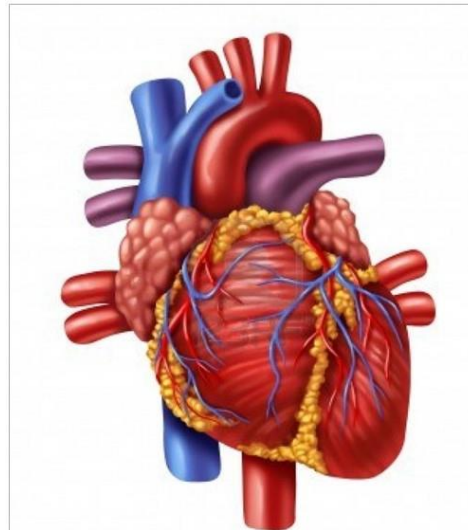
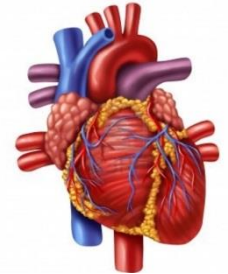


Cardiac Anatomy & Physiology



Circulatory System

The heart is a hollow muscular organ made of specialised cells that allow it to act as a pump within the circulatory system



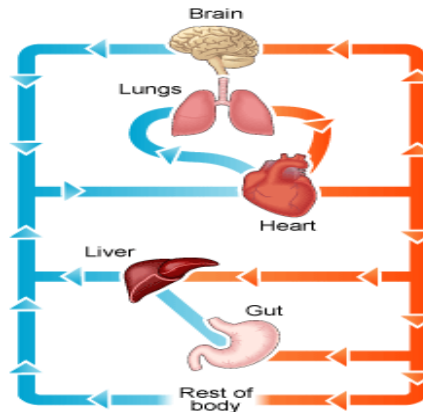
Cardiovascular and **lymphatic systems** make up the **circulatory system** a vast network of organs and vessels responsible for the flow of:

- **Blood**
- **Nutrients**
- **Hormones**
- **Oxygen and other gases**

To and from the Cells of the body

The Lymphatic system

- Lymph
- Lymph nodes
- Lymph vessels



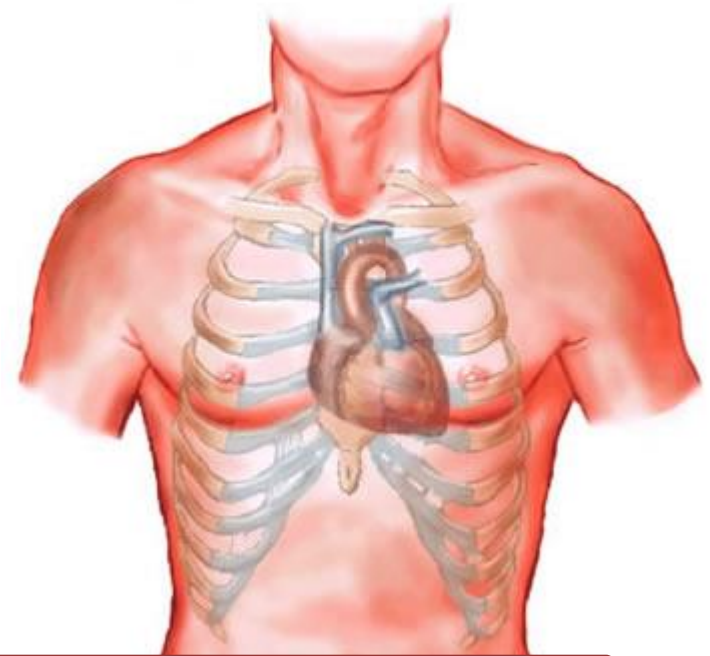
The Cardiovascular system

- Blood
- Blood vessels
- Heart

The Heart

The Heart is:

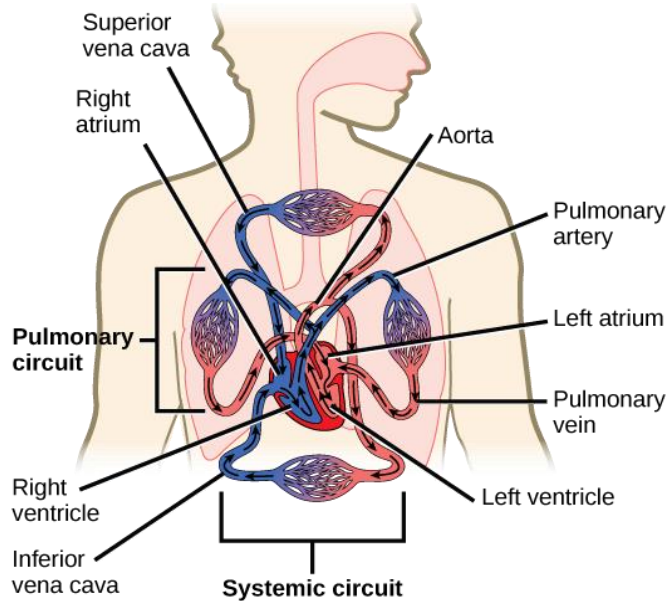
- Located between the lungs in the centre and to the left of the midline
- It is cone shaped and about the size of your own clenched fist
- Can never stop pumping



Primary Function is to drive blood through the cardiovascular system delivering :

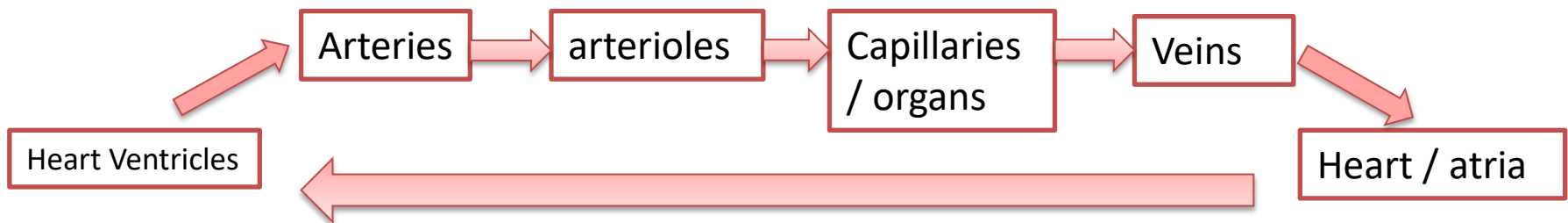
- Oxygenated blood to the tissues and organs of the body sufficient for their metabolic needs
- Deoxygenated blood to the lungs for gaseous exchange

Cardiovascular system

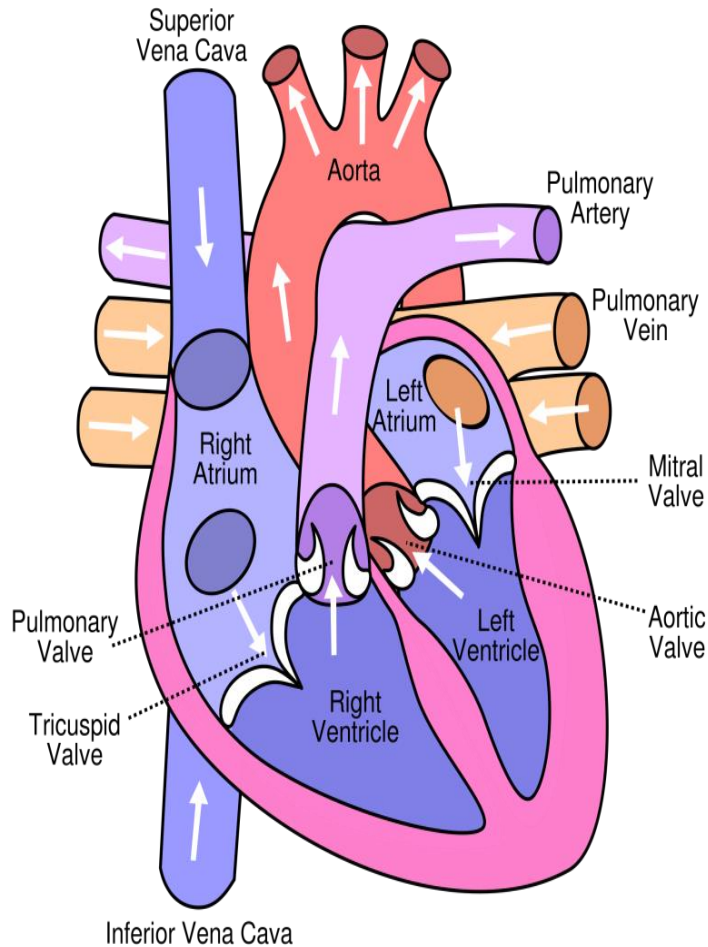


The average human adult has **4-6 litres** of blood repeatedly cycled throughout the body in a closed circulatory system.

It is called a closed system because the blood is contained within the heart and blood vessels at all time and blood always flows in a forward direction.



Structures



Human heart is divided into 4 chambers

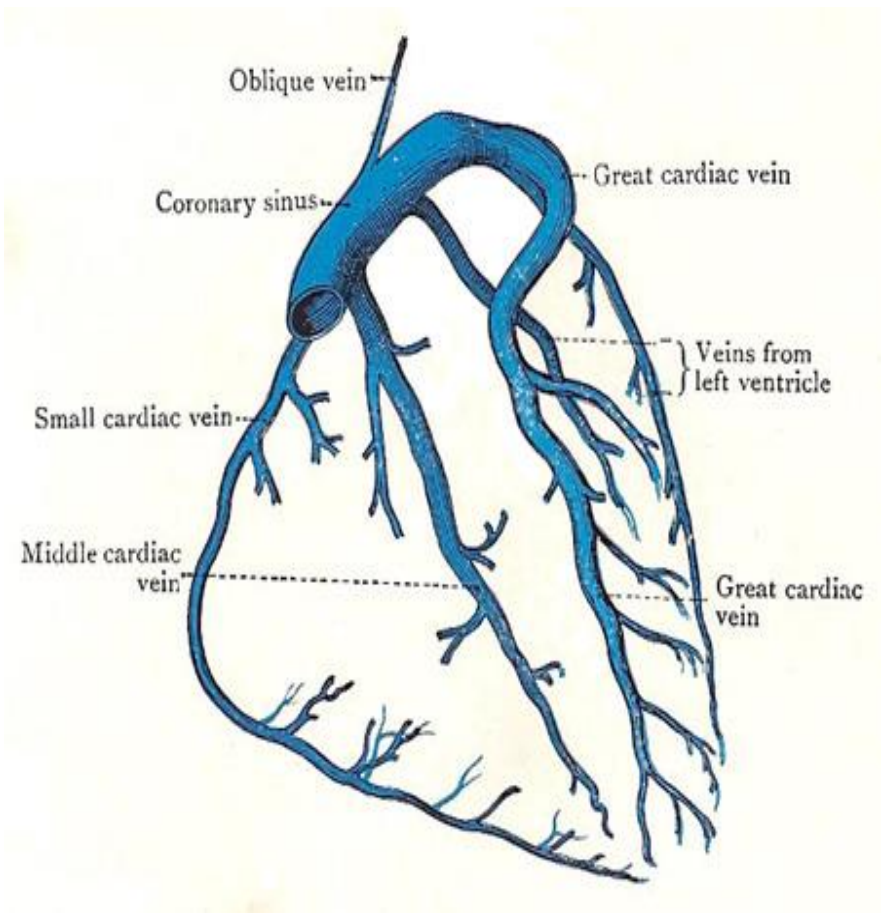
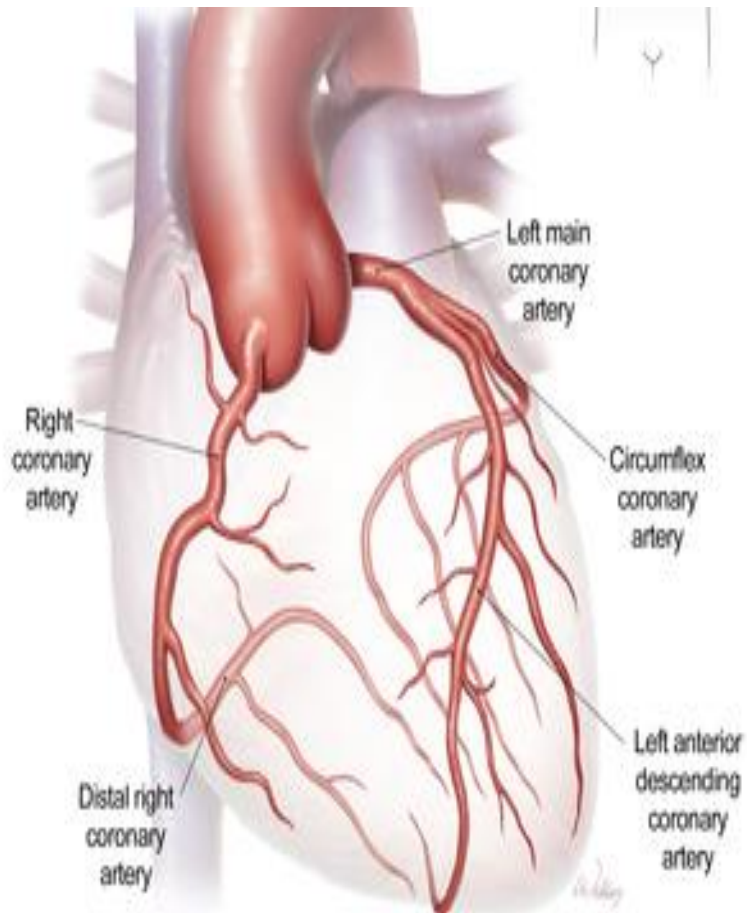
- 2 Atria and 2 Ventricles – these are hollow chambers which receive blood
- They are surrounded by myocardial cells which are able to relax and contract

The cardiovascular system consists of circuits:

- Pulmonary circuit provides blood flow between the heart and lungs
- Systemic circuit allows blood to flow to and from the rest of the body
- Coronary circuit provides blood to the heart

The heart valves ensure that blood flows in one direction through the system

Coronary Circuit



Conduction system

There are 2 basic types of cardiac cell (Myocytes)

- **Myocardial cells**

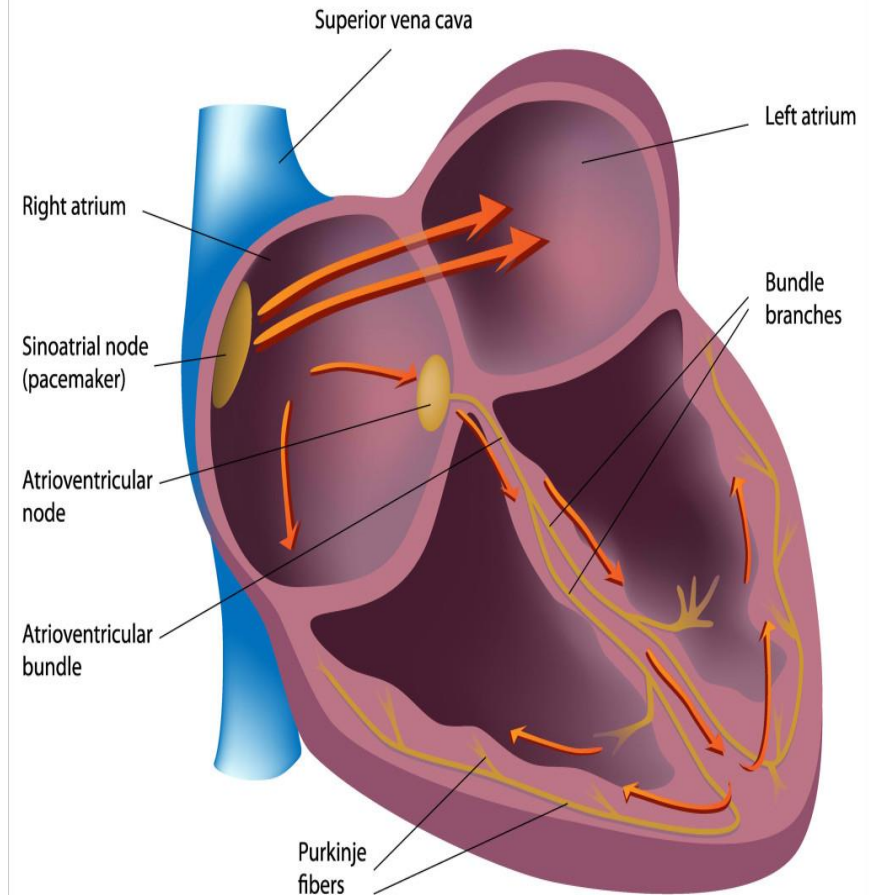
contractile
respond to an electrical impulse
and contract

- **Specialised cells**

the conduction system generates electrical impulses and transmits them through the myocardium

Site of electrical impulse generation	Rate of impulse generation / min
SA node	60 - 100
AV node	40 - 60
Ventricles	< 40

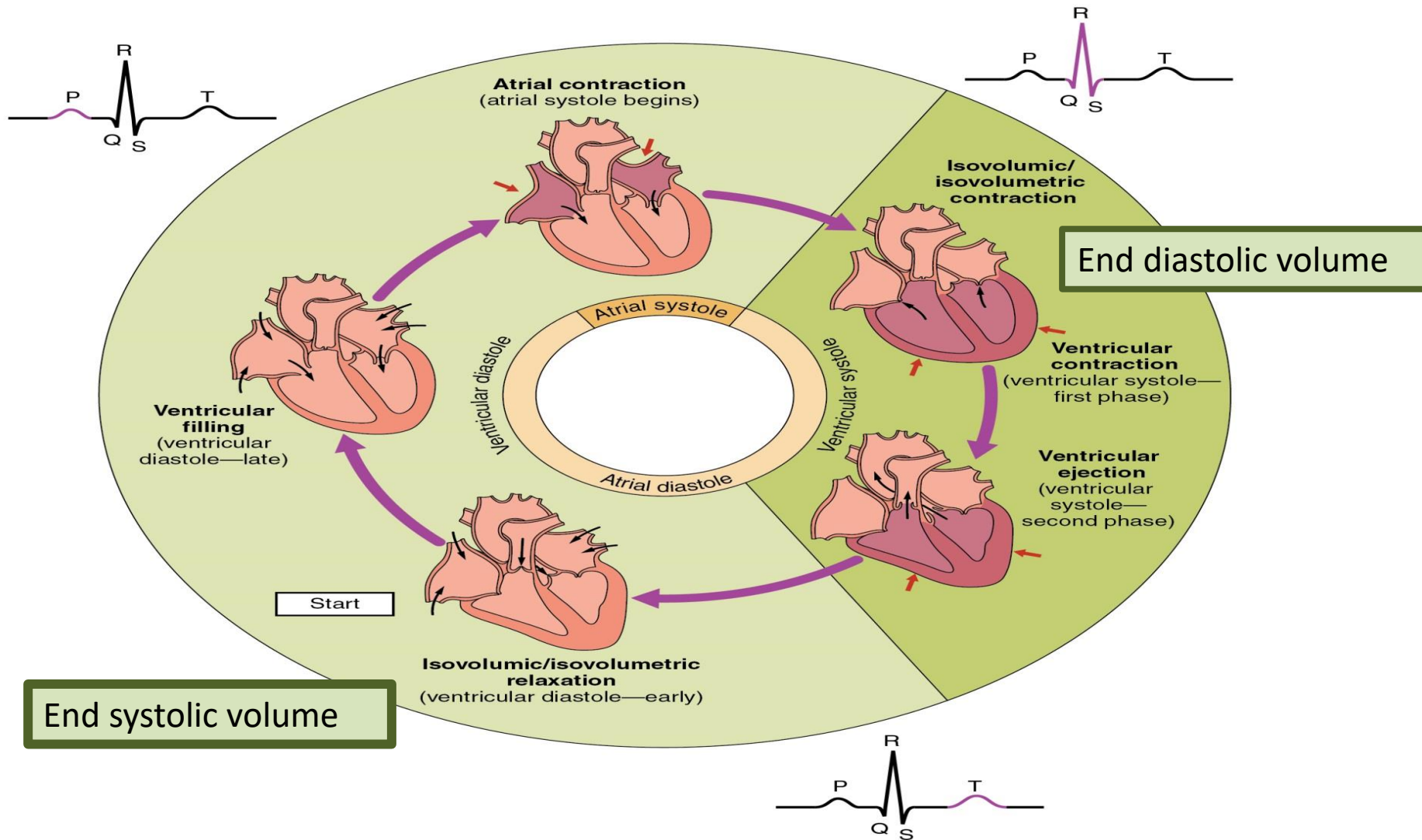
The Cardiac Conduction System



The Cardiac Cycle

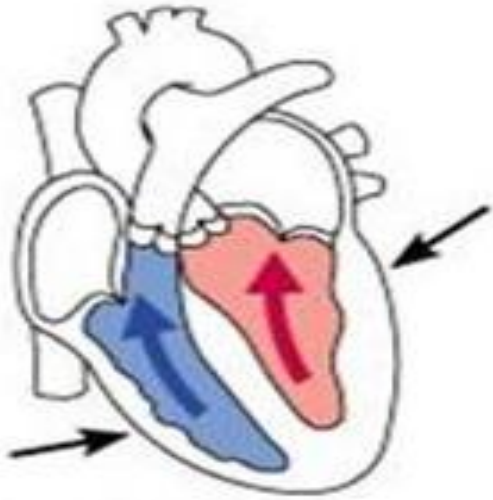
Contraction of a chamber = **Systole**

Relaxation of a chamber = **Diastole**



Introduction of Key Terms

End Diastolic Volume = amount of blood in the ventricles at the end of filling / diastole



End Systolic volume = amount of blood in the ventricles at the end of contraction / systole



The ventricles never completely empty

Stroke Volume = The amount of blood pumped out of the ventricles per beat / contraction (approx 70mls in a healthy adult male)

$$EDV - ESV = SV$$

Introduction of Key Terms

Cardiac Output (CO)

Amount of blood ejected by the heart per minute = cardiac output (CO)

In a healthy resting adult CO = approx 5-6 litres

$$\text{CO} = \text{Heart Rate} \times \text{Stroke volume}$$

Ejection fraction is a measurement of the percentage of blood leaving your heart each time it contracts.

Usually measured with imaging e.g. ECHO / cardiac catheterisation / MRI.

Cardiac output and Ejection fraction are important indicators of how efficiently the heart can meet the demands of the body

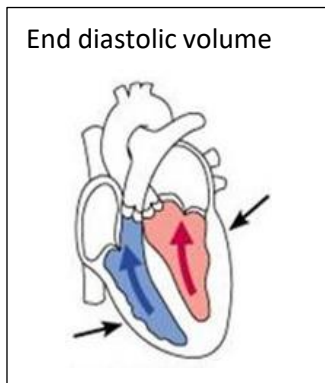
THANK YOU



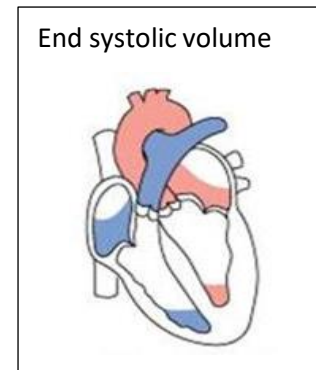
Key points

The output from the right and left side of the heart must always balance.

- THE AMOUNT OF BLOOD IN THE VENTRICLES AT THE END OF FILLING BEFORE SYSTOLE = **END DIASTOLIC VOLUME**
- THE AMOUNT OF BLOOD IN THE VENTRICLES AT THE END OF CONTRACTION OR SYSTOLE = **END SYSTOLIC VOLUME** - THE VENTRICLES NEVER COMPLETELY EMPTY



$$EDV - ESV = SV$$



End diastolic volume = 125mls

End systolic volume = 50mls

The amount of blood pumped out of the ventricles per beat = stroke volume - approximately 70mls in a healthy adult male. In this example: 125ml – 50 mls = 75mls

Key points

Amount of blood ejected by the heart per minute = cardiac output (CO)
in a healthy resting adult CO = approx 5-6 litres

$$\text{CO} = \text{Heart Rate} \times \text{Stroke volume}$$

$$\text{E.g. CO} = 70\text{bpm} \times 75\text{mls} = 5,250\text{mls}$$

Ejection fraction is a measurement of the percentage of blood leaving your heart each time it contracts. Usually measured with imaging e.g. ECHO / cardiac catheterisation / MRI.

Cardiac output and Ejection fraction are important indicators of how efficiently the heart can meet the demands of the body