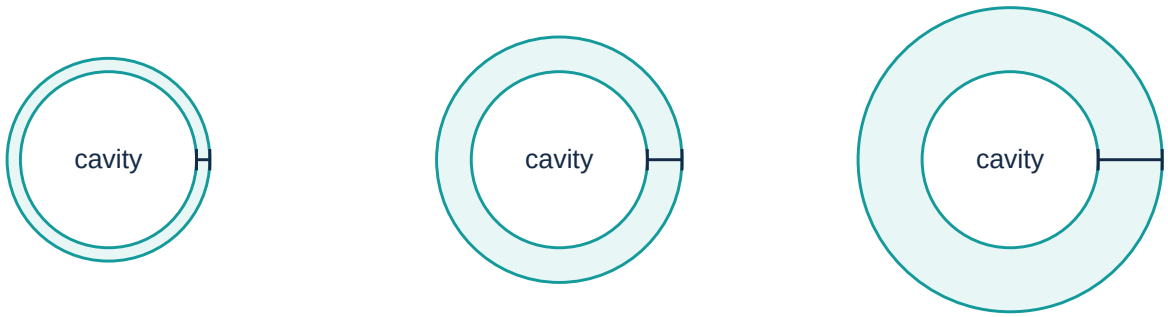
Match muscle to pumping work

The myocardium is the cardiac muscle layer. Differences in its thickness reflect the pressure each chamber normally needs to generate when it contracts.

1. COMPARE MUSCULAR WALLS, NOT CAVITY SIZES



Equal-sized cavities make the wall comparison clear. These are isolated schematic sections, not actual chamber shapes, dimensions or measured thickness ratios.

2. ATRIA: LOW-PRESSURE TRANSFER

Each atrium moves blood into the adjacent ventricle through an atrioventricular valve. This short, low-resistance route requires relatively little pressure, so the atrial wall contains less cardiac muscle. Atrial contraction helps complete ventricular filling.

3. VENTRICLES: EJECT INTO ARTERIES

Ventricles must generate enough pressure to exceed the pressure in their outlet arteries and eject blood through semilunar valves. Their thicker muscular walls produce more force than atrial walls. The right and left ventricles then face different circulatory loads.

Much ventricular filling occurs passively while the chambers relax. Thin atrial walls do not mean the atria are inactive or that they pump blood directly to the lungs or body.

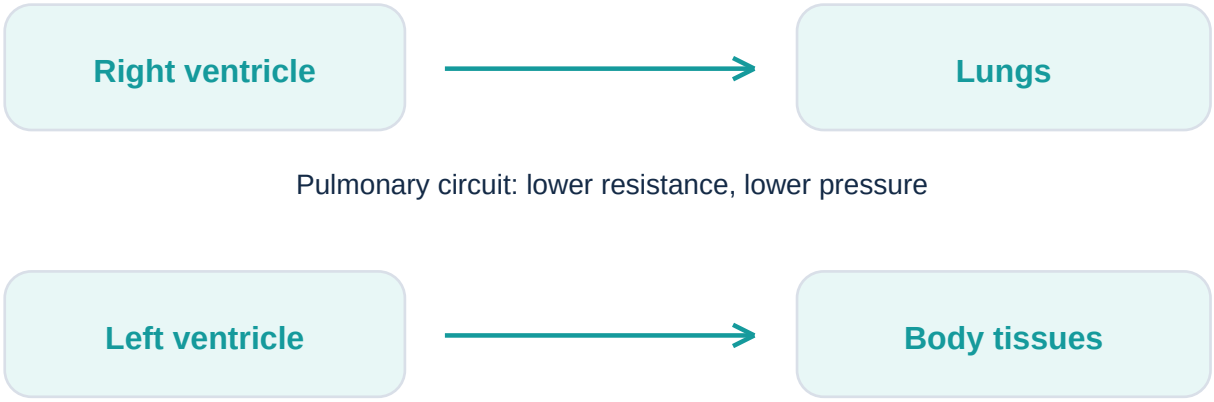
Relative muscle thickness: OpenStax Anatomy & Physiology 2e, section 19.1.
Filling and ventricular ejection: OpenStax, section 19.3.

Scope: Cambridge Biology 9700 syllabus, section 8.3, outcome 2, p. 28.

Why the left wall is thickest

Both ventricles pump blood out of the heart, but the systemic circuit presents greater resistance than the pulmonary circuit. The left ventricle must generate higher pressure.

1. DESTINATION CHANGES THE PRESSURE NEEDED



Pulmonary circuit: lower resistance, lower pressure

Systemic circuit: higher resistance, higher pressure

Arrows show destinations, not path lengths, flow speeds or vessel widths.

2. RIGHT VENTRICLE: LOWER PRESSURE IS SUFFICIENT

The pulmonary circuit is short and has relatively low resistance. The right ventricle therefore needs less muscle than the left. Its lower-pressure output is also suited to the delicate pulmonary capillaries, where excessive pressure would increase fluid leakage.

3. LEFT VENTRICLE: OVERCOME SYSTEMIC RESISTANCE

The left ventricle sends blood through the aorta into the systemic circulation. A larger pressure difference is needed to maintain flow against its greater overall resistance. The thick left ventricular myocardium can generate the force required for this higher pressure.

Distance is a useful first clue, but resistance is the stronger explanation. Resistance depends on vessel dimensions and arrangement, not on distance alone.

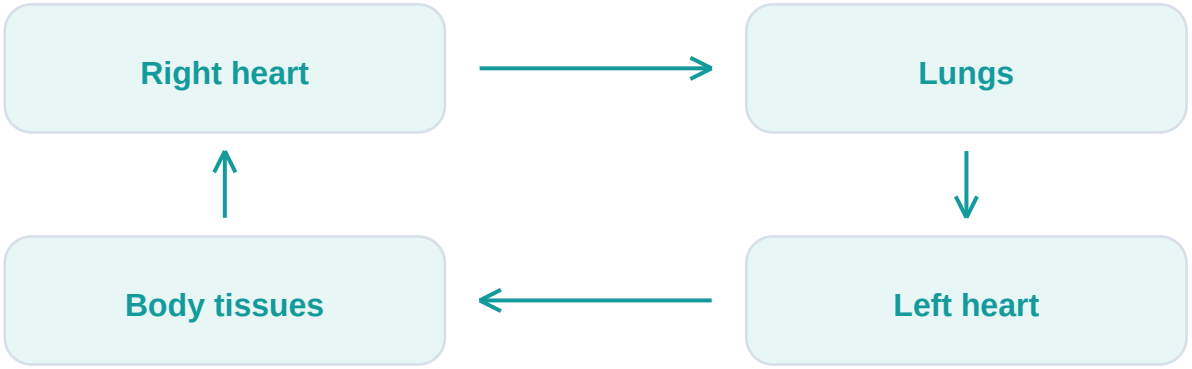
Ventricular comparison: OpenStax Anatomy & Physiology 2e, section 19.1.
Pressure difference and resistance: OpenStax, section 20.2.

Scope: Cambridge Biology 9700 syllabus, section 8.3, outcome 2, p. 28.

Higher pressure, not more blood

Wall thickness explains the pressure-generating task. It does not mean that the left ventricle normally pumps a larger volume of blood per minute than the right.

1. TWO PUMPS CONNECTED IN SERIES



2. SAME AVERAGE OUTPUT, DIFFERENT PRESSURES

In a normal steady state, the two ventricles pump the same average volume per minute. Blood passes through both circuits in sequence. If one side persistently pumped more than the other, blood would accumulate between them. The left side works at higher pressure, not a higher long-term flow.

3. KEEP THE EXPLANATION IN THREE PARTS

Atrium	Adjacent ventricle	Low pressure; thin wall
Right ventricle	Pulmonary circuit	Lower pressure; thicker wall
Left ventricle	Systemic circuit	Higher pressure; thickest wall

Avoid saying that oxygenated blood needs more force simply because it contains oxygen. The key link is destination and resistance → pressure requirement → muscular wall thickness.

Connected circulation and chamber roles: NHLBI, How Blood Flows through the Heart.
Equal ventricular output and unequal pressure: OpenStax Anatomy & Physiology 2e, 19.1.

Scope: Cambridge Biology 9700 syllabus, section 8.3, outcome 2, p. 28.