

Glencoe Science

# Biology

**Interactive Classroom**



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# Chapter 28 Fishes and Amphibians

**Section 1:** Fishes

**Section 2:** Diversity of Today's Fishes

**Section 3:** Amphibians

A herd of zebras running across a grassy field.

EXIT




## 28.1 Fishes

### Characteristics of Vertebrates

- Vertebrates have a vertebral column and specialized cells that develop from the nerve cord.
- The vertebral column, or spinal column, is the hallmark feature of vertebrates.
- Classes of vertebrates include fishes, amphibians, reptiles, birds, and mammals.


## 28.1 Fishes

### Vertebral Column

- A vertebral column made of **cartilage** or bone surrounds and protects the dorsal nerve cord. 
- The vertebral column functions as a strong, flexible rod that muscles can pull against during swimming or running.

## 28.1 Fishes

### Neural Crest

- A **neural crest** is a group of cells that develop from the nerve cord in vertebrates. 
- Portions of the brain and skull, certain sense organs, and some nerve fibers are some of the structures that develop from the neural crest.

## 28.1 Fishes

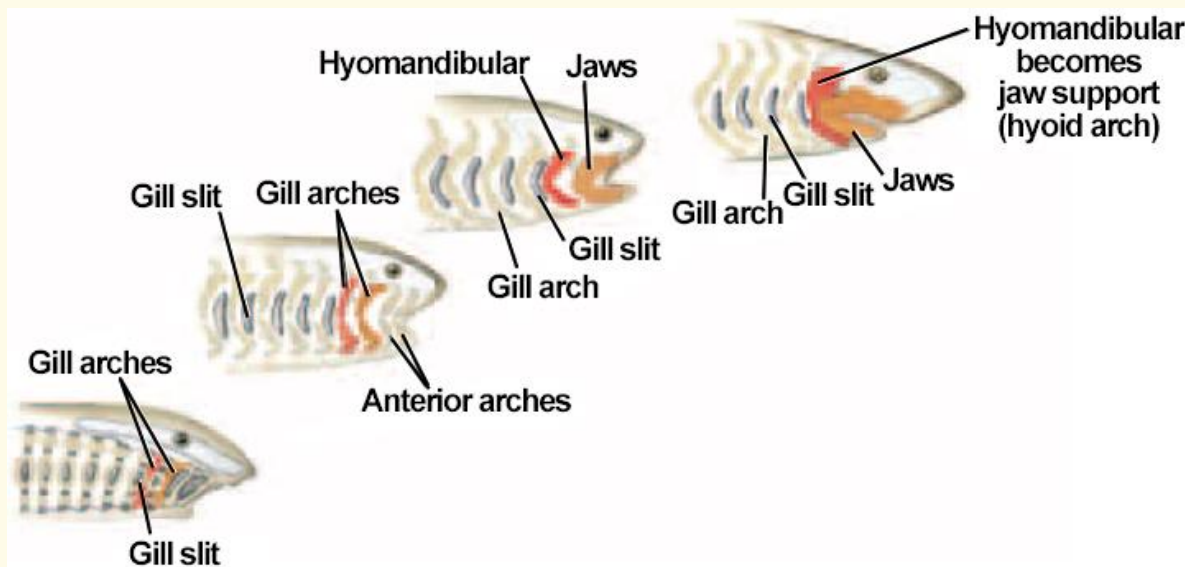
### Characteristics of Fishes

- Fishes are found in a variety of habitats including seas, lakes, ponds, streams, and marshes.
- Most fishes have vertebral columns, jaws, paired fins, scales, gills, and single-loop blood circulation.

## 28.1 Fishes


### Jaws

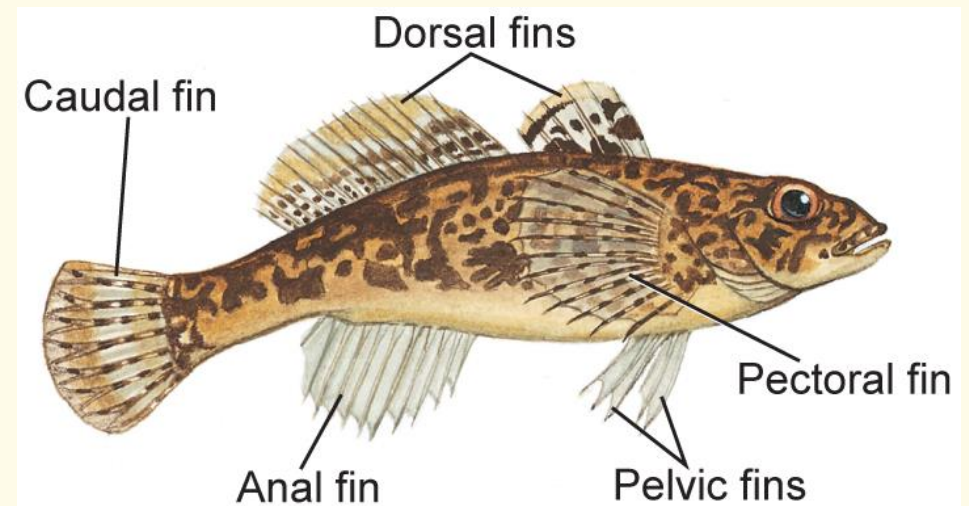
- Anterior gill arches evolved into jaws in ancient fishes.
- The development of jaws allowed ancient fishes to prey on a larger range of animals.



## 28.1 Fishes

### Paired Fins


- A **fin** is a paddle-shaped structure on a fish or other aquatic animal that is used for balance, steering, and propulsion. 
- Paired fins reduce the chance of rolling to the side and allow for better steering during swimming.

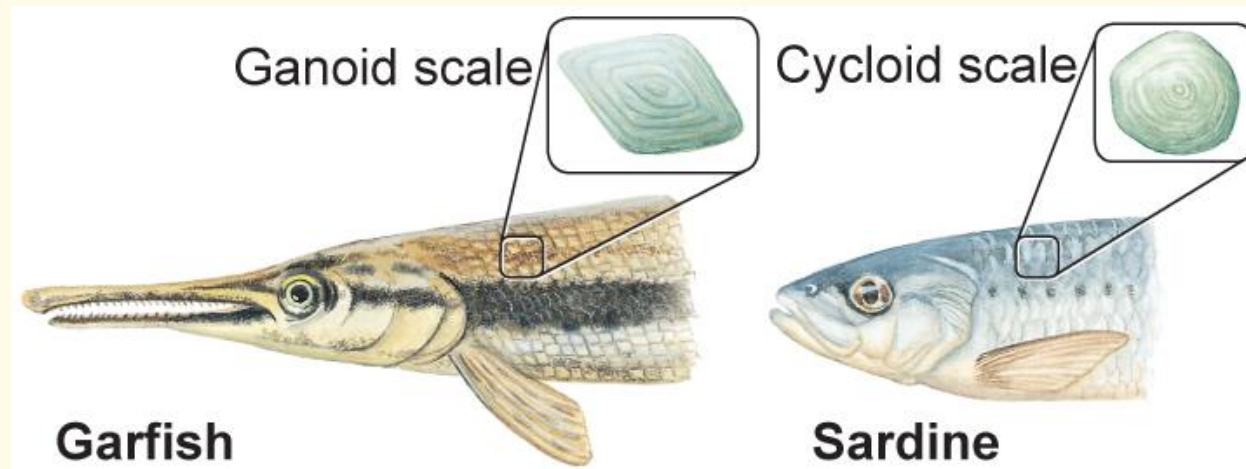




## 28.1 Fishes

### Scales

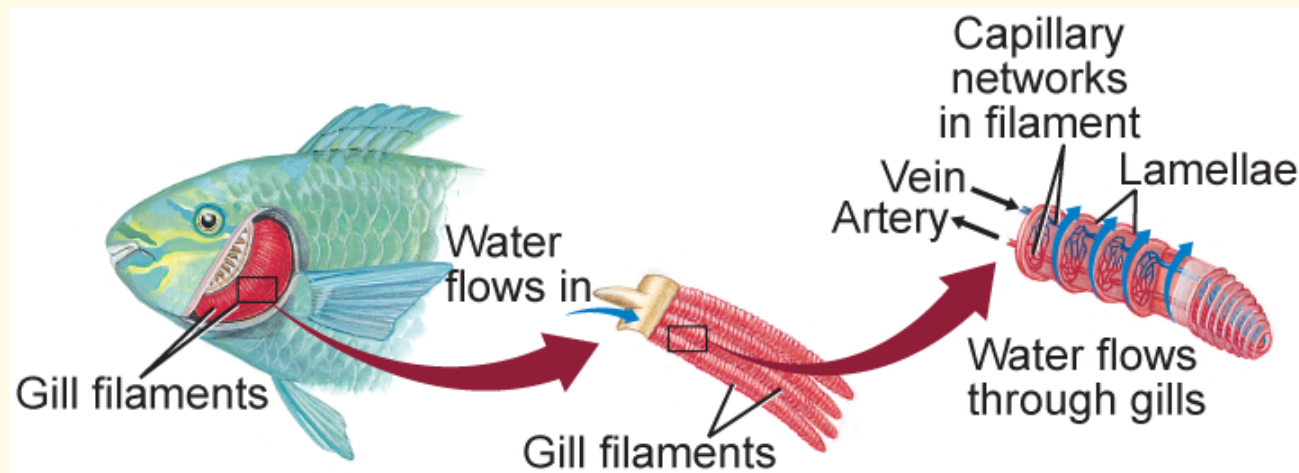
- There are four types of fish **scales**. 
- Ctenoid scales
- Cycloid scales
- Placoid scales
- Ganoid scales



## 28.1 Fishes



### Gills

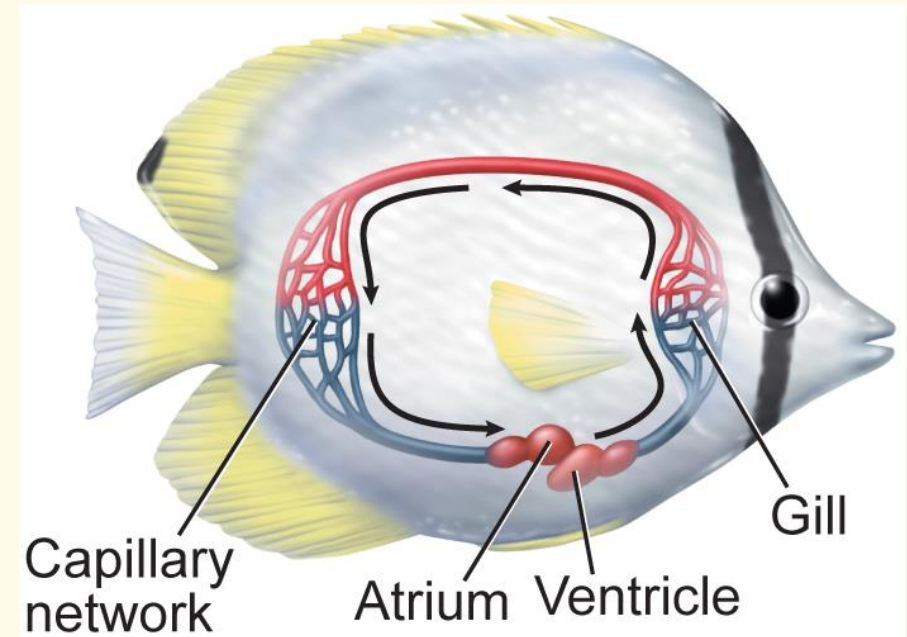
- Fishes get oxygen when water that enters their mouths flows across their gills, where oxygen from the water diffuses into the blood.
- Gills are composed of thin filaments that are covered with highly-folded, platelike lamellae.

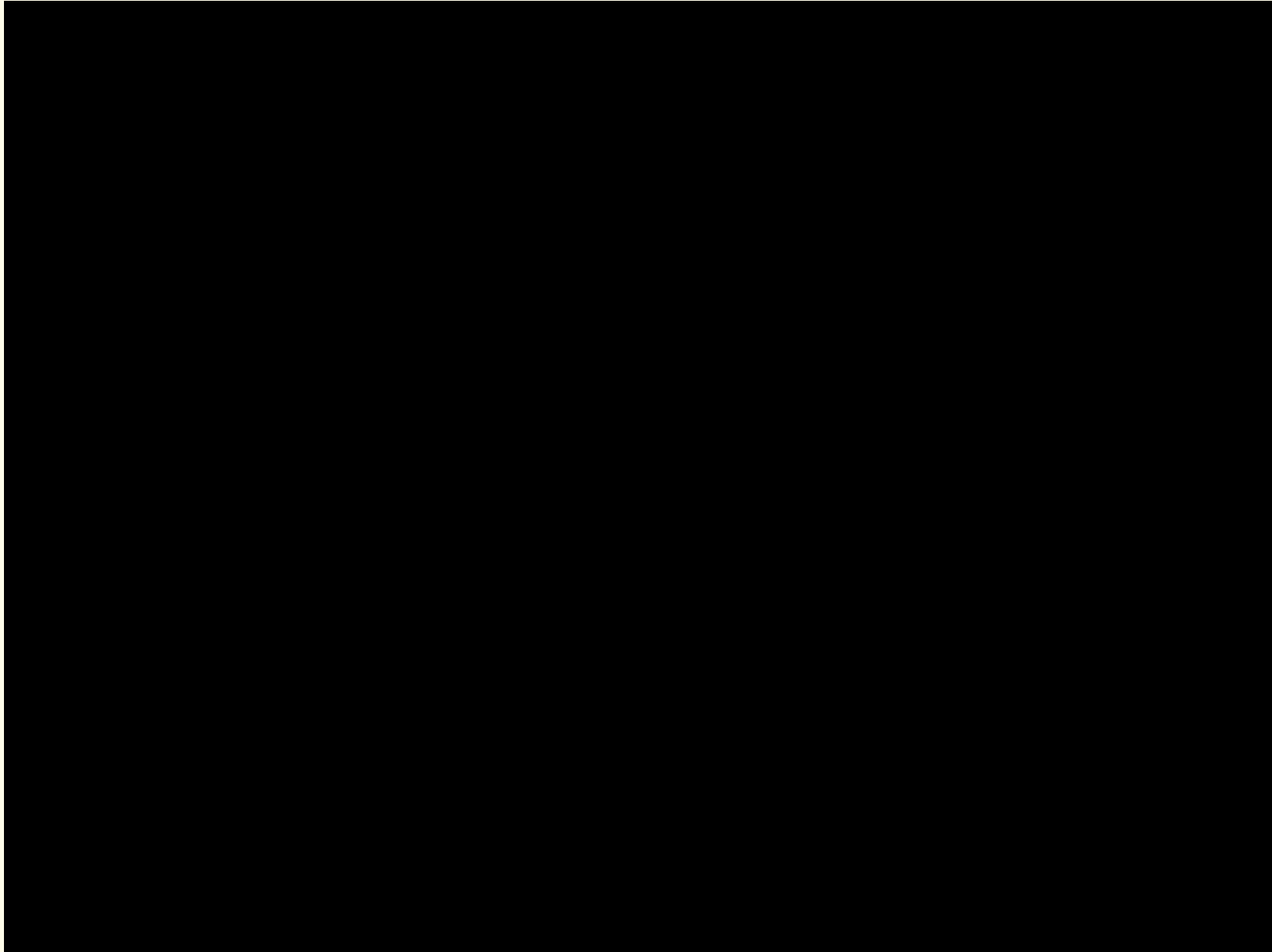


## 28.1 Fishes

### Circulation

- Vertebrates have a closed circulatory system.
- In most fishes, the heart consists of two main chambers—the **atrium** and the **ventricle**.  





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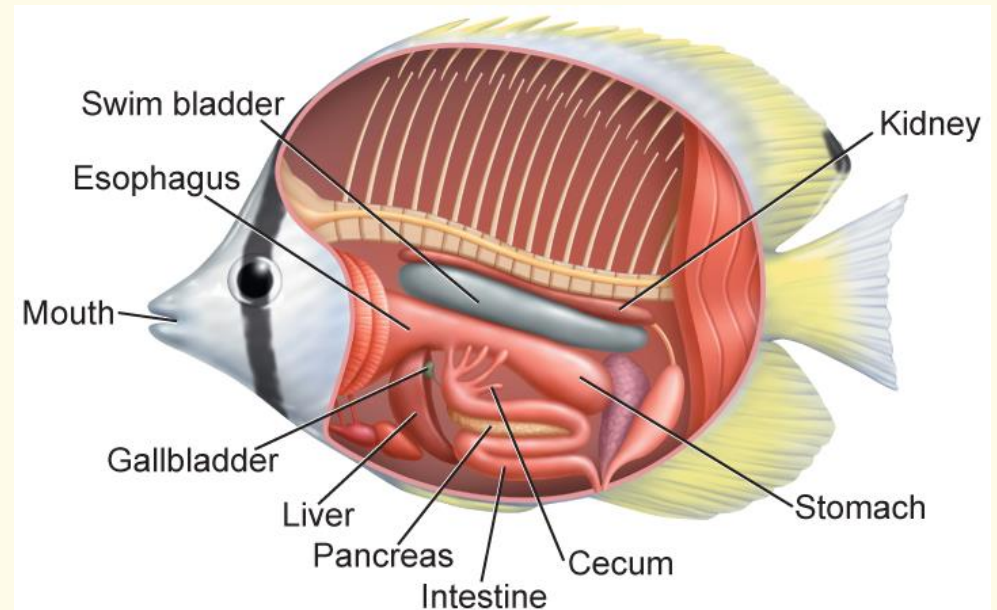




## 28.1 Fishes


### Feeding and Digestion

- Most fishes swallow their food whole, passing it through a tube called the esophagus to the stomach, where digestion begins.



## 28.1 Fishes

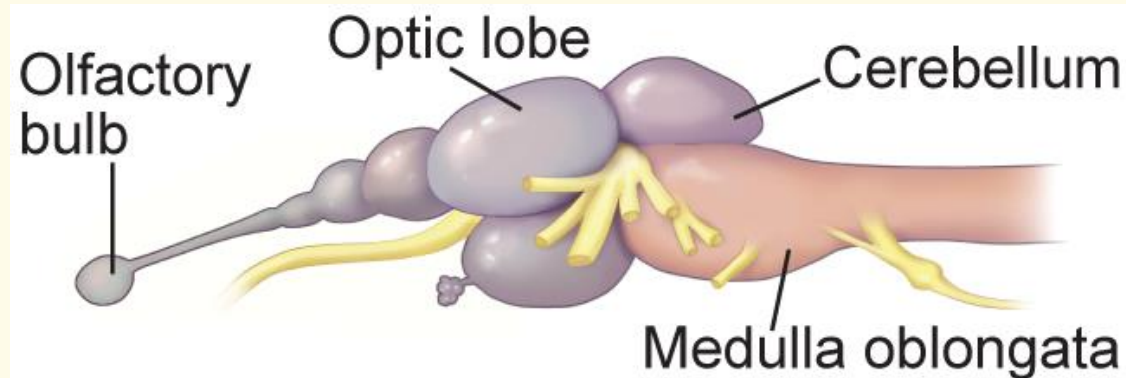
### Excretion

- Cellular wastes are filtered from fishes' blood by the kidneys.
- A **nephron** is a filtering unit within the kidney that helps maintain the salt and water balance of the body and to remove cellular waste products from the blood. 

## 28.1 Fishes


### The Brain and Senses

- Color vision, chemical detection, hearing, and balance are coordinating in the brain.
- The **lateral line system** is a special sensor that allows fish to detect even the slightest movements in water. 🔊



## 28.1 Fishes


### Reproduction

- The majority of fishes reproduce through external fertilization.
- Male and female fishes release their gametes near each other in the water in a process called **spawning**. 



## 28.1 Fishes

### Movement

- Fishes are well adapted to swimming in the water.
  - Streamlined shape
  - Paired fins
  - Swim bladder 
- Fishes move through the water by contracting muscle groups on either side of their bodies.

## 28.2 Diversity of Today's Fishes

### Classes of Fishes

- Scientists have grouped fishes into three classes based on their body structure.
  - Jawless fishes
  - Cartilaginous fishes
  - Bony fishes

## 28.2 Diversity of Today's Fishes

### Jawless Fishes

- Hagfish feed on soft-bodied invertebrates and dead or dying fish on the sea floor.
- Lampreys are parasites that feed by attaching themselves to other fishes.



Lamprey

## 28.2 Diversity of Today's Fishes

### Cartilaginous Fishes

- All cartilaginous fishes have skeletons made of cartilage.
- The flexible skeleton, rows of sharp teeth, a streamlined body, and placoid scales make sharks one of the top predators in the sea.
- Skates and rays have flattened bodies that are adapted for living on the ocean floor.



## 28.2 Diversity of Today's Fishes

### Bony Fishes

- There are two groups of bony fishes: the ray-finned fishes and the lobe-finned fishes.
- Thin, spinelike rays support the fins of ray-finned fishes.
- Lobe-finned fishes have muscular lobes and joints similar to those of land vertebrates.

Concepts In Motion  
**Animation**

Visualizing  
Bony Fishes

Click here to proceed!

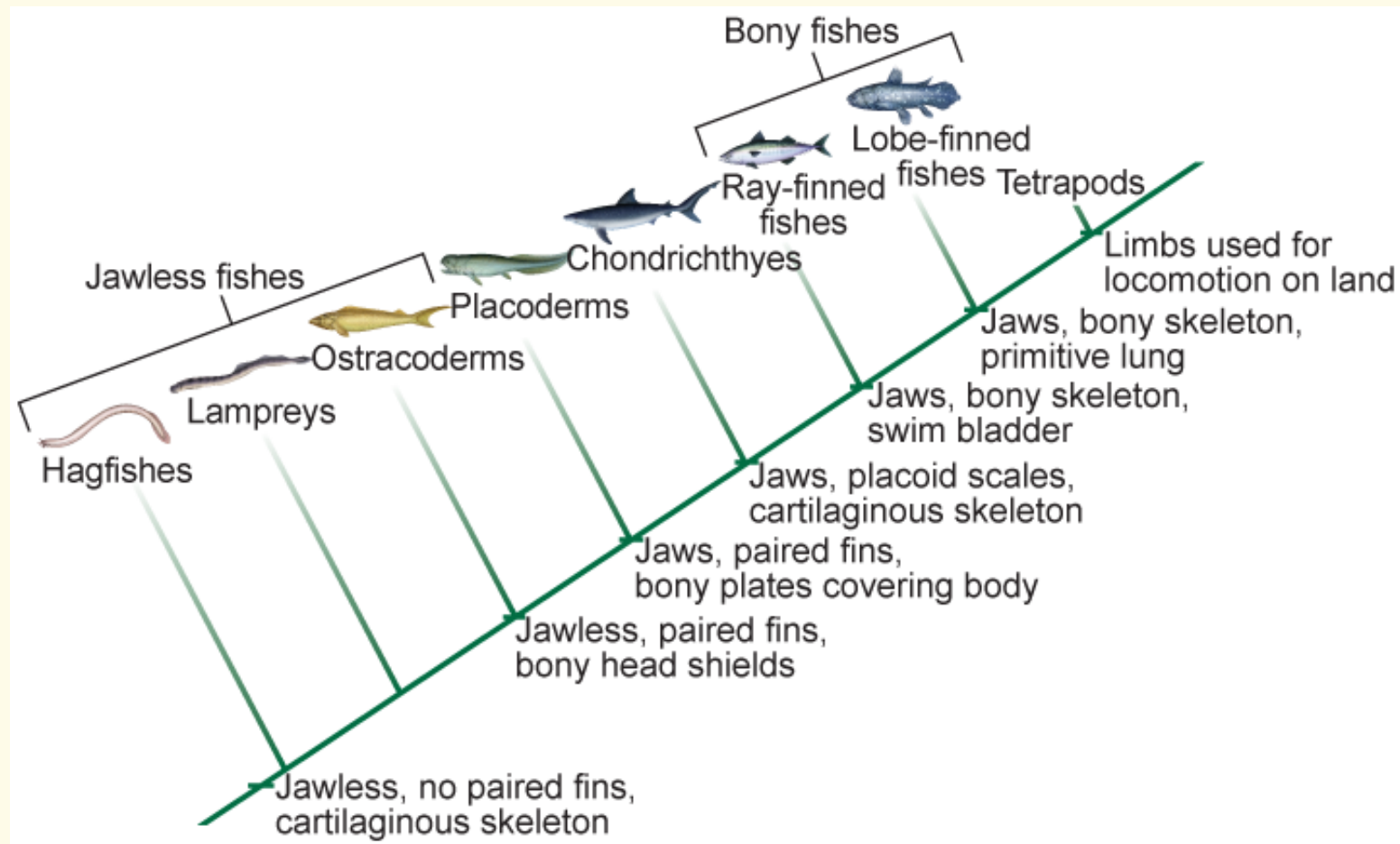
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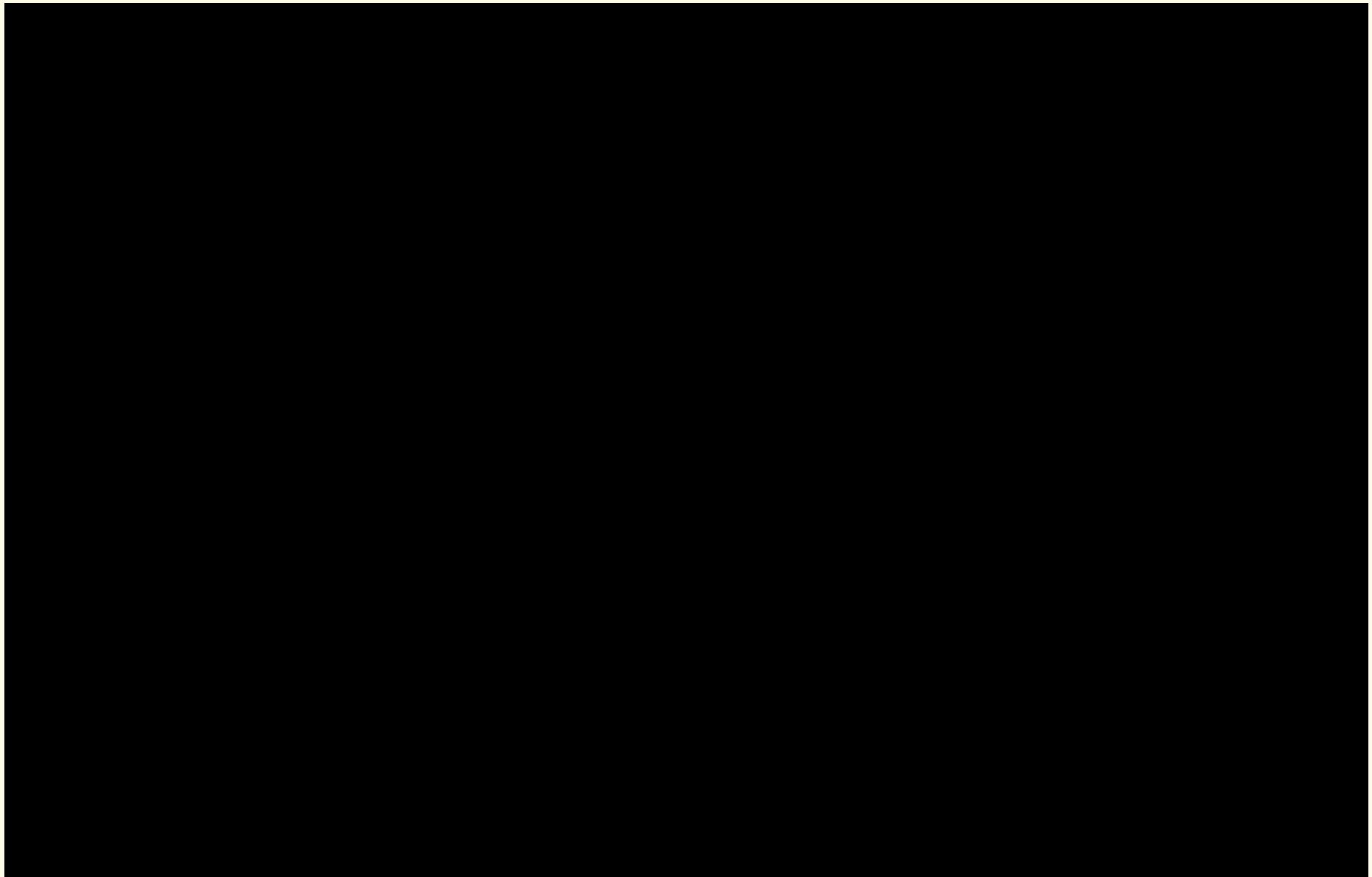
## 28.2 Diversity of Today's Fishes

### Evolution of Fishes



## 28.3 Amphibians

<div> <div></div> <div>Adaptations to Land</div> </div>		
Conditions in Water	Conditions on Land	Terrestrial Vertebrate Adaptations
Water exerts a buoyant force that counters the force of gravity.	<ul style="list-style-type: none"> <li>• Air is about 1000 times less buoyant than water.</li> <li>• Animals must move against gravity.</li> </ul>	Limbs develop and the skeletal and muscular systems of terrestrial animals become stronger.
Oxygen is dissolved in water and must be removed by gills through countercurrent circulation.	<ul style="list-style-type: none"> <li>• Oxygen is at least 20 times more available in air than in water.</li> </ul>	With lungs, terrestrial animals can get oxygen from air more efficiently than from water.
Water retains heat, so the temperature of water does not change quickly.	<ul style="list-style-type: none"> <li>• Air temperature changes more easily than water temperature.</li> <li>• Daily temperatures may change by 10°C between day and night.</li> </ul>	Terrestrial animals develop behavioral and physical adaptations to protect themselves from extreme temperatures.



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## 28.3 Amphibians

### Characteristics of Amphibians

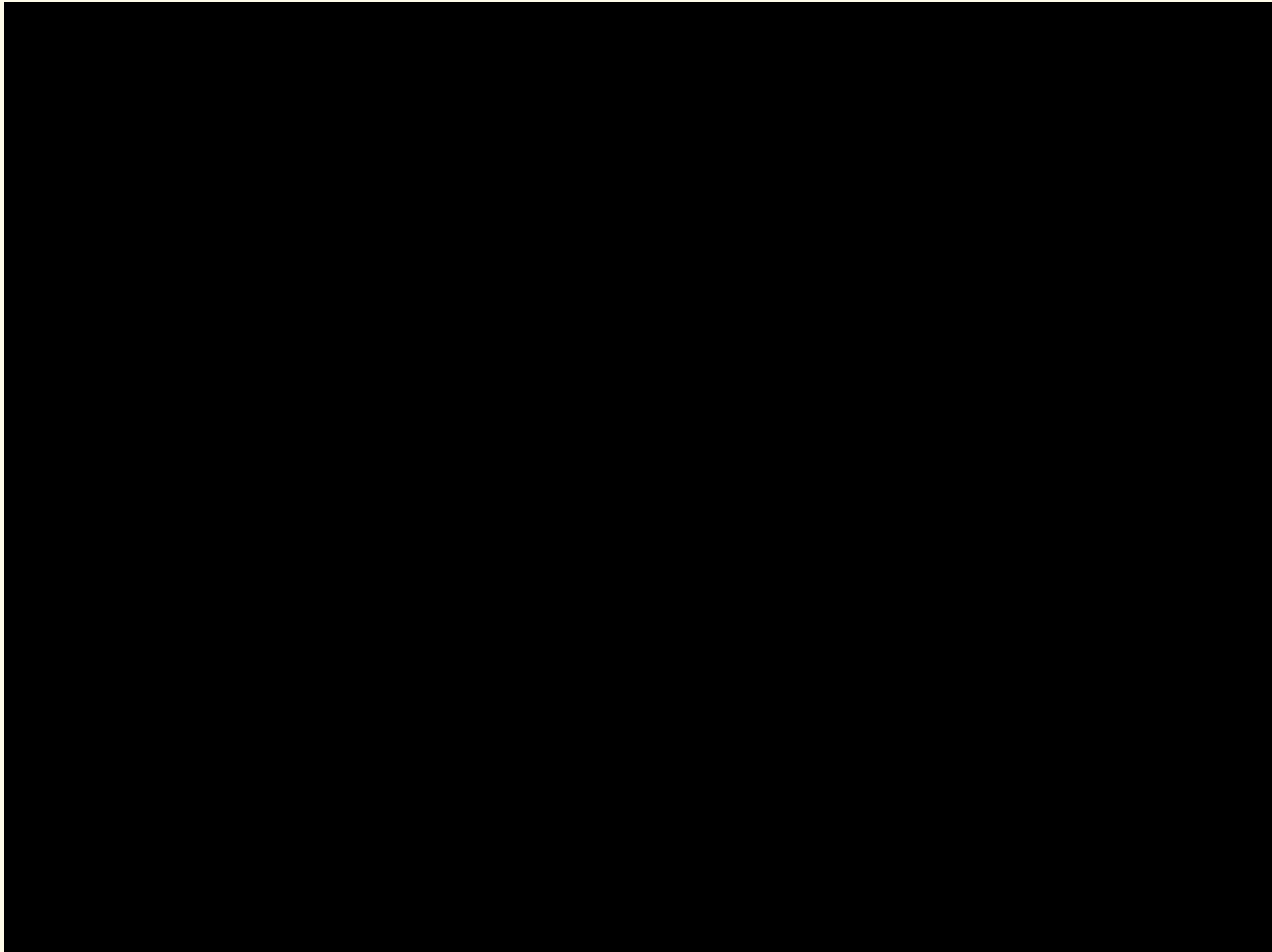
- Most amphibians begin life as aquatic organisms.
- After metamorphosis, they are equipped to live life on land.



Tadpole



Frog



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## 28.3 Amphibians

### Feeding and Digestion

- Most frog larvae are herbivores, whereas salamander larvae are carnivores.
- As adults, their diets are similar as both groups become predators.
- The digestive system of an amphibian is very similar to that of a fish.

## 28.3 Amphibians

### Excretion

- Amphibians filter wastes from the blood through their kidneys, and excrete either ammonia or urea as the waste product.
- Ammonia is excreted by amphibians that live in the water.
- Urea is stored in the urinary bladder until it is eliminated from the body through the **cloaca**. 

## 28.3 Amphibians

### Respiration

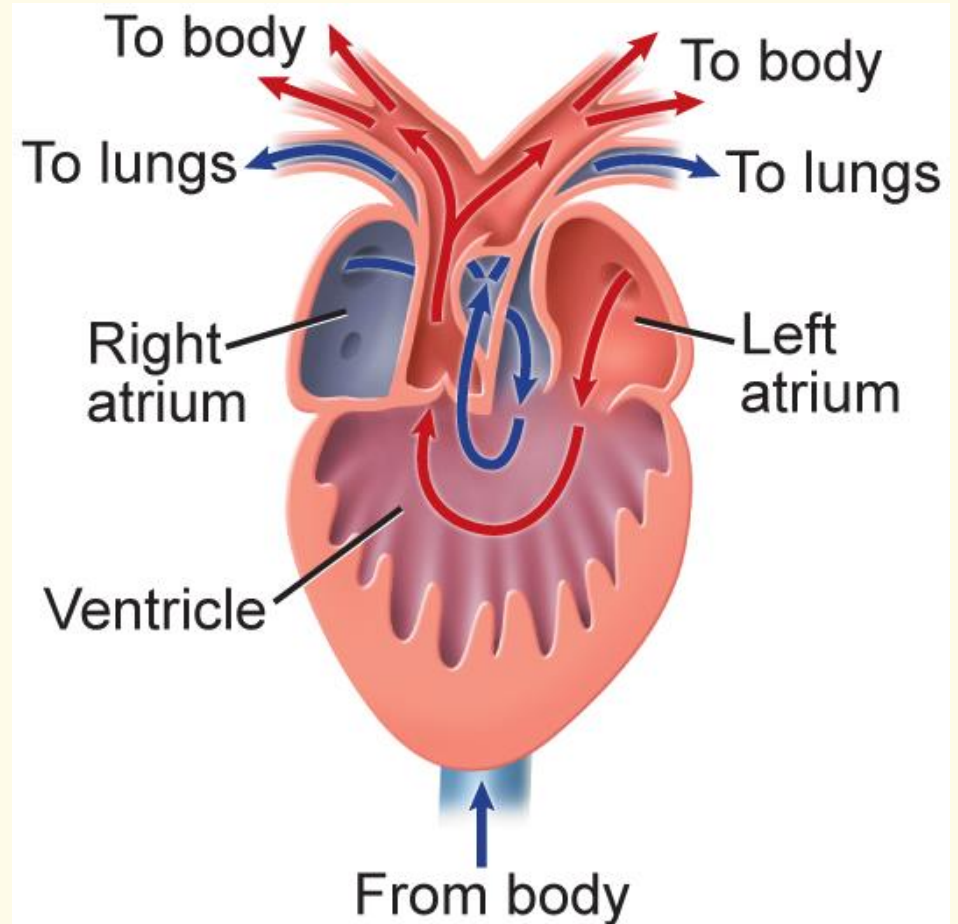
- As larvae, most amphibians exchange gases through their skin and gills.
- As adults, most breathe through lungs, their thin, moist skin, and cavities in the mouth.



## 28.3 Amphibians



### Circulation

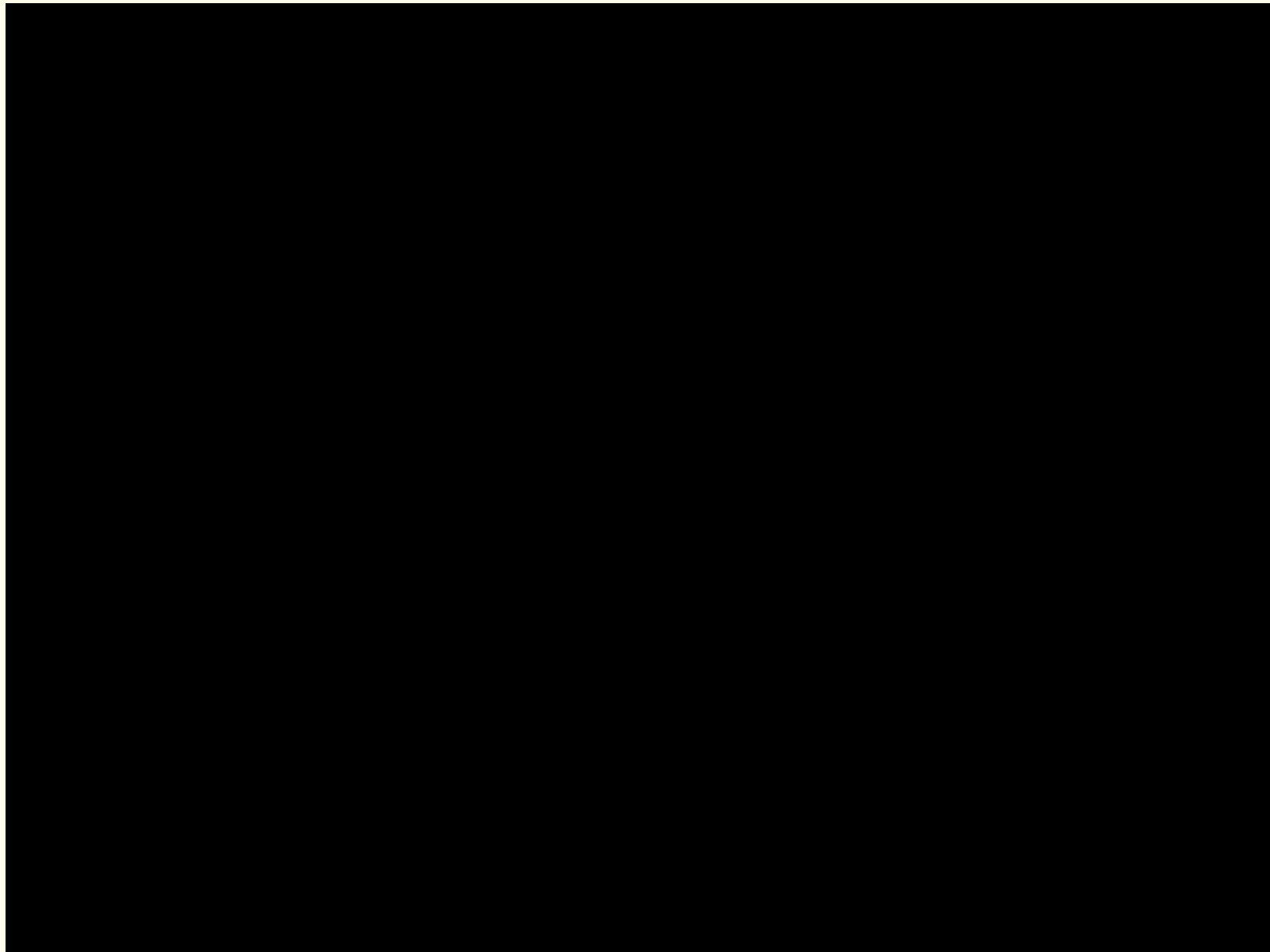
- Amphibians have a double-loop circulatory system.
- Amphibians have three-chambered hearts.



## 28.3 Amphibians

### The Brain and Senses

- Amphibians use sight to locate and capture prey that fly at high speeds and to escape predators.
- Frogs have **nictitating membranes** that protect their eyes. 
- Frogs use their **tympanic membrane** to hear high-pitched sounds and to amplify sounds from the vocal cords. 



## 28.3 Amphibians

### Reproduction and Development

- In most amphibians, fertilization is external and the shell-less eggs must be laid and fertilized in water.
- Tadpoles hatch from the egg and undergo metamorphosis from a fishlike animal to an air-breathing one.

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## 28.3 Amphibians

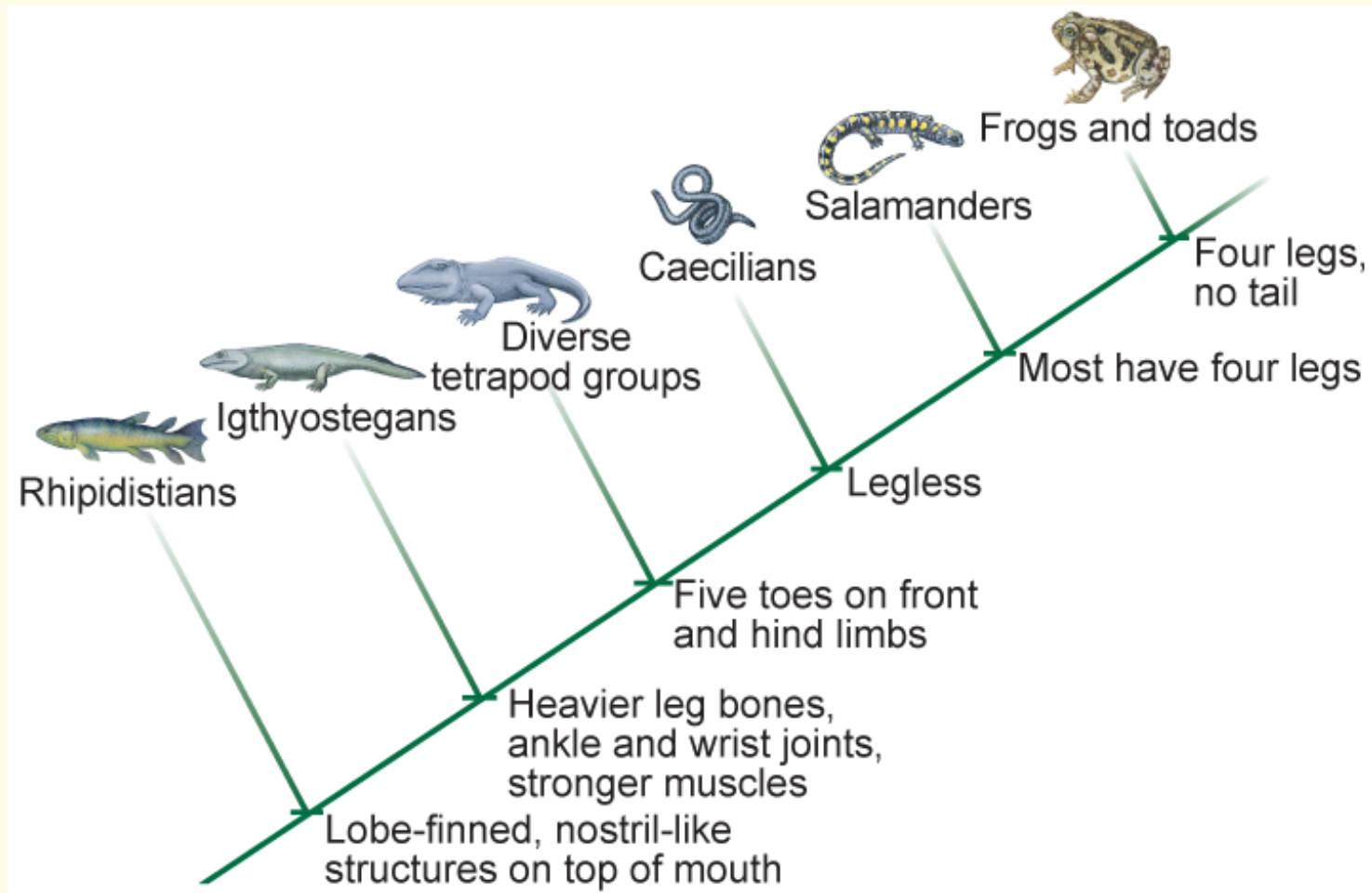
### Amphibian Diversity

- Scientists classify modern amphibians into three orders.
  - Order Anura includes frogs and toads.
  - Order Caudata includes salamanders and newts.
  - Order Gymnophiona includes caecilians.



## 28.3 Amphibians

### Evolution of Amphibians



## Chapter Resource Menu



Chapter Diagnostic Questions



Formative Test Questions



Chapter Assessment Questions



Standardized Test Practice



biologygmh.com



Glencoe Biology Transparencies



Image Bank



Vocabulary



Animation

Click on a hyperlink to view the corresponding lesson.

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Resources



## Chapter Diagnostic Questions



What body part developed in terrestrial vertebrates and functions like the lateral line system in fish?

- A. lungs
- ☒ B. ears
- C. limbs
- D. cloaca

## Chapter Diagnostic Questions



Which is *not* a characteristic of fish?

- A. jaws
- B. gills
- C. vertebral columns
- ☒ D. open circulatory system

## Chapter Diagnostic Questions



Identify the function of the pyloric cecum.

- ☒ A. secrete enzymes for digestion
- ☐ B. synthesize amino acids
- ☐ C. filter wastes
- ☐ D. circulate blood



## 28.1 Formative Questions



Why is a vertebral column an important adaptation in vertebrate animals?

- A. It enhances an animal's movement.
- B. It decreases the need for muscles.
- ☒ C. It protects the ventral notochord.
- D. It increases the efficiency of the exoskeleton.

## 28.1 Formative Questions



What is one important thing that fishes cannot do?

- A. secrete enzymes for digestion
- ☒ B. synthesize certain amino acids
- C. absorb nutrients into their bloodstream
- D. adjust the water balance in their bodies

## 28.1 Formative Questions



What enables a fish to detect movement in the water?

- A. optic system
- B. olfactory system
- ☒ C. lateral line system
- D. medulla oblongata

## 28.1 Formative Questions



What does a fish use to regulate buoyancy?

- A. cecum
- B. gallbladder
- C. float regulator
- ☒ D. swim bladder

## 28.2 Formative Questions



Which fish is a parasite?

- A. hagfish
- ☒ B. lamprey
- C. skate
- D. coelacanth

## 28.2 Formative Questions



What is a shark's skeleton composed of?

- A. bone
- B. chitin
- ☒ C. cartilage
- D. notochord



## 28.2 Formative Questions



Which group of fishes contains members that have lungs?

- A. cartilaginous fishes
- B. jawless fishes
- ☒ C. lobe-finned fishes
- D. ray-finned fishes

## 28.2 Formative Questions



Which fish is a 70 million-year-old “living fossil” that was caught off the coast of South Africa?

- ☒ A. Coelacanth
- ☐ B. Ostracoderm
- ☐ C. Placoderm
- ☐ D. Sarcopterygus

### 28.3 Formative Questions



How is a frog able to survive the winter at the bottom of a frozen pond?

- ☒ A. It breathes through its skin.
- ☐ B. It develops gills for absorbing oxygen.
- ☐ C. Its circulatory system shuts down.
- ☐ D. Its lungs extract oxygen from the water.

### 28.3 Formative Questions



How many heart chambers does an amphibian have?

- A. one atrium and one ventricle
- ☒ B. two atria and one ventricle
- C. one atrium and two ventricles
- D. two atria and two ventricles

### 28.3 Formative Questions



What part of an amphibian's body does the nictitating membrane cover?

- A. eardrums
- ☒ B. eyes
- C. skin
- D. lungs

### 28.3 Formative Questions



What does an amphibian sense with its tympanic membrane?

- A. light
- B. movement
- ☒ C. sound
- D. taste



### 28.3 Formative Questions



What is the name for an organism that obtains its body heat from its external environment?

- A. cold-blooded
- ☒ B. endotherm
- C. exotherm
- D. dermothem

### 28.3 Formative Questions



Which is a global factor that might be causing a decline in amphibian populations worldwide?

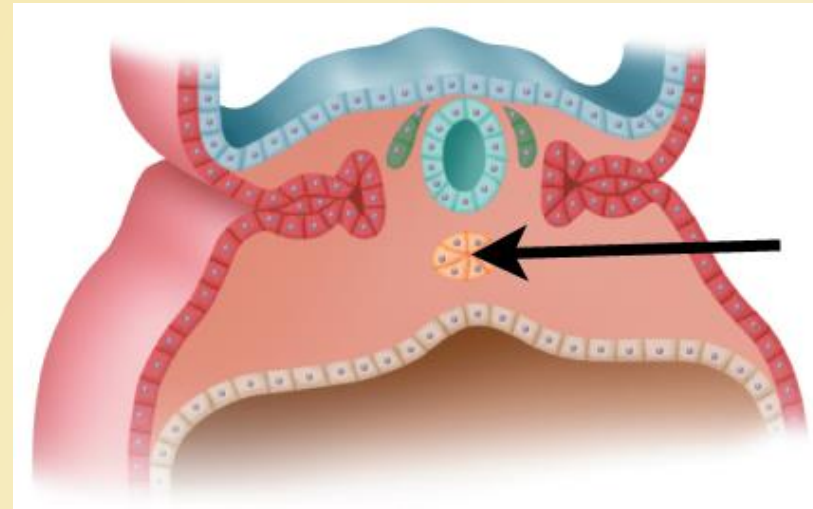
- A. decreasing temperature
- B. exotic competitors
- ☒ C. longer dry seasons
- D. habitat destruction

## Chapter Assessment Questions



Name the structure of the vertebral column shown.

- A. neural crest
- B. notochord**
- C. nerve cord
- D. ectoderm



## Chapter Assessment Questions



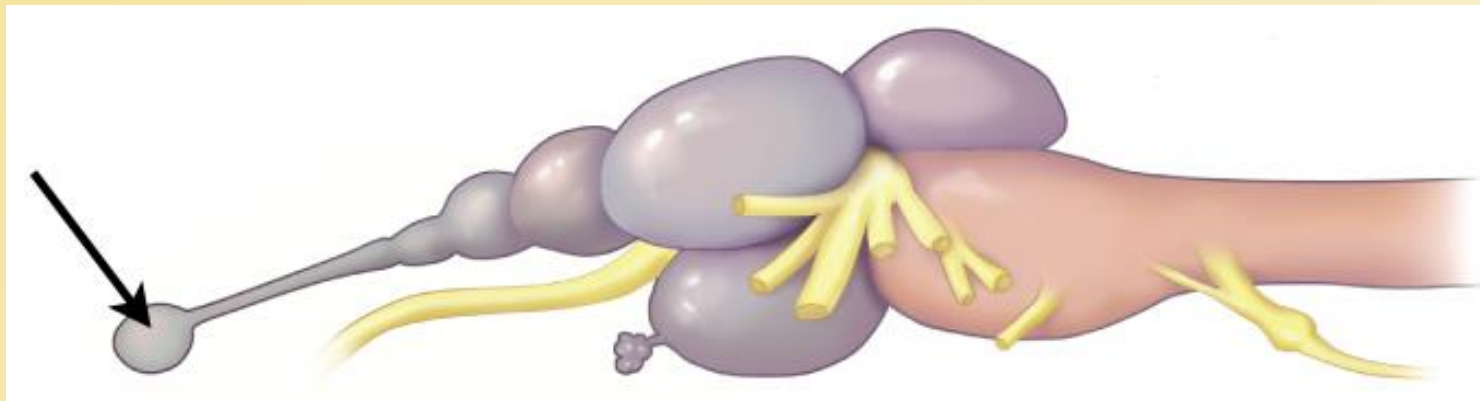
Which is not a characteristic of the circulatory system of amphibians?

- ☒ A. two-chambered heart
- ☐ B. double loop system
- ☐ C. undivided ventricle
- ☐ D. right atrium receives deoxygenated blood from the body

## Chapter Assessment Questions



What structure is indicated?



- A. cerebellum
- B. medulla oblongata
- C. optic lobe
- ☒ D. olfactory bulb

## Standardized Test Practice



What level of classification is Vertebrata?

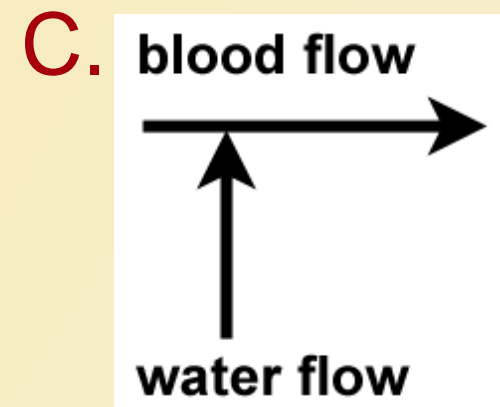
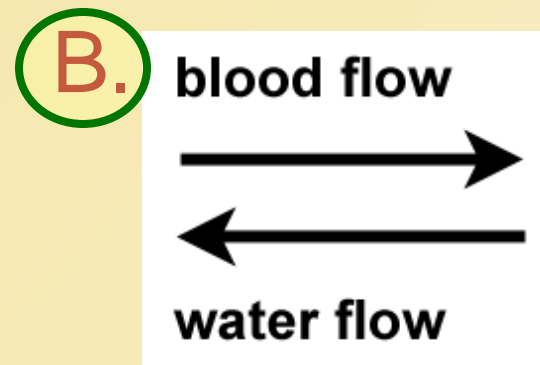
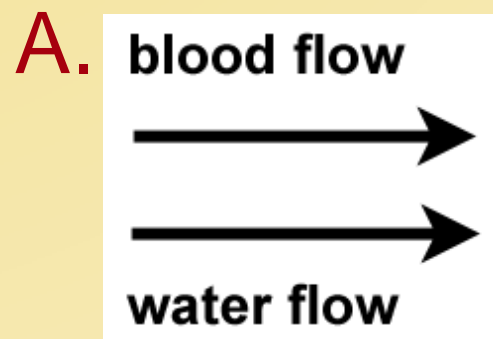
- A. subkingdom
- B. phylum
- ☒ C. subphylum
- D. superclass



## Standardized Test Practice



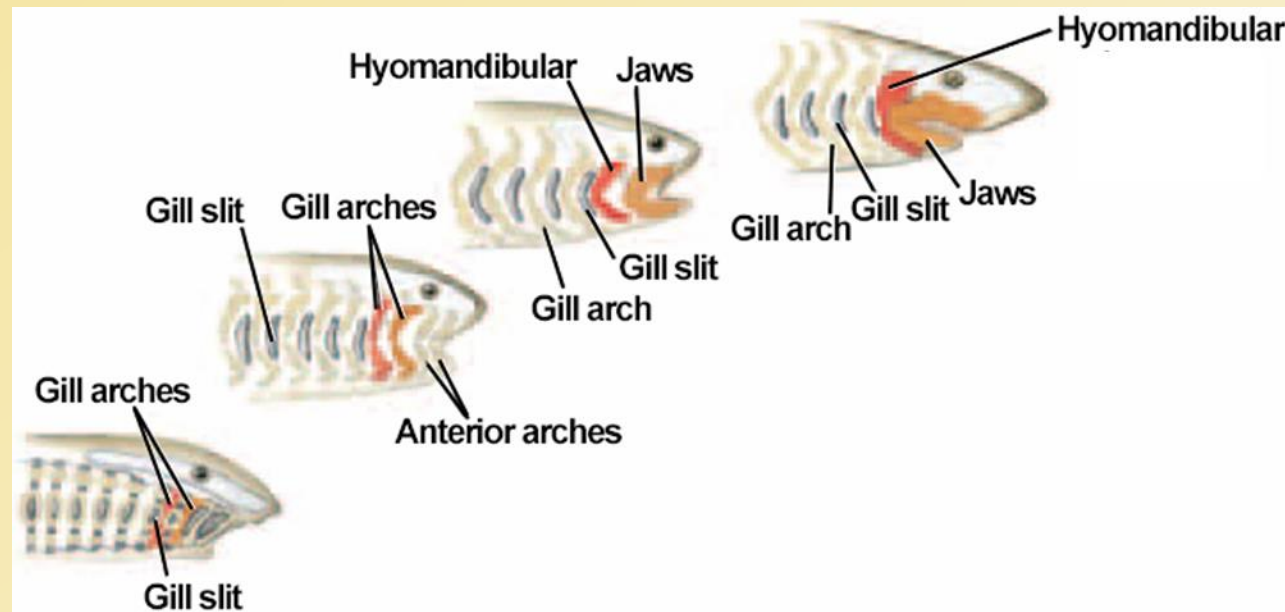
Which shows the direction of blood flow through a gill in relation to water flow over the gill surface?



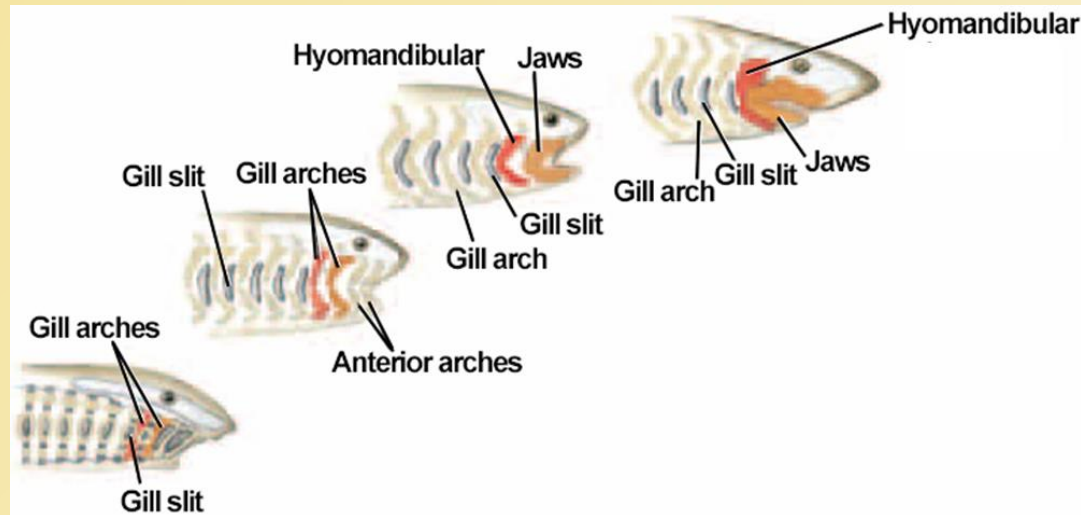
## Standardized Test Practice



Which structures evolved to form jaws in ancient fishes?



## Standardized Test Practice



- A.** gill arches
- B.** gill slits
- C.** hyoid arch
- D.** hyomandibular

## Standardized Test Practice



How does blood flow through a fish's body?

A. heart → body → gills → heart

☒ B. heart → gills → body → heart

C. heart → gills → heart → body

## Standardized Test Practice



True or False

The operculum are gill structures which contain many blood vessels.

**Standardized Test  
Practice**

What is the *first* thing a shark is able to sense when it is still a great distance from its prey?

- A. bioelectrical fields
- ☒ B. chemicals in the water
- C. vibrations in the water
- D. visual images of its prey



## Standardized Test Practice



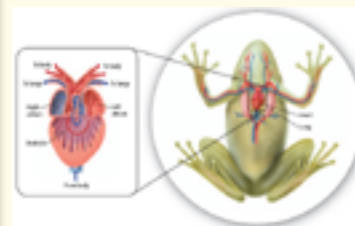
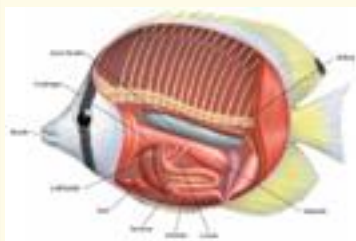
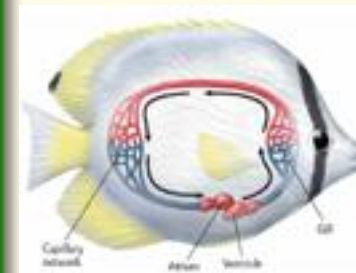
Why is the production of large numbers of eggs an important adaptation for some fishes?

- A. Their offspring are developed internally.
- B. They reproduce by internal fertilization.
- ☒ C. Their eggs and juveniles are prey to other animals.
- D. They guard their fertilized eggs from predators.

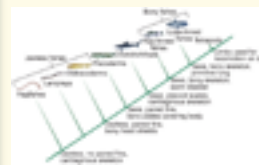
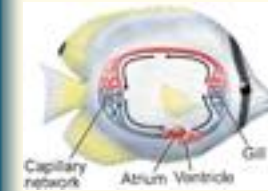
**Standardized Test  
Practice**

Which amphibian, when picked up by a dog, may cause the dog to get sick and vomit?

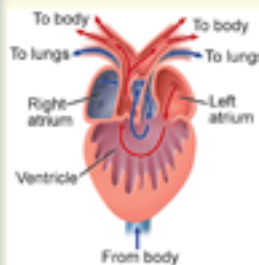
- A. frog
- B. newt
- ☒ C. toad
- D. salamander



## Image Bank














Adaptations to Land		
Adaptations to Water	Adaptations to Land	Terrestrial vertebrate adaptations
Water is more abundant than land, so the body is more rounded.	Water is less abundant than land, so the body is more elongated.	Body shape and the internal and external structures of terrestrial vertebrates are adapted to life on land.
Support is provided by the water, so the body is more rounded.	Support is provided by the body, so the body is more elongated.	Body shape and the internal and external structures of terrestrial vertebrates are adapted to life on land.
Water is more abundant than land, so the body is more rounded.	Water is less abundant than land, so the body is more elongated.	Body shape and the internal and external structures of terrestrial vertebrates are adapted to life on land.



## Vocabulary

### Section 1

-  cartilage
-  neural crest
-  fin
-  scale
-  operculum
-  atrium
-  ventricle
-  nephron
-  lateral line system
-  spawning
-  swim bladder

## **Vocabulary**





### Section 2



tetrapod

## Vocabulary

### Section 3

-  cloaca
-  nictitating membrane
-  tympanic membrane
-  ectotherm



## Animation



- Circulation in Fish
- Visualizing Bony Fishes
- Amphibian Life Cycle
- A Frog