Spiral Valve Some amphibians have a spiral valve that divides the conus arteriosus. The spiral valve also helps keep the two streams of blood separate as they leave the heart. Even so, some oxygen-poor blood is delivered to the body's tissues. Recall, however, that amphibians also obtain oxygen through their skin. This extra oxygen partly makes up for the limitations of their circulatory system.

Double-Loop Circulation The path of circulation in amphibians is different from that in most fishes. As amphibians evolved, their circulatory system changed to support their life on land. The result was a second circulatory loop. This change allowed more oxygen to be delivered to their bodies. Examine **Figure 12,** and compare the single-loop circulation of most fishes with the double-loop circulation of amphibians.

Notice the circulatory loop that connects an amphibian's heart to its lungs. In this loop, amphibians have blood vessels that are not found in fishes—the pulmonary veins. The **pulmonary veins** are the vessels that carry the oxygen-rich blood from the amphibian's lungs directly back to its heart. An amphibian's second circulatory loop carries the oxygen-rich blood from the heart to the body. The advantage of this arrangement is that oxygen-rich blood can be pumped to the amphibian's tissues at a much higher pressure and speed than it can in fishes. (Recall that in fishes, blood is pumped through the narrow capillaries of the gills before reaching the body organs. Blood flow slows as it moves through the gill capillaries. As a result, much of the heartbeat's force is lost.)

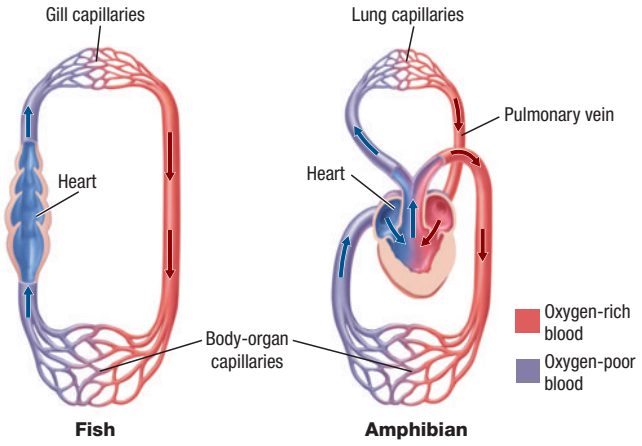


Figure 12 Circulation in most fishes involves a single loop. Amphibians have a second loop that goes from the heart to the lungs and back to the heart.

› **Reading Check** *How is the circulatory system of amphibians different from the circulatory system of most fishes?*

READING TOOLBOX

Comparisons Using **Figure 12,** write two sentences that compare and two sentences that contrast fish and amphibian circulation.

Section 3 Review

› KEY IDEAS

1. **Describe** the key characteristics of amphibians.
2. **Identify** the function of the tympanic membrane.
3. **Summarize** how amphibians take in oxygen.
4. **Contrast** the single-loop circulation of fishes with the double-loop circulation of amphibians.

CRITICAL THINKING

5. **Justifying Conclusions** You read an article in a newspaper that states that amphibians are very vulnerable to pollutants in the water around them. Do you think this is likely? Why or why not?
6. **Comparing Structures** Which sense organ of a terrestrial amphibian resembles the fish's lateral line in function? Explain your answer.

WRITING FOR SCIENCE

7. **Writing News Articles** Use library resources and the Internet to research the worldwide decline in amphibian numbers that scientists have observed over recent years. Prepare a report on your findings in the form of a written news article or as a segment for a TV news program.

READING TOOLBOX

Visual Literacy Use **Figure 12** to compare the circulatory pathways of fish and amphibians. Ask students "What is the function of the second loop in the amphibian system?" (The second loop creates a circulatory pathway to and from the lungs.) "What advantage does the double-loop system provide?" (The amphibian's heart pumps oxygen-rich blood to the amphibian's tissues at much higher pressures than can happen in the fish's single-loop system.) LS Visual

› Close

Formative Assessment

The advantage of double-loop circulation is

A. more efficient oxygen transport to support the higher metabolic rates needed to live on land (Correct! Double-loop circulation enables oxygen-rich blood to reach body tissues faster than in fish.)
B. the tympanic membrane prevents the mixing of oxygen-rich and oxygen-poor blood (Incorrect. The tympanic membrane is a sense organ, and not related to amphibian circulation.)
C. lungs became more efficient than gills (Incorrect. Gills are actually more efficient than lungs.)
D. that it created a site for cutaneous respiration (Incorrect. Cutaneous respiration occurs at the skin's surface.)

Answers to Section Review

1. Most amphibians share five key characteristics: legs, lungs, double-loop circulation, a partially divided heart, and cutaneous respiration.
2. transfer the vibrations of sound waves to the inner ear
3. through gills, lungs, and the skin
4. In single-loop circulation, blood is pumped through gills and then travels through the body. In double-loop circulation, blood is pumped to the lungs and then travels back to the heart, which pumps it to the rest of the body. Blood flows faster and more efficiently in a double-loop system.
5. Amphibian skin is very permeable. This lets oxygen in but it also allows pollutants to easily cross the skin.
6. the tympanic membrane, which also picks up vibrations in the environment
7. Presentations should cover the history of this area of research and should also include scientific explanations for the phenomenon. Articles and presentations should be free of personal opinion.