

MODULE 4 L04

Cardiac Output

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4. Cardiac Output

- Definition
 - ❖ Volume of blood ejected from the heart **per minute**
 - Two factors
 - Volume of blood
 - How much blood is ejected per minute

$$CO = SV \times HR$$

SV = amount of blood ejected **per contraction**

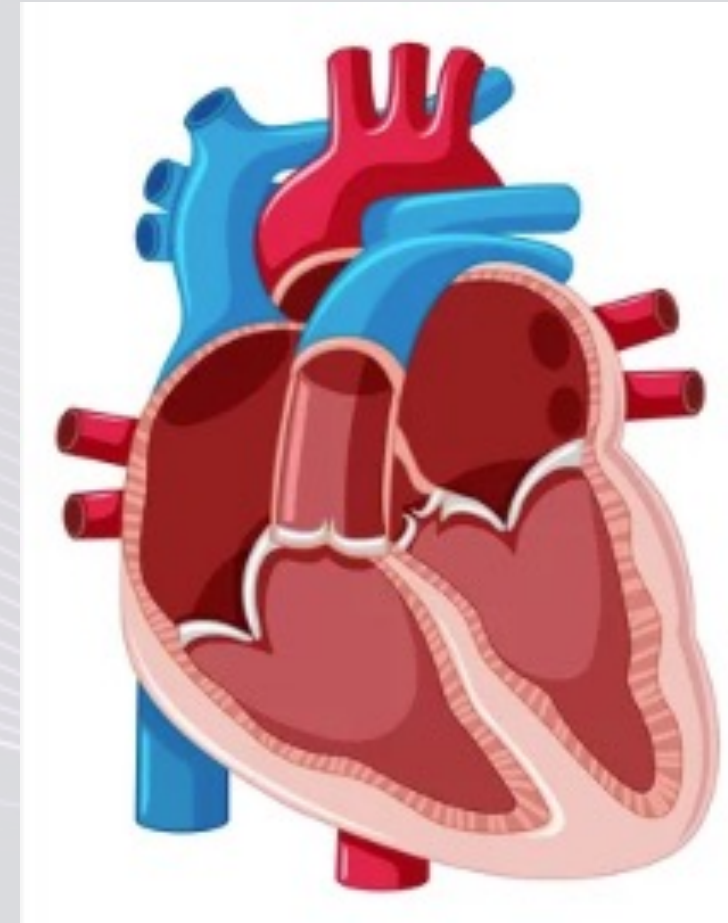
HR = heart beats **per minute**

$$SV = EDV - ESV \rightarrow SV = 130 - 60 = 70mL$$

EDV = end diastolic volume (130 mL)

ESV = end systolic volume (60 mL)

$$CO = 70mL \times 70bpm = 4.9L/min$$



Factors Contributing to Stroke Volume

1. Venous return filling the heart
 - Preload
 - ❖ Maximum volume of blood in the heart
 - ❖ Which will stretch the ventricle walls
 - Related to the Frank-Starling Law
 - The more you stretch the heart, the greater the reflexive contraction = more blood gets ejected
2. Heart contraction
 - Dependent on calcium ions
 - ❖ Factors that promote or inhibit the presence of calcium = ionotropic agents
 - a) Positive agents – noradrenaline and parathyroid hormone
 - b) Negative agents - calcium blocker drugs or electrolyte imbalances
3. Blood ejection from the heart
 - Afterload
 - ❖ When blood gets ejected, it encounters resistance
 - ↑ resistance
 - ↑ afterload
 - ↓ stroke volume

Factors Contributing to Heart Rate

- Autonomic Nervous System
 1. Parasympathetic
 - ❖ Arises from branches of the vagus nerve
 - ❖ Decreases heart rate
 - Restricted to:
 - SA node
 - AV node
 - Coronary arteries
 2. Sympathetic
 - ❖ Arises from cervical and upper thoracic chain ganglia
 - ❖ Increases heart rate
 - ❖ Increases strength of contraction
 - Restricted to:
 - SA node
 - AV node
 - Coronary arteries
 - Cardiac musculature throughout the heart

Autonomic innervation of the heart

