

### How Sharks Work 6-8

#### **Program Description:**

How do sharks' body systems work together for life processes? Students will assess the unique body systems of sharks and rays and how they help them be apex predators in their environments. Students will compare the skeletal composition of sharks and rays to their own, while discovering sensory organs that have electromagnetic reception!

#### **At the end of program, students can...**

- Identify organs involved in the respiratory and cardiovascular system of sharks.
- Compare the difference of shark anatomy to bony fish.

#### **Background:**

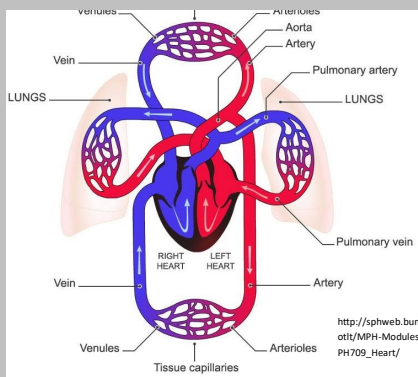
- All animals have organs, which are a group of tissues that perform a specific form and function. These organs work together to create an organ system. The cardiovascular system works the same way in fish and humans. The primary function of the heart and blood vessels is to transport oxygen, nutrients and byproducts of metabolism.
- Oxygenated and nutrient rich blood is distributed to tissues via the arterial system, which branches into smaller and smaller blood vessels from arteries to arterioles to capillaries (where most exchange occurs).



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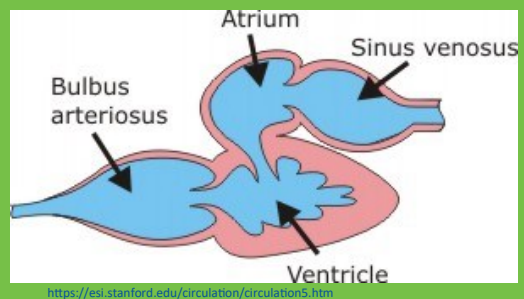
### Human Cardiovascular System

- The primary functions of the heart and blood vessels are to transport oxygen, nutrients and byproducts of metabolism.
- The heart functions as a pump to maintain circulation. The heart is a vital organ, which in humans has four distinct chambers.
- The right side of the heart (right atrium and right ventricle) receives blood returning from the periphery and sends it to the lungs (via the pulmonary artery) for re-oxygenation.
- Once blood is reoxygenated in the lungs, it is returned to the left side of the heart to pump to the rest of the body.



### Fish Cardiovascular System

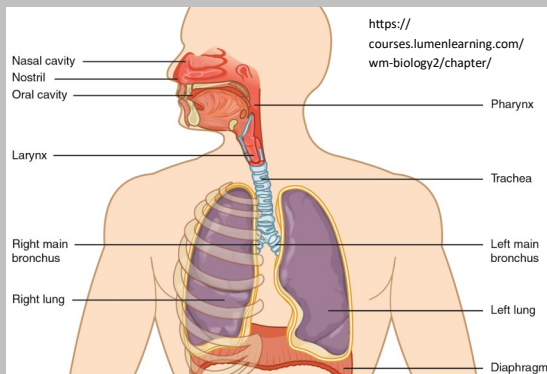
- This system consists of the heart, the arteries, the capillaries, and the veins.
- It is in the capillaries that the interchange of oxygen, carbon dioxide, nutrients, and other substances such as hormones and waste products takes place.
- The capillaries lead to the veins, which return the venous blood with its waste products to the heart, kidneys, and gills.
- The blood from the body, which is low in oxygen enters the atrium, is pumped into the ventricle, then pumped out into the bulbus arteriosus and on to the gills.



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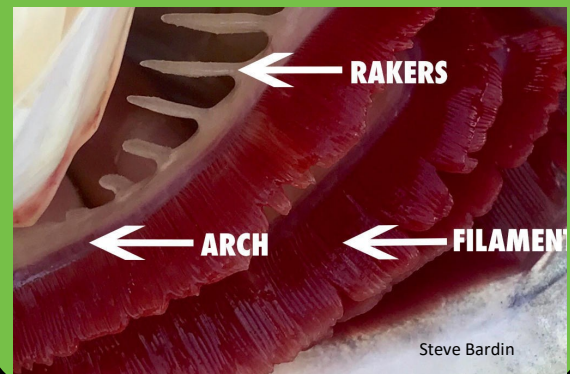
### Human Respiratory System

- The human gas-exchanging organ, the lungs, is located in the thorax, where its delicate tissues are protected by the bony and muscular thoracic cage.
- The lungs provide the tissues of the human body with a continuous flow of oxygen and clears the blood of the gaseous waste product, carbon dioxide.
- Atmospheric air is pumped in and out regularly through a system of pipes, called conducting airways, which join the gas-exchange region with the outside of the body. The airways can be divided into upper and lower airway systems.



### Fish Respiratory System

- Oxygen and carbon dioxide dissolve in water, and most fishes exchange this water by means of the gills.
- The gills lie behind and to the side of the mouth cavity and consist of fleshy filaments supported by the gill arches and filled with blood vessels, which give gills a bright red color.
- Water taken in continuously through the mouth passes backward between the gill bars and over the gill filaments, where the gills take up oxygen and return carbon dioxide to the water.





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**Instructions:** Read the previous pages, then answer the questions below.

- In addition to heart and vessels, what is one feature that is similar between the human cardiovascular system and the fish cardiovascular system?

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- What is one feature that is different between the human cardiovascular system and fish cardiovascular system?

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- What is one feature that is similar between the human respiratory system and fish respiratory system?

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- In addition to lungs and gills, what is one feature that is different between the human respiratory system and fish respiratory system?

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- By predicting, or doing further research to answer the question, are there other organ systems fish and humans have in common?

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- Sharks' skeletal structures are made up of what? Name one place on the human body this can be located.

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- What are the differences between shark respiratory system and bony fish respiratory system?

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- What is the organ that aids sharks in buoyancy? What is it in bony fish?

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- How can a shark diet be identified from anatomy alone? Give an example of that feature and the diet associated with that feature.

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- Name an animal that uses organs to create an electric field.

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- What was the name of the shark organ that allows them to sense electromagnetic fields? \_\_\_\_\_

- What types of water can sharks be found in? \_\_\_\_\_

- What adaptation allows bull sharks to be the only shark to survive in \_\_\_\_\_ water?

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- What adaptations allows epaulette sharks to survive for outside of water in \_\_\_\_\_ zones for up to an hour?

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**Instructions:** Read the previous pages, then answer the questions below.

- In addition to heart and vessels, what is one feature that is similar between the human cardiovascular system and the fish cardiovascular system?

**Both hearts pump blood throughout the body, both hearts receive deoxygenated blood or both systems transport nutrients, etc. throughout the body.**

- What is one feature that is different between the human cardiovascular system and fish cardiovascular system?

**Humans have a 4 chamber heart, fish have a 2 chambered heart, Human hearts received oxygenated blood, fish hearts do not.**

- What is one feature that is similar between the human respiratory system and fish respiratory system?

**Both take in oxygen and expel carbon dioxide, the mouth is a necessary part of both respiratory systems or both oxygenate the blood for the whole body.**

- In addition to lungs and gills, what is one feature that is different between the human respiratory system and fish respiratory system?

**Human respiratory system can be divided into an upper and lower, humans obtain oxygen through air while fish obtain it through water, or fish do not have airway pipes to conduct the oxygen.**

- Predicting, or doing further research, are there other organ systems fish and humans have in common?

**Fish have all the same systems except lymphatic. All the organ systems of course look different between the two.**



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- Sharks' skeletal structures are made up of what? Name one place on the human body this can be located.

**It is made up of Cartilage and can be found in the nose, ear, ribs or between any spot two bones are meeting.**

- What are the differences between shark respiratory system and bony fish respiratory system?

**Some shark species can have spiracles to help pump the water and bony fish have an operculum.**

- What is the organ that aids sharks in buoyancy? What is it in bony fish?

**In sharks it is the liver, in bony fish it is the swim bladder.**

- How can a shark diet be identified from anatomy alone? Give an example of that feature and the diet associated with that feature.

**Based on teeth, sharp pointy means bony fish or larger or rounded means shelled animals.**

- Name an animal that uses organs to create an electric field.

**Electric eel is most well known and mentioned in program.**

- What was the name of the shark organ that allows them to sense electromagnetic fields? **Ampullae of Lorenzini**

- What types of water can sharks be found in? **Fresh, brackish and salt.**

- What adaptation allows bull sharks to be the only shark to survive in **Fresh** water?

**Bull sharks retain salt in the cells to prevent rupturing.**

- What adaptations allows epaulette sharks to survive for outside of water in **Coastal/Tidal** zones for up to an hour?

**Rotate fins 90° to "walk" and slows breathing, heart rate and brain function.**