Biol 11

Ch 31 REVIEW: Fishes and Amphibians

1. What are the characteristics that unify Vertebrates? Fish? Amphibians?

Vertebrates are chordates that develop a vertebral column, 2 sets of paired appendages, a closed circulatory system, ventral heart, and lungs or gills for breathing.

Fish are aquatic vertebrates with scales, fins and pharyngeal gills.

Amphibians are vertebrates that have aquatic larvae & terrestrial, lung-breathing adults. They have moist skin, no scales and no claws.

2. List the three main groups of fishes and include some representative species for examples. ***Jawless fish: hagfish and lampreys. Cartilaginous fish: sharks, skates and rays. Bony fish – all the rest; salmon, cod, guppies, goldfish, marlins, etc.***
3. What did the first fishes look like? How did they eat? ***The first fishes had large, bony plates covering their body. They did not have jaws, so they ate small particles filtered out of the water or sucked up off the ocean bottom.***
4. What evolved characteristic revolutionized fish evolution? Why? ***Jaws were much more efficient at getting larger food particles into the fishes bodies. This meant they could eat a larger variety of food,***
5. What structures on a fish evolved into hipbones, front and back limbs and shoulder bones? ***It is believed that the pelvic girdle of fishes evolved into hipbones for terrestrial vertebrates; the pectoral girdle evolved into shoulder bones; pelvic fins developed into hind limbs and pectoral fins developed into forelimbs.***
6. How do fish (including lampreys and hagfish) eat? List a few adaptations. ***Fish have all types of feeding – filter feeding, herbivores, detritus feeders, carnivores, omnivores, and parasites. Lampreys and hagfish are parasitic/detritus feeders respectively.***
7. Describe the digestive system of the fish, following the path of food as it travel through, and naming the structures as it passes. ***Food enters via the mouth and travels to the stomach through the esophagus. The stomach stores food and begins the digestion. Digestion continues as the food is passed to the pyloric ceca where digestive enzymes are added and absorption of nutrients begins. Digestion is completed in the intestines where further digestive enzymes are received from the gall bladder/liver and the pancreas. The intestines also are responsible for completing the absorption of nutrients and passing the undigested materials out of the body at the anus.***
8. Label the diagram of the fish. Be sure to know the function of all the structures!

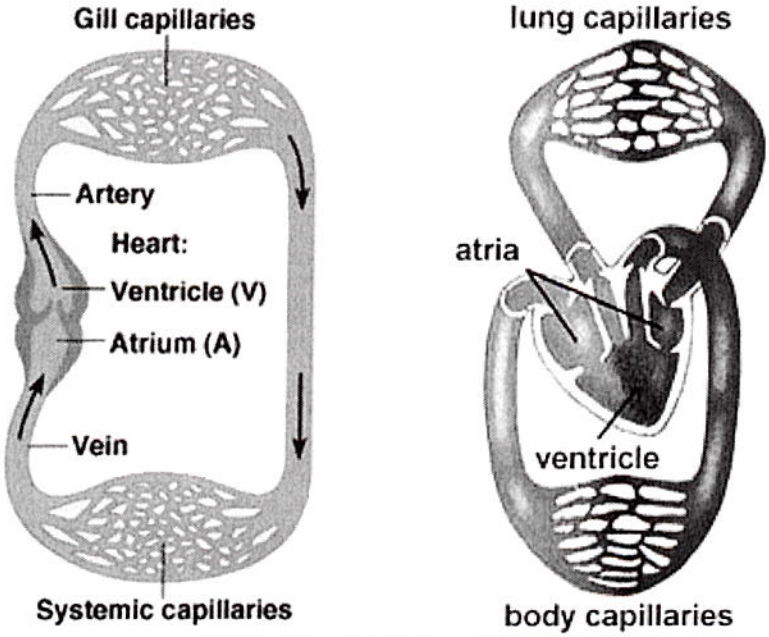
a. skull
b. gills
c. spinal cord
d. kidney
e. swim bladder
f. vertebra
g. muscles
h. ovary or testes
i. anus
j. stomach
k. intestines
l. pyloric ceca
m. esophagus
n. liver
o. gall bladder
p. heart
q. mouth
r. brain

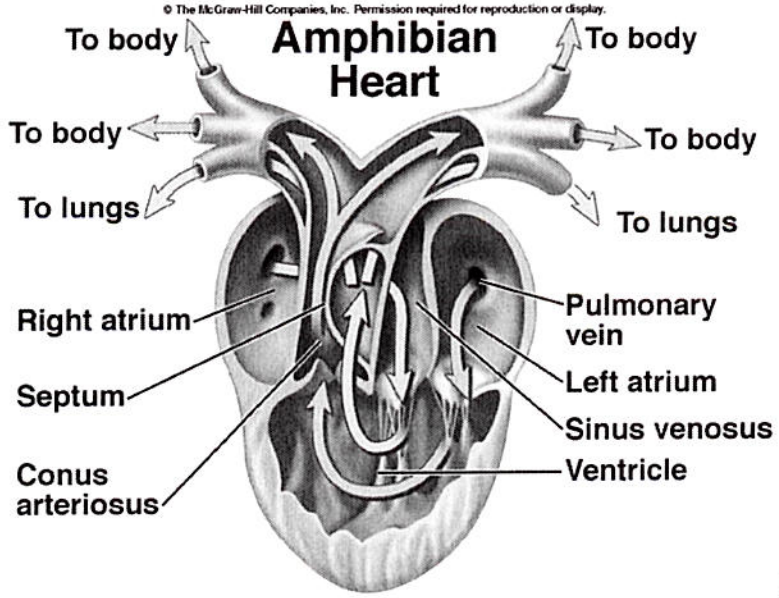
9. How do fish breathe? How do they get water over their gills? ***Fish pump water into their mouth, over their gills and out the pharyngeal gill slits. Oxygen is picked up by the feathery gills that have a large surface area for absorption.***
10. What adaptation allows some fish to survive in oxygen poor water? ***Some fish have modified swim bladders that are lined with blood vessels. They gulp air into the swim bladder and use it as a primitive lung.***
11. What happens if a fish's gills dry out? ***Oxygen must first dissolve in water before it will diffuse through the membranes of the gills. If the gills dry out, they don't collect oxygen any more, and the fish will suffocate.***
12. What are swim bladders for? ***Swim bladders are used to help the fish control it's buoyancy in the water, so it doesn't always have to swim to keep itself below the surface or off of the bottom.***
13. How do skates and rays breathe without getting mud into their systems? ***Skates and rays have a special opening on the upper surface to bring water in and across the gills.***
14. Follow the path of blood through the hearts of the both the fish and the amphibian, naming the structures that the blood passes on it's way around the heart and the circulatory system. ***Fish: blood from the body collects in the sinus venosus and moves into the atrium. The atrium contracts and pumps blood into the ventricle. The ventricle contracts and pumps blood into the aorta, which is also muscular. The blood then travels to the gills, picks up oxygen and delivers it to the body cells before returning to the heart via the sinus venous.***

Amphibians: Blood from the body collects in the vena cava and drains into the sinus venous. Blood from the head and skin drain directly into the sinus venosus. The sinus venosus drains into the right atrium which contracts and pumps the blood into the ventricle. At the same time, blood from the lungs drains into the right atrium, which contracts and sends blood into the ventricle. This means that in the ventricle, oxygenated blood from the lungs will mix with the deoxygenated blood coming from the body. The ventricle contracts and pumps the blood out – most of the blood goes to the body, and the rest of it goes to the lungs. At the lungs it picks up oxygen and returns to the left atrium while the body cells take the oxygen from the other blood and it returns to the heart via the vena cava..

15. How do fish get rid of their nitrogenous wastes? ***Some of the nitrogenous wastes diffuse out through the gills, but the rest is taken out of the blood with kidneys.***
16. What do kidneys control other than metabolic wastes in the body for fishes? How is this different in saltwater fish compared to fresh water fish? ***Freshwater fish are constantly gaining water through osmosis. If the kidneys did not remove this excess water, the fishes cells would lyse and the fish would die. In saltwater fish, the opposite is true; they are constantly losing water to the ocean, and so the kidneys concentrate the urine and recycle as much water as possible.***
17. How do "daylight fish" see differently from "darkness fish"? ***Daylight fish have excellent color vision while the "darkness fish" have extra large eyes, with big pupils. They don't see color as well, but they can see in the dark very well.***
18. What sense is present in fish but not very well developed? ***Fish have ears, but they aren't very effective.***

19. What is the lateral line system? ***The lateral line system detects motion in the water to detect predators and other fish around them.***
20. What sense do many fish have that humans do not have? ***Many fish can detect electricity in the water. Sharks have particularly sensitive electricity detectors.***
21. What is the most developed sense organ for fish? ***Their chemoreceptors are the best developed – they work like our taste and smell.***
22. Label the diagram of the fish heart /circulatory system.





a. sinus venosus
b. atrium
c. ventricle
d. aorta (musclular)

23. Label the diagram of the amphibian heart/circulatory system

24. How do most fish reproduce? ***Most fish have external fertilization, but some have internal fertilization.***
25. Describe the difference between oviparous, ovoviviparous and viviparous. ***Oviparous means that the animal lays eggs and the offspring develop outside of the body inside the eggs. The offspring use the yolk sack for nutrition. Ovoviviparous animals make eggs but they stay inside the body to incubate. The body does not feed the offspring – they develop inside the eggs feeding off of the yolk sacs. Viviparous animals do not have eggs – they feed the developing offspring inside their bodies by connecting tissues with their own bodies. (the placenta)***
26. How do some fish communicate with their potential mates? ***Some fish do elaborate dances and make nests to communicate with and attract a mate.***
27. How are jawless fish different than most vertebrates? ***Jawless fish are the only vertebrates that don't develop a backbone, nor do they have jaws.***
28. What two classes of jawless fish are still around today? ***Lampreys and hagfishes.***
29. How do lampreys eat? (describe the adult and the larvae) ***Larval lampreys are filter feeders, but adults are parasites. They attach to the sides of other fish, scrape through the flesh and feeds on the soft tissue below. They might not kill the fish, but they leave a gaping wound that is easily infected.***
30. How and what do hagfish eat? ***Hagfish eat dead/dying fish by scraping a hole in their side.***
31. What peculiar traits do hagfish have? ***They release slime *(lots of it), have multiple hearts, open circulatory systems and tie themselves into knots.***
32. Label the diagram of the fish brain and the amphibian brain. What is the function of each part of the brain?

1. ***olfactory lobe – processes information from the chemorecteptors***
2. ***Cerebrum – in the fish it is mostly used to process the info from the chemoreceptors along with the olfactory lobe, but in amphibians it coordinates more decisions on capturing prey and finding a mate.***
3. ***optic lobe – process information from the eyes***
4. ***cerebellum – coordinates muscle movement***
5. ***medulla – controls respiration, heartrate, digestion***
6. ***spinal cord – delivers messages from the body to the brain and from the brain to the body.***

33. What fish are included in the cartilaginous fish? ***Cartilaginous fish are sharks, skates, rays and a few other uncommon fish.***
34. What are they called cartilaginous fish? ***They have a skeleton made of cartilage, which is softer and more flexible than bone. We have cartilage on the ends of our nose and in our ears.***
35. How are the teeth arranged in sharks? ***They have MANY teeth arranged in 6-20 rows. Teeth are replaced when they are lost or wear out.***
36. What two groups are included in the bony fish group? Which one is larger? Give examples of each. ***The bony fish are divided into the ray-finned fish and the lungfish/lobe-finned fish. (which makes three groups, not two!) The ray-finned fish group is the largest by far, and they are your typical fish – salmon,***

angelfish, trout, etc. The lungfish rare, and so are the lobe-finned fish. The only living example of the lobe-finned fish is **Latimeria.**

37. How do lungfish and lobe-finned fish differ? How are they similar? ***Lungfish (as their name implies) use a primitive lung when the oxygen levels are low. Lobe-finned fish have a bone arrangement in their fins that is similar to the limbs of terrestrial vertebrates, and they have been observed walking along the bottoms of their aquarium using their fins like limbs. They are similar in that they are both ancient types of fish, and they both seem to be a link to our ancestors.***
38. Why are the lungfish and the lobe-finned fish of interest to evolutionists? ***Each of the fish exhibit a characteristic that suggests that they may be ancestors to terrestrial vertebrates.***
39. What is the name of the only living lobe-finned fish today? ***Latimeria***
40. Describe the statement: "amphibians are to the animal kingdom what mosses and ferns are to the plant kingdom". ***They are comparing these groups because they both are the "bridges" to terrestrial life. Mosses and ferns are dependent on water for their reproduction and for keeping their gametes moist, just like amphibians are. They are half-way out of the water, in a manner of speaking.***
41. What does amphibian mean? Why is this an appropriate title for these creatures? ***Amphibian means "both life". This is appropriate because the do seem to have both the life of a marine vertebrate and the life of a terrestrial animal.***

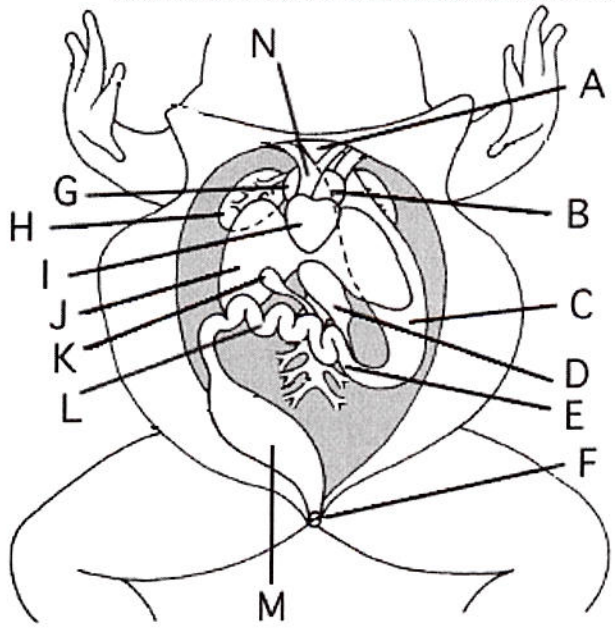
What are the characteristics that unify the amphibians? ***Amphibians are vertebrates that have aquatic larvae & terrestrial, lung-breathing adults. They have moist skin, no scales and no claws.***

42. What animals are the most likely ancestors to amphibians? ***Lobe-finned fish.***
43. What difficulties did amphibians have to overcome in order to live out of the water? What adaptations evolved to deal with these difficulties? ***Amphibians had to develop lungs so they could breath out of the water, and a more efficient method of circulating the oxygen to the cells. They have a 3-chambered heart. They also had to protect their new lungs and prevent them from collapsing, - the rib cage does this job. They had to get stronger muscles and bones to support themselves and move themselves outside of the water. They had to develop better hearing out of the water, and they had to develop ways of preventing desiccation (drying out).***
44. What things keep the amphibians restricted to living very close to the water (or at least in very moist places)? ***They have to keep their skin moist in order to get enough oxygen, many need water for their external fertilization, and they all have shell-less eggs which will desiccate if they are out of water.***
45. What/how do tadpoles eat? Compare this to the eating of the adult. ***Tadpoles are filter feeders or herbivores, while frogs are carnivores. Tadpoles digestive system is very long to accommodate the more difficult process of digesting plant material.***
46. How do amphibian's digestive system and circulatory system have to change when they change from a tadpole to a frog? ***The digestive systems of tadpoles are designed to digest plants and small particles – the adults are more complicated and have more accessory organs like the pancreas, liver and gall bladder to add digestive enzymes to the intestines. The circulatory systems in a tadpole are like***

a fish's – a two chambered heart and single loop system. The adult develops a double loop system to service the lungs and deliver the oxygen more efficiently to the body and a three chambered heart to pump the blood faster with more blood pressure.

47. Compare the frog's heart to a fish heart. Which is more efficient? Why? ***The frog's heart is more efficient than that of the fish, since the partially oxygenated blood gets an extra pump from the heart to make it around to the body cells. The additional blood pressure means that oxygen can be delivered faster and will return to the heart faster to pick up more oxygen.***
48. Follow the path of food through the digestive system of an amphibian, listing the names of the structures as the food passes through, and what happens to the food as it passes. ***Food enters the amphibian through the mouth, travels down the esophagus and is stored temporarily in the stomach. Digestion begins in the stomach. The food then continues into the intestines, where digestive enzymes are added from the gall bladder, liver and the pancreas. The small intestines complete the digestion and absorb the nutrients – undigested materials are passed to the large intestines (colon) and then stored in the cloaca until they leave the body via the anus.***
49. How do frogs breathe? Tadpoles? ***Frogs breathe using by gulping air into their mouths and then forcing the air into their lungs. They also are able to absorb oxygen through the skin inside their mouths, and the moist skin all over their body. Tadpoles breathe using their gills.***
50. How do frogs get rid of nitrogenous wastes? ***Frogs have kidneys that collect the nitrogenous wastes from the blood, and send it to the urinary bladder via the ureter. The urine is then added to the solid wastes to be expelled by the cloaca via the anus.***
51. Compare the eyes of a frog with the eyes of a fish. What new structures have the frogs developed? What is not as good in terms of a frog's sight? ***Frogs eyes are able to turn in their socket so they can look around without turning their heads as much. They also have nictitating membranes and eyelids to protect their eyes and help keep them moist. They see movement really well, but fish have a better color vision then frogs do.***
52. Compare the ears of a fish with the ears of a frog. (also the lateral line system) ***The ears of a fish are not very effective, but they have the lateral line system that detects motion very well. On land, it is harder to detect motion. Though amphibians still have a lateral line system they have developed a better ear to for hearing.***
53. How do amphibians protect themselves against predators? ***They can run away, stay hidden, and camouflage themselves. They can also secrete chemicals that are unpleasant to smell, or toxic. (the poison on poison arrow frog is strong enough to kill large animals in very small doses.)***
54. How do frogs reproduce? ***The male will climb onto the females back and squeezes her. She then releases her eggs, and the male will fertilized them (externally).***

55. How do some salamanders mate without ever coming close to one another? ***Some salamander males will deposit a package of sperm, and then entice the female to pick it up – with her cloaca.***
56. What different ways do amphibians care for their young? ***Amphibians might carry their young on their backs, or on their legs, or incubate them in their mouths (and stomachs!)***
57. How do salamanders differ from frogs and toads? ***Salamanders retain their tails; frogs and toads do not.***
58. What is interesting about the crimson-spotted newt? ***This newt moves back and forth from the water to the land, and then back again a few times in its' life cycle.***
59. How did the poison arrow frog get its name? ***Natives used to rub their arrowheads on the backs of these frogs. The poison was so strong, it could kill larger animals with one arrowhead.***
60. Label the internal structures of an amphibian. Describe the function of each of the structures that are different from the fishes.



b. left atrium
c. stomach
d. Pancreas
e. intestine
f. anus
g. right atrium
h. lungs
i. ventricle
j. liver
k. gall bladder
l. intestine
m. colon / cloaca
n. aorta
o. heart
p. kidneys
q. ureter
r. urinary bladder
s. lungs
t. cloaca