures are necessary for internal fertilization? (3 pts)
2. Please list three different animal phyla in which fertilization is internal. (3 pts)
3. Please three different Classes of the Phylum Chordata in which fertilization is internal. (3 pts)
4. What is the best argument to support the suggestion that internal fertilization was a necessary evolutionary step in the colonization of land? (6 pts)

Question 8. This question will assess your understanding of the reproductive system.

1. Please briefly define the hermaphroditic reproductive mode and offer one example of an hermaphroditic animal. (4 pts)
2. Increased investment per offspring has been cited as a major evolutionary trend in reproduction among animals. Despite that this will mean fewer offspring per reproductive episode, why might this be advantageous anyway? (4 pts)
3. 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):

drop in amniotic egg figure
from text...

albumin (1 pt)
allantois (1 pt)
amnion (1 pt)
chorion (1 pt)
embryo (1 pt)
shell (1 pt)
yolk sac (1 pt)

Question 9. This question will assess your understanding of the excretory system.

1. Briefly explain what are the two major problems solved by the excretory system?
 - (2.5 pts)
 - (2.5 pts)
 2. Briefly describe the key features of the excretory system of a:
 - A. flatworm - (2.5 pts)
 - B. grasshopper - (2.5 pts)
 - C. fish - (2.5 pts)
 - D. bird - (2.5 pts)
-

Question 10. This question will assess your understanding of the excretory system.

The graphic below shows the three principal molecular types in which nitrogenous wastes are excreted by animals.

{drop in diagrams of molecular structures..}

_____ (6 pts)

1. On the blank lines above, write the names of these molecules.
 2. What are the major evolutionary trends in the excretion of nitrogenous waste that allowed animals to colonize land? (9 pts)
-

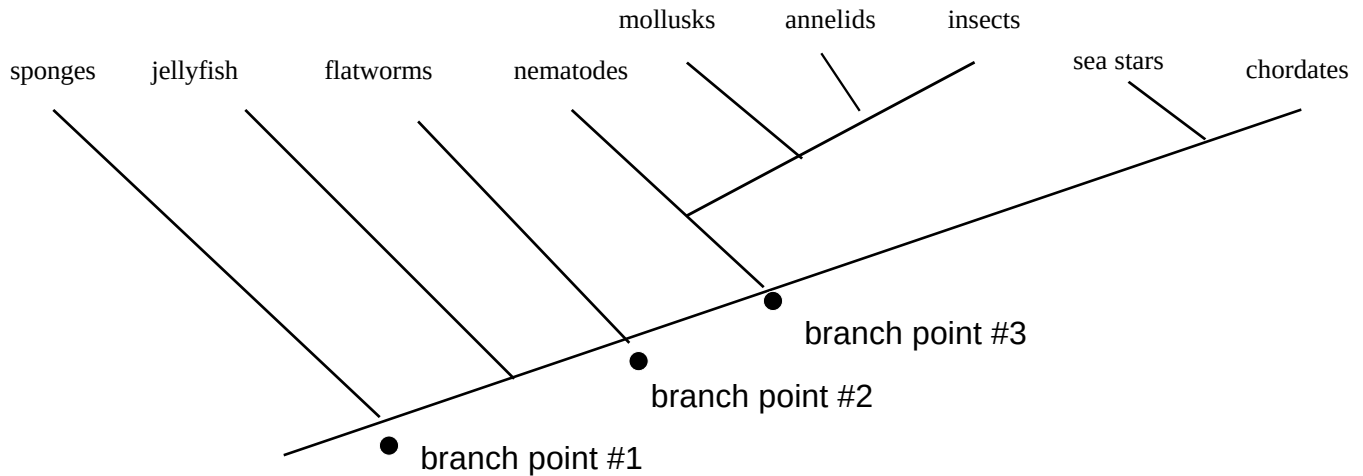
Question 11. This question will assess your understanding of phylogenetic systematics.

1. Please define the concept of a “shared derived character.” (6 pts)
 2. Please explain why constructing a phylogeny to classify a group of related animals must be based on identifying and comparing the “shared derived characters” among them. (9 pts)
-

Question 12. This question will assess your understanding of the digestive system.

1. Describe the unique characteristics of the digestive system of the following four chordates
 - A. shark (3 pts)
 - B. rabbit (4 pts)
 - C. cow (4 pts)
 - D. bird (4 pts)
-

Question 13. This question will assess your understanding of the evolution of the digestive system. Consider the diagram below showing the evolutionary relationships among the major groups of animals:



1. Branch point #1 marks the evolution of what aspect of the digestive system? This characteristic is found in all animals that derive to the RIGHT (jellyfish and up) and is lacking in animals that derive to the LEFT (sponges). (2 pts)
2. Branch point #2 marks the evolution of what aspect of the digestive system? This characteristic is found in all animals that derive to the RIGHT (both the protostome and deuterostome lineages) and is lacking in animals that derive to the LEFT (flatworms). (2 pts)
3. Branch point #3 marks the evolution of what aspect of the digestive system? This characteristic is found in all animals that derive to the RIGHT (all deuterostomes) and is lacking in animals that derive to the LEFT (all protostomes). (2 pts)

Question 14. Identify and briefly state the function of each of the structures labeled with pins A, B, C,

- | | | |
|-----|--------------------|---------------|
| A). | name of structure: | its function: |
| B). | name of structure: | its function: |
| C). | name of structure: | its function: |
| D). | name of structure: | its function: |
| E). | name of structure: | its function: |
| F). | name of structure: | its function: |
| G). | name of structure: | its function: |
| H). | name of structure: | its function: |
| I). | name of structure: | its function: |
| J). | name of structure: | its function: |

Question 15. Choose ANY ONE of the essay questions you see on the next page and answer it in the space below.

- (1) Skeletal Muscular System: Compare and contrast the three types of muscle tissue found in animals, and briefly explain how muscle tissue contracts.
 - (2) Circulatory System: Please briefly explain the adaptations of the circulatory system to control body temperature by endothermic terrestrial and aquatic vertebrates (hints: what does counter-current heat exchange mean? and how is blood flow to peripheral tissues controlled and how does this affect body heat exchange with the environment?).
 - (3) Respiratory System: What is hemoglobin? How is hemoglobin adapted to carry oxygen? Why exactly is oxygen released where it is supposed to be in capillary beds (hint: what affects the hemoglobin "percent saturation" curve)?
 - (4) Digestive System: What are the specific design features of various mammalian jaws and mouths that allow mammals to eat (a). grasses? (b). muscle tissue of large animals? (c). both plants and animals, and (d). plankton? Please use specific organisms as examples in each part.
 - (5) Excretory System : How exactly is urine concentrated in the nephron of a vertebrate kidney, and what variables (morphological or hormonal) regulate urine concentration among vertebrates?
 - (6) Neuro-endocrine System: How exactly does a nerve conduct a signal and what exactly is a signal? How are these signals conducted among nerve cells?
 - (7) Sensory Systems: How exactly do our eyes detect light? Compare and contrast the structure and function of the vertebrate eye vs. the arthropod compound eye.
 - (8) Reproductive System: Viviparity (bearing live young) has evolved many times among different lineages of chordates. Exactly how are these young nourished (in terms of food, oxygen, and removal of metabolic wastes) prior to birth in representative chordates such as in a shark, a lizard, and a mammal?
-

Biology 154 Practical Exam 2, Thursday, April 18, 1996

Question 1. Consider the diagram below showing the evolutionary relationships (at 8 branch points) among the major phyla of animals:

- A). What major evolutionary innovation occurred at branch point #1? (In other words, what major new characteristic evolved and was subsequently found among the derived organisms along the RIGHT branch from #1 and not found along the LEFT branch from #1?)
 - B). What major evolutionary innovation occurred at branch point #2?
 - C). What major evolutionary innovation occurred at branch point #4?
 - D). What major evolutionary innovation occurred at branch point #5?
 - E). What major evolutionary innovation occurred at branch point #6?
-

Question 2. Consider the diagram below showing the evolutionary relationships (at 8 branch points) among the major groups of chordates:

- A). What was the major evolutionary innovation in the skeleto/muscular system that occurred at branch point #2? (In other words, what major new characteristic evolved and was subsequently found among the derived organisms along the RIGHT branch at #2?)
 - B). What was the major evolutionary innovation in feeding apparatus (the digestive system) that occurred at branch point #3?
 - C). What was the major evolutionary innovation in the circulatory system that occurred at branch point #5?
 - D). What was the major evolutionary innovation in the reproductive system that occurred at branch point #6?
 - E). What was the major evolutionary innovation in the respiratory system that occurred at branch point #8?
-

Question 3. In front of you are three animals labeled "A", "B" and "C". Use the dichotomous key on the next page to determine to which Phylum of animals these belong. Document each step along the way by writing the little number at the left of each row for each decision as you go.

animal A -	Phylum:
animal B -	Phylum:
animal C -	Phylum:

Question 4. Circulatory System. Please list and briefly explain the major evolutionary trends in the evolution of circulatory system design...

...among protostome phyla -

...among chordate classes –

Question 5. Respiratory System

- A). Please briefly state what is the main “problem” solved by the respiratory system?
- B). Below are 5 animals that greatly differ in how their respiratory systems solve the problem asked above. Please briefly describe their specific problems and their specific solutions.
1. flatworm (Platyhelminthes) -
 2. squid (Mollusca) -
 3. insect (Arthropoda)-
 4. shark (Chondrichthyes) -
 5. lizard (Reptilia) -
-

Question 6. Digestive System

- A). Please briefly state what is the main “problem” solved by the digestive system?
- B). Below are 5 animals that greatly differ in how their digestive systems solve the problem asked above. Please briefly describe their specific problems and their specific solutions.
1. hydra (Cnidaria) -
 2. insect (Arthropoda)-
 3. shark (Chondrichthyes) -
 4. bird (Aves) -
 5. cow (Mammalia)
-

Question 7. Identify and briefly state the function of each of the structures labeled with pins A, B, C,

- | | | |
|-----|--------------------|---------------|
| A). | name of structure: | its function: |
| B). | name of structure: | its function: |
| C). | name of structure: | its function: |
| D). | name of structure: | its function: |
| E). | name of structure: | its function: |
| F). | name of structure: | its function: |
-

Question 8. For this organism name the specific type of each system it possesses, and answer question E.

- A). Circulatory System:
- B). Mode of reproduction and type of fertilization:
- C). Skeletal system:
- D). Respiratory system:
- E). Does this organism have a neuro-endocrine system? If so, what makes up this system?
-

Question 9. Sensory Systems.

- A. Fossorial animals live underground. Which sensory systems would you expect to be underdeveloped in these types of animals? (4 pts)
- B. Describe the organs used for "hearing" in a fish versus the organ used in humans. (4 pts)
- C. Describe a sensory organ located in the skin of any organism. (2 pts)
-

Question 10 Skeletal-Muscular Systems

- A. What are the differences between the skeletons of sharks and true fishes? (2 pts)
- B. How do the differences in (A) impact upon the swimming modes in these organisms? (2 pts)
- C. Name two different organisms that have hydrostatic skeletons. (3 pts)
- D. What is the main difference in mode of locomotion between organisms that possess hydrostatic skeletons versus exoskeletons? (3 pts)
-

Question 11 Reproductive System.

- A. This organism is an hermaphrodite. What does that mean? (2 pts)
- B. Name the two major modes of reproduction and give an example for each. (8 pts)
-

Question 12 Excretory System

- A. Briefly explain the two separate problems solved by the excretory system in chordates. (6 pts)
- B. Please briefly describe two totally different excretory systems designs found in animals from two different phyla. (4 pts)
-

Question 13 Upon which system did YOU specialize? _____

What is the one really good question that you were prepared to answer that we did not ask you about YOUR system? And, what is the answer to that question? [please answer this station after you have completed the entire practical, and the answer - "you asked all the good questions" is not acceptable.]

the question we didn't ask about YOUR system (4 pts)
its answer - (6 pts)

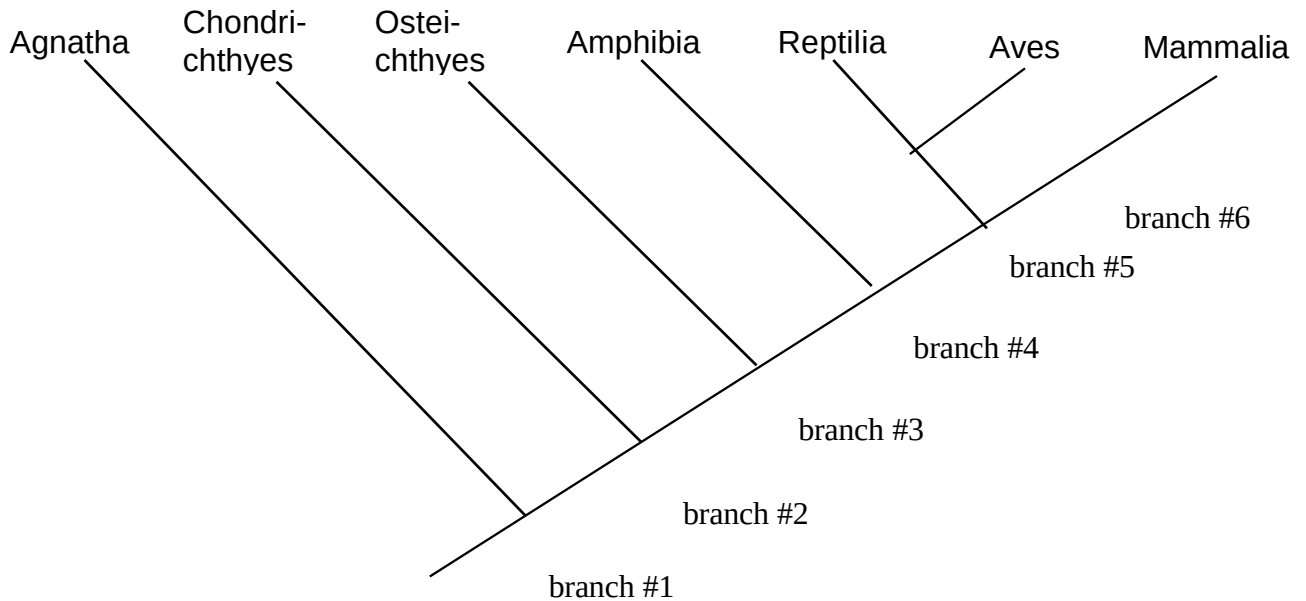
Question 14 Upon which system did YOU specialize? _____

What is the one really good question that you were prepared to answer that we did not ask you about a DIFFERENT SYSTEM THAN YOUR SYSTEM? And, what is the answer to that question?

the question we didn't ask about A DIFFERENT SYSTEM THAN YOUR SYSTEM: (4 pts)
its answer - (6 pts)

Biology 154 Lab Exam 2,**Thursday, April 12, 1995**

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



Please list what major new characteristic(s) evolved and was/were subsequently found along the RIGHT branch at each numbered point #1-#6, and in addition state what major change(s) resulted in habitat and/or way of life.

Question 2. In front of you are three insects labeled "A", "B" and "C". Use the dichotomous key on the next page to determine to which Order of insects these belong. Document each step along the way by writing the little number at the left of each row for each decision as you go.

Question 3. Reproductive System

Part A. Please list three different animal phyla in which fertilization is internal.

Part B. Please three different Classes of the Phylum Chordata in which fertilization is internal.

Part C. Given your answers to Parts A. and B. above, what is the best line of evidence to refute the suggestion that internal fertilization was a necessary evolutionary step in the colonization of land?

Part D. Among chordates, briefly describe what was the key adaptation of reproduction that allowed full terrestrial existence?

Question 4. Circulatory System. Please list and briefly explain the major evolutionary trends in the evolution of circulatory system design...

- ...among protostome phyla -
 - ...among chordate classes -
-

Question 5. Respiratory System

Part A. Please briefly state what is the main "problem" solved by the respiratory system?

Part B. Among animals there are at least 5 different respiratory system designs depending in the size of the organism and its habitat. What are these 5 solutions and among whom are these found?

Question 6. Circulatory and Respiratory System. Why is it possible for flying insects, which are among the most active of all animals to have an open circulatory system?

Question 7. Digestive System. Please list the major similarities and differences between the digestive systems of an earthworm, a shark, and a human.

- major similarities -
 - major differences –
-

Question 8. Excretory System.

Part A. Please, briefly explain the 2 separate problems solved by the excretory system in chordates.

Part B. Please briefly describe at least three totally different excretory system designs found in three animals from three different phyla.

Question 9. Skeleto-Muscular System

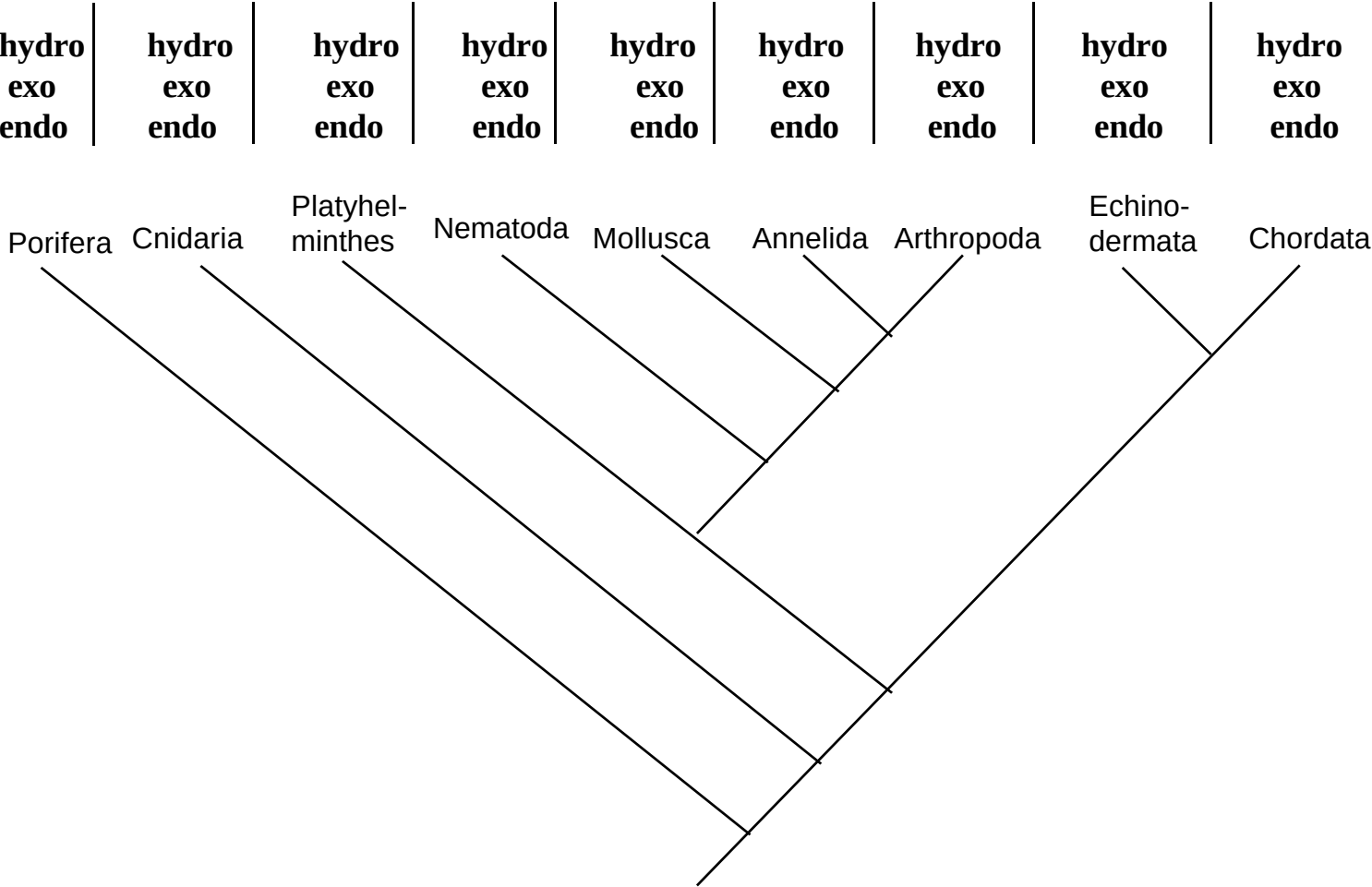
Please answer ONE of the three questions below in the space provided.

- either - Why do sharks swim by slow whole-body undulations from side to side, whereas fish rely more on swishing their tail and other fins? [Hint: how is the difference in their modes of locomotion due to their different muscular and endoskeletal designs?]
 - or - Please list and briefly explain at least three major trends in the evolution of endoskeletal design in the chordates. What anatomical changes occurred and what changes resulted in where the animal lived?
 - or - When mammalian muscles contract they bulge outwards (recall any Arnold Schwarzenegger movie). Why might this fact be disadvantageous to fish, and how are fish muscles designed to minimize this problem?
-

Question 10. Skeleto-Muscular System.

Part A. There are three basic design types to animal skeletal systems: hydrostatic, exoskeletal, and endoskeletal. Please briefly describe each.

Part B. Below is a phylogenetic tree of the major animal phyla. Indicate by circling “hydro”, “exo”, “endo”. which type of skeletal support system predominates in each phyla below.



Question 11. Your Favorite Question.

What is the one really good question that you were prepared to answer that we did not ask you? And, what is the answer to that question? [the answer - “you asked all the good questions” is not acceptable.]

the question we didn’t ask-
its answer –