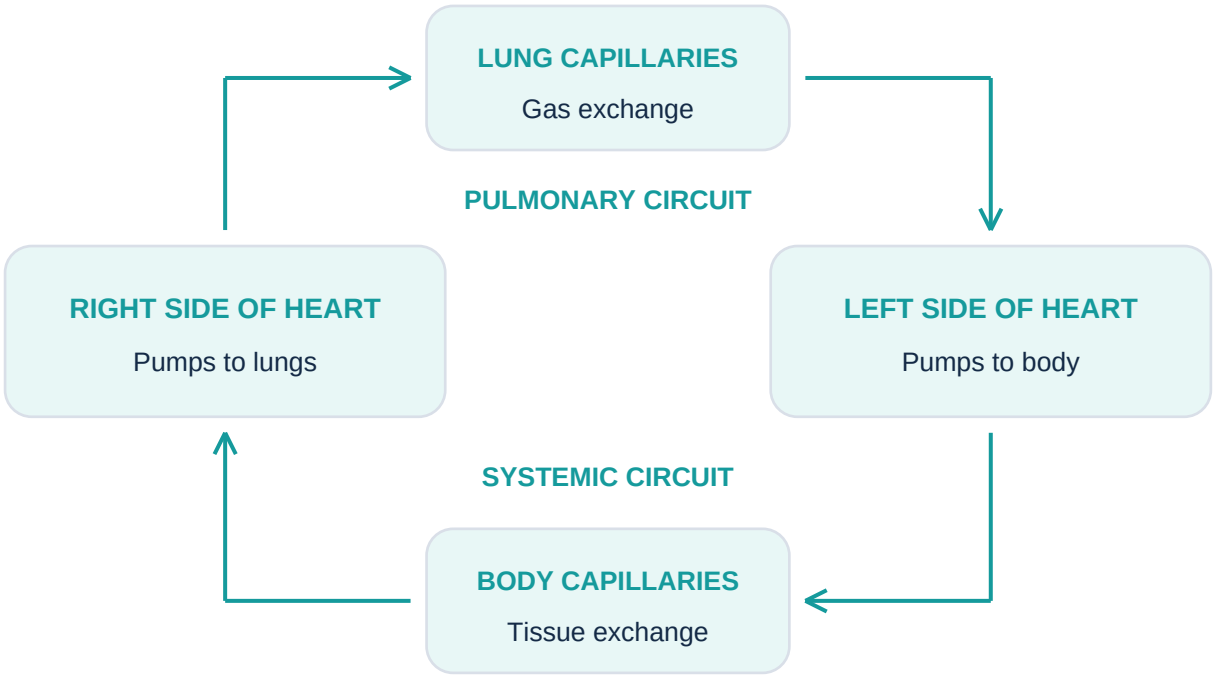
# One heart, two linked circuits

The mammalian circulatory system consists of a muscular heart, blood and blood vessels. The heart drives flow through a pulmonary circuit and a systemic circuit.

## 1. FOLLOW ONE COMPLETE CIRCUIT




Schematic route, not anatomy. Both heart boxes are parts of ONE heart; they are not two separate hearts.

## 2. WHY IT IS CALLED DOUBLE

A blood parcel passes through the heart twice per complete circuit: once through the right side before the lungs, and once through the left side before the body. Double does not mean two heartbeats or two hearts.

## 3. SEPARATE CIRCUITS, DIFFERENT PRESSURES

The left side raises pressure again after blood has passed through the lungs. Systemic pressure can be higher for delivery to body tissues while pulmonary pressure remains lower, helping protect delicate lung capillaries.

Circuit and flow reference: NIH/NHLBI, How Blood Flows through the Heart.

Scope: Cambridge Biology 9700 syllabus, section 8.1, outcome 1, p. 27.

# Know the order of the vessels

Blood vessels form a connected transport network. Their names describe their position and role in the route, not simply the oxygen concentration of the blood inside.

## 1. FROM THE HEART, THROUGH TISSUES, BACK

Arteries ⩾ Arterioles ⩾ Capillaries ⩾ Venules ⩾ Veins

Heart outflow feeds arteries. Veins return blood to the heart. The sequence applies to both pulmonary and systemic circuits.

The network branches into many small vessels and later merges again. These boxes represent vessel categories, not five single tubes of equal size.

## 2. ARTERIES AND ARTERIOLES: THE OUTWARD ROUTE

Arteries carry blood away from the heart. They branch into smaller arteries and arterioles, which feed capillary networks. Arterioles help regulate how much blood reaches particular tissues.

## 3. CAPILLARIES: THE EXCHANGE REGION

Capillary walls are very thin, giving a short distance for exchange between blood and surrounding tissues. Capillary networks link the arterial side of the circulation to the venous side.

Venules collect blood from capillaries and join to form veins. Veins carry blood towards the heart. Remember direction: artery = away; vein = towards. Detailed vessel structure follows in later lessons.

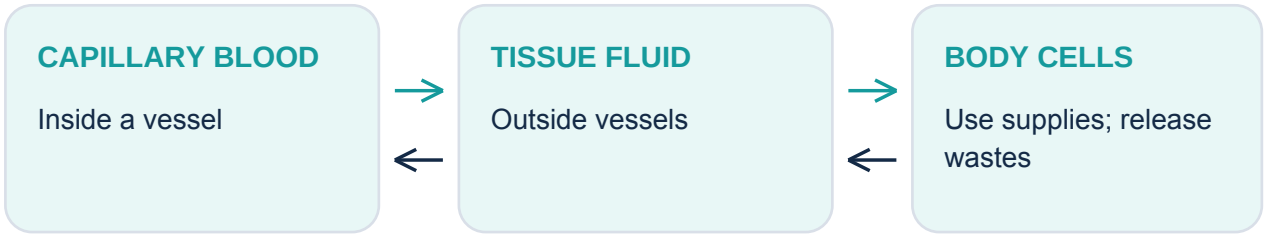
Circuit and flow reference: NIH/NHLBI, How Blood Flows through the Heart.

Scope: Cambridge Biology 9700 syllabus, section 8.1, outcome 1, p. 27.

# Closed does not mean no exchange

In a closed circulation, blood flows within the heart and blood vessels rather than directly bathing body cells. Exchange still occurs across capillary walls, via tissue fluid.

## 1. BLOOD AND BODY CELLS ARE NOT ONE SPACE




Upper arrows: oxygen and nutrients move towards cells.
Lower arrows: carbon dioxide and other wastes move towards blood.

Arrows indicate exchange of substances, not bulk movement of whole blood out of the vessels.

## 2. CLOSED AND DOUBLE ANSWER DIFFERENT QUESTIONS

Closed describes where blood flows: inside a vessel network. Double describes the route: heart to lungs to heart to body to heart. A circulation can be closed without being double; the terms are not synonyms.

## 3. DEFINE VESSELS BY DIRECTION, NOT OXYGEN

In the pulmonary circuit, arteries carry relatively oxygen-poor blood to the lungs, while veins return oxygen-rich blood to the heart. This does not change the definitions of artery and vein.

Core recall: mammals have a closed double circulation with a heart, blood, arteries, arterioles, capillaries, venules and veins. The next lesson names the main pulmonary and systemic vessels.

Circuit and flow reference: NIH/NHLBI, How Blood Flows through the Heart.

Scope: Cambridge Biology 9700 syllabus, section 8.1, outcome 1, p. 27.