

Circulatory systems

Revision notes · The circulatory system is a pump, vessels and valves giving one-way flow; compare the single circulation of a fish with the double circulation of a mammal.

For Cambridge IGCSE Biology 0610 (and 0970, which has the same content). **Supplement** is Extended content, only examined on Papers 2 and 4.

Circulatory systems Spec 9.1

Single and double circulation Spec 9.1.1, 9.1.2, 9.1.3, 9.1.4

The **circulatory system** is a system of blood vessels with a pump and valves to ensure **one-way flow of blood**. The pump is the heart. The vessels are arteries, veins and capillaries. Valves stop blood flowing backwards.

Supplement

Single circulation of a fish

Supplement

In a fish the blood passes through the heart only once during each complete circuit of the body.

Supplement

1. The heart pumps deoxygenated blood to the gills.
2. In the gill capillaries the blood picks up oxygen. Blood pressure falls because the capillaries are so narrow.
3. The oxygenated blood flows on to the organs and muscles of the body, but at lower pressure.
4. The blood returns to the heart.

Supplement

Double circulation of a mammal

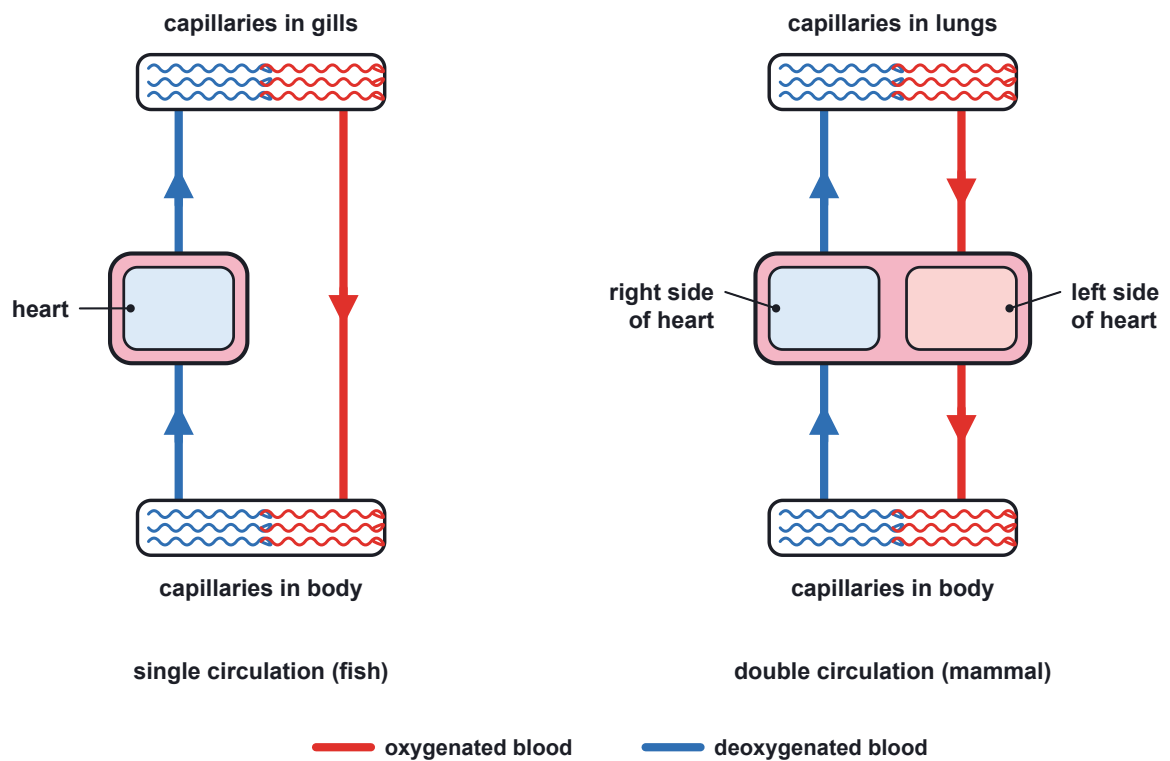
Supplement

In a mammal the blood passes through the heart twice during each complete circuit of the body. There are two separate circuits.

Supplement

- **Pulmonary circulation**: right side of the heart, then the lungs, then back to the left side of the heart.
- **Systemic circulation**: left side of the heart, then the rest of the body, then back to the right side of the heart.

Supplement



In a fish the blood passes through the heart **once** in each circuit. In a mammal it passes through **twice**.

Supplement

Advantages of a double circulation

Supplement

After blood has passed through the lung capillaries its pressure is low. In a double circulation it returns to the heart to be pumped again.

Supplement

- Blood is pumped at **high pressure** to the body, so oxygen and glucose reach the tissues quickly.
- Blood pressure in the lungs can be kept lower, so the delicate lung capillaries are not damaged.
- Mammals have a high rate of respiration (for example, to keep their body temperature constant), so they need this fast supply of oxygen and glucose.

Supplement

Single and double circulation compared

Feature	Fish (single)	Mammal (double)
Times blood passes through the heart in one circuit	Once	Twice
Pressure of blood reaching the body organs	Low, as it has just passed through the gill capillaries	High, as it is pumped again after the lungs

Supplement

Exam tip: Always say the blood returns to the heart before going to the body in a double circulation. That is the idea that earns the marks for the advantage.

Quick check

1. What is the circulatory system?
2. **Supplement** How many times does blood pass through the heart in one circuit of a fish?
3. **Supplement** Name the two circuits of a mammal's double circulation.
4. **Supplement** Give one advantage of a double circulation.

Quick check answers

Circulatory systems

1. A system of blood vessels with a pump and valves to ensure one-way flow of blood.
2. Once (single circulation).
3. Pulmonary (heart to lungs and back) and systemic (heart to body and back).
4. Blood is returned to the heart and pumped to the body at high pressure, so substances are delivered faster.