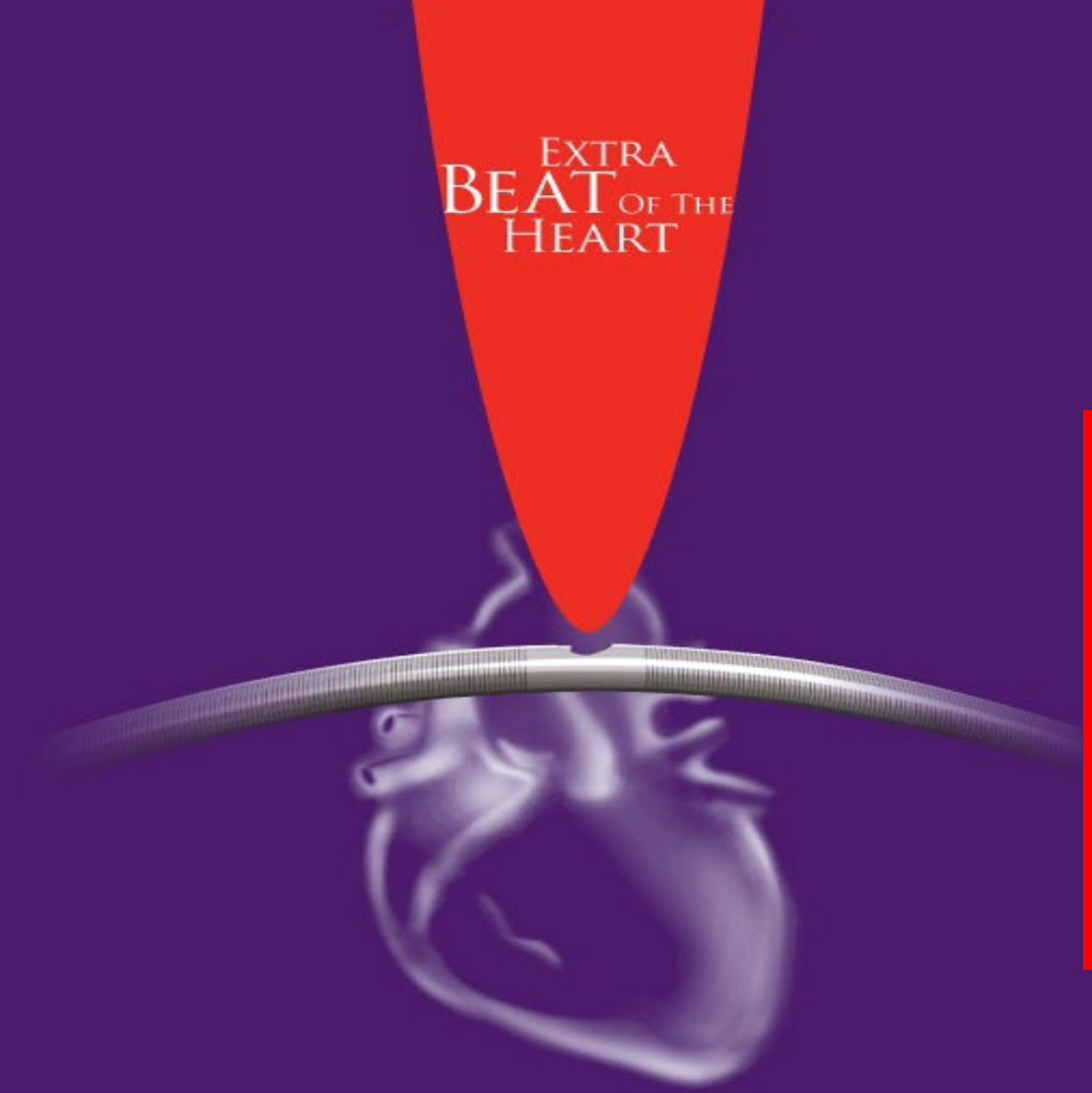


iVAC 2L Academy
Circulatory System

PulseCath

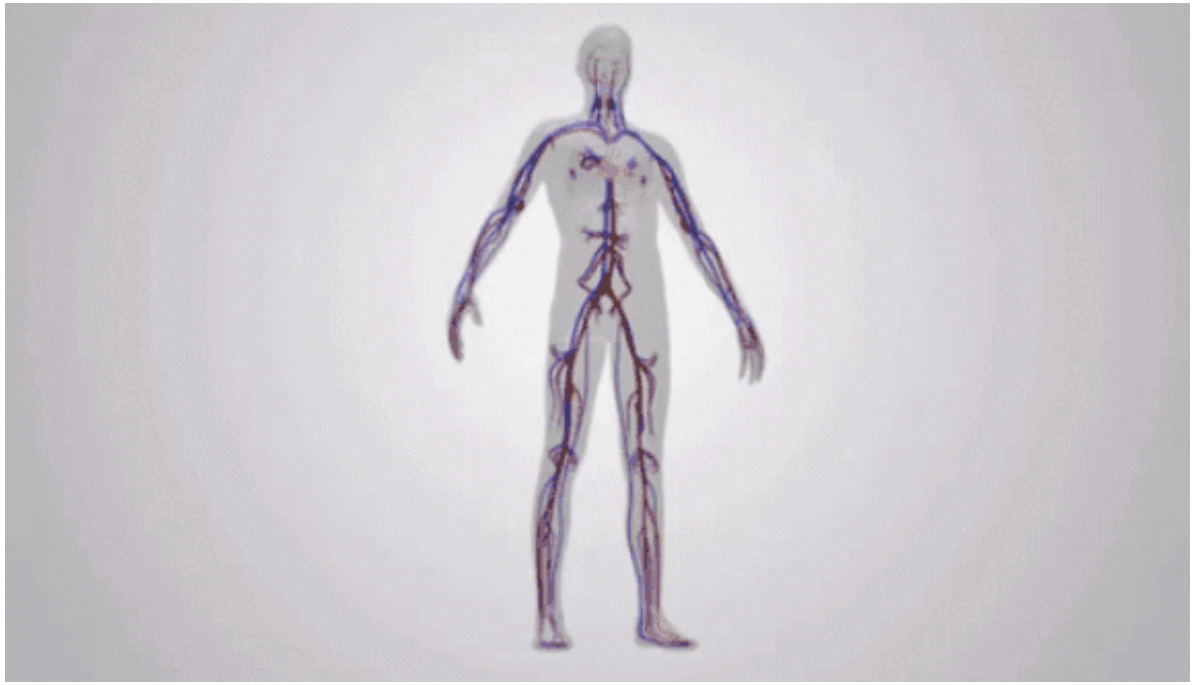
V112022_001

Theory of the Circulatory system

Humans have a closed circulatory system, typical of all vertebrates, in which blood is confined to vessels and is distinct from tissue cells

The heart pumps blood into large vessels that branch into smaller ones leading into the organs

Materials are exchanged by diffusion between the blood and the tissue cells



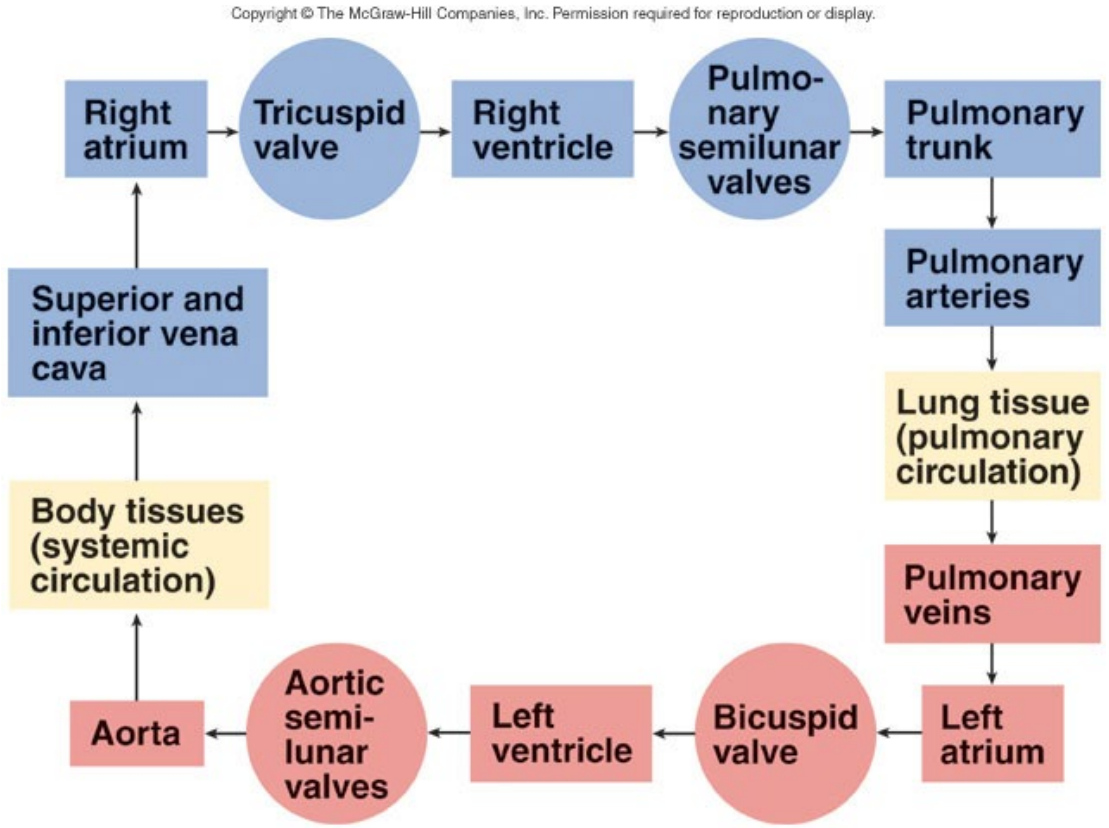
Cardiac Cycle

The heart consists of two pumps that work together, right and left half

Repetitive contraction (systole) and relaxation (diastole) of heart chambers

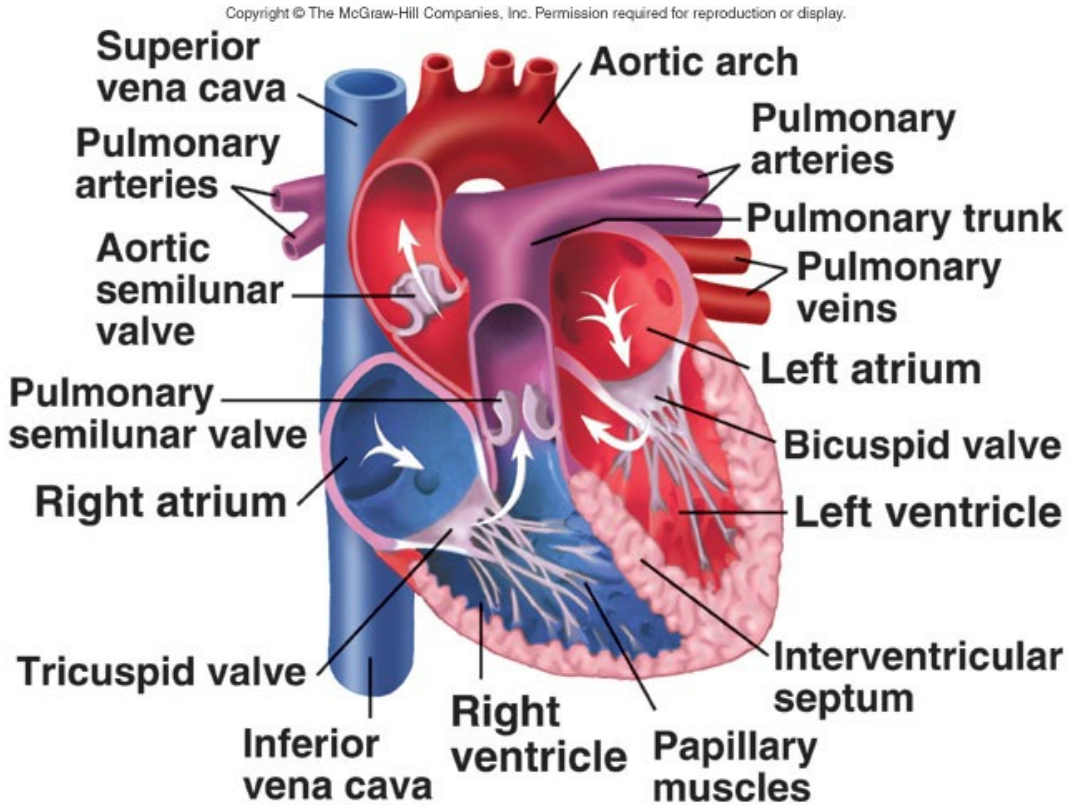
Blood moves through circulatory system from areas of higher to lower pressure

- Contraction of heart produces the pressure



Functions of the Heart

- Generating blood pressure
- Routing blood
  - Heart separates pulmonary and systemic circulations
- Ensuring one-way blood flow
  - Heart valves ensure one-way flow
- Regulating blood supply
  - Changes in contraction rate and force match blood delivery to changing metabolic needs



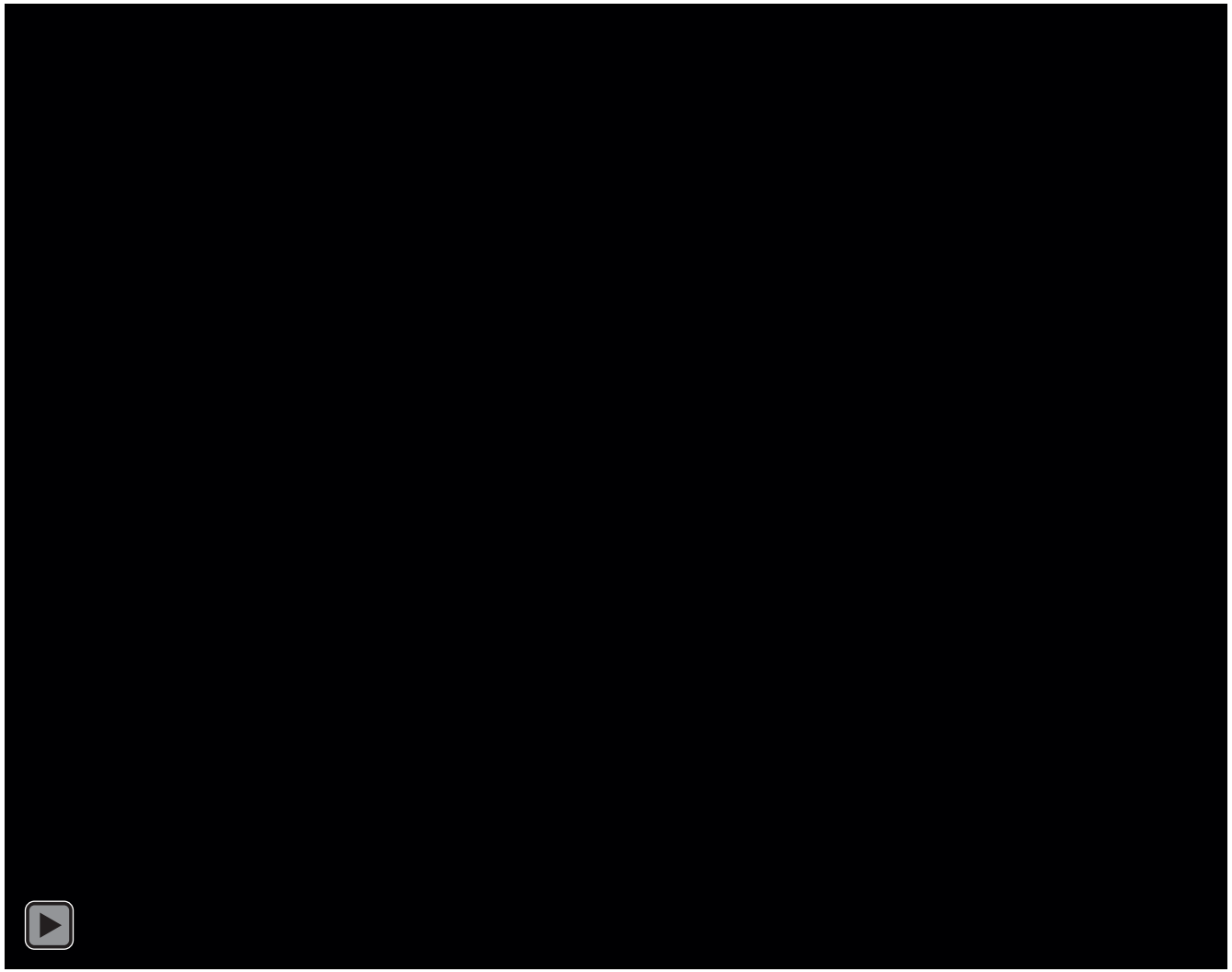
Events during Cardiac Cycle

The cardiac cycle involves four major stages of activity

- Isovolumic relaxation
- Inflow
- Isovolumic contraction
- Ejection

Blood is allowed to enter relaxed ventricle chamber from vein through venous valve

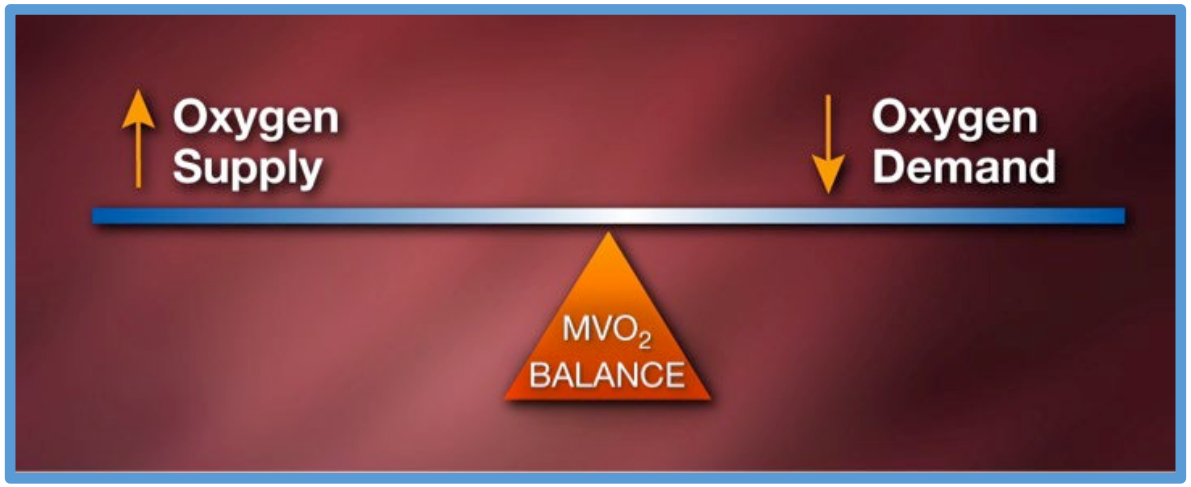
Heart muscle contracts ventricle and blood is expelled through the atrial valve to artery



https://library.med.utah.edu/kw/pharm/hyperheart/

Theory of counterpulsation

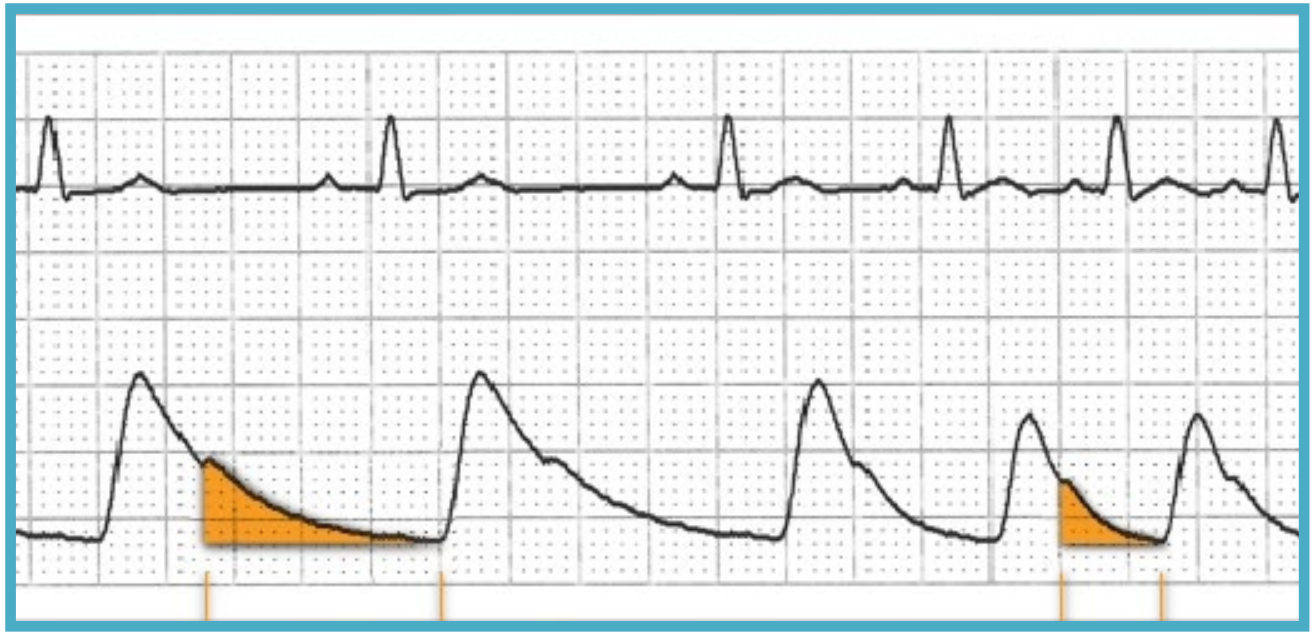
The primary goal of Counterpulsation Therapy is to balance supply and demand of oxygen



Overview of Cardiac Performance

Oxygen Supply/ Demand - Diastolic Time/Pressure and Heart rate

- Decreased diastolic filling time = decreased stroke volume
- Decreased diastolic pressure = decreased myocardial oxygen supply
- Increased heart rate = increased demand for myocardial oxygen



Diastolic Phase
60 BPM

Diastolic Phase
130 BPM

Overview of Cardiac Performance

Oxygen Demand - Afterload (Left Side)

Resistance left ventricle has to overcome to eject blood from heart

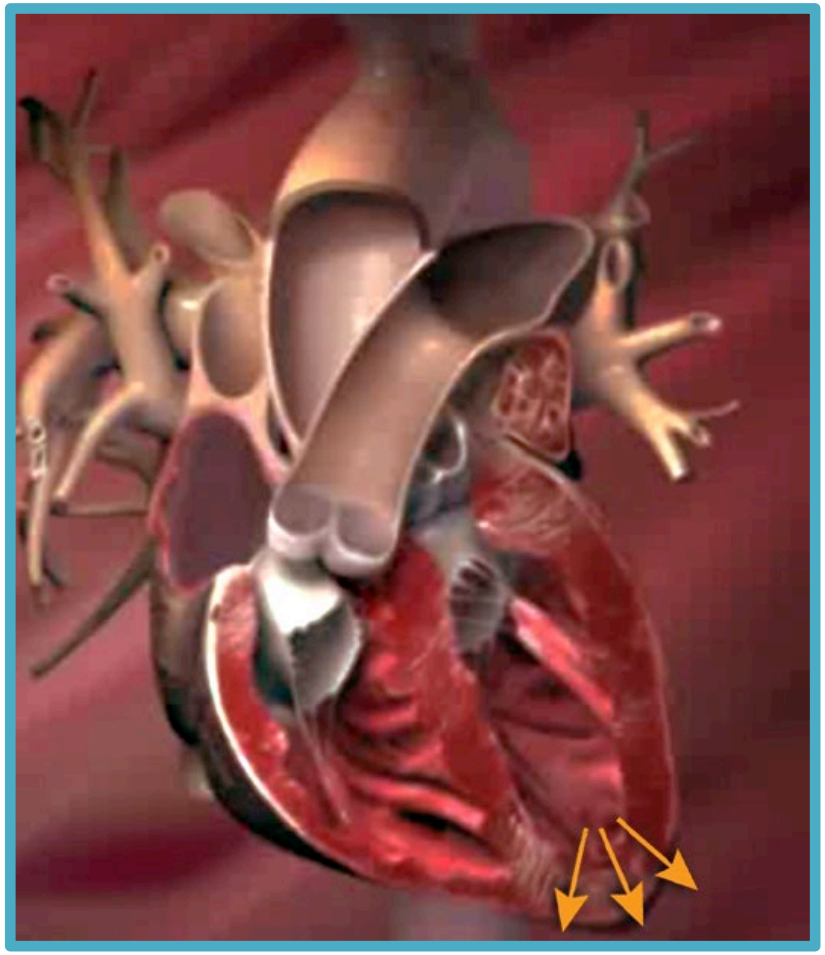
- Measured by Systemic Vascular Resistance (SVR)
  - Normal values: 900 - 1400 dyn-s/s/cm^{-5}

Overview of Cardiac Performance

Oxygen Demand - Preload (Left Side)

Volume of blood in left ventricle at end of diastole, creating a "stretch" in muscle fibers

- Measured by Pulmonary Artery Wedge Pressure (PAWP)
  – Normal values: 4-12mmHg



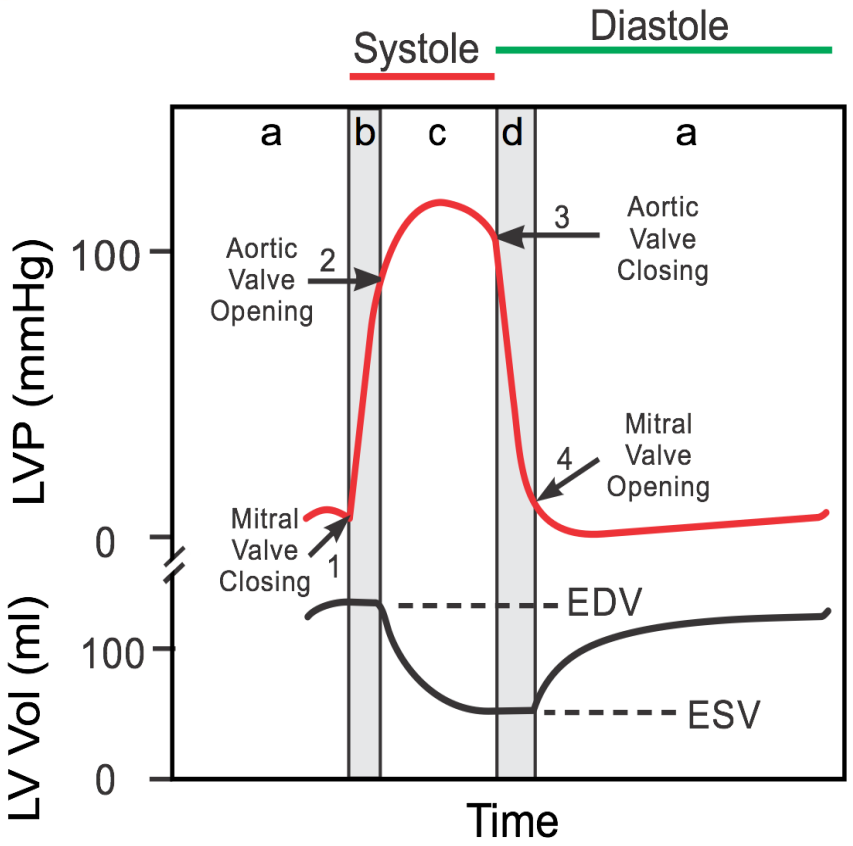
Overview of Cardiac Performance

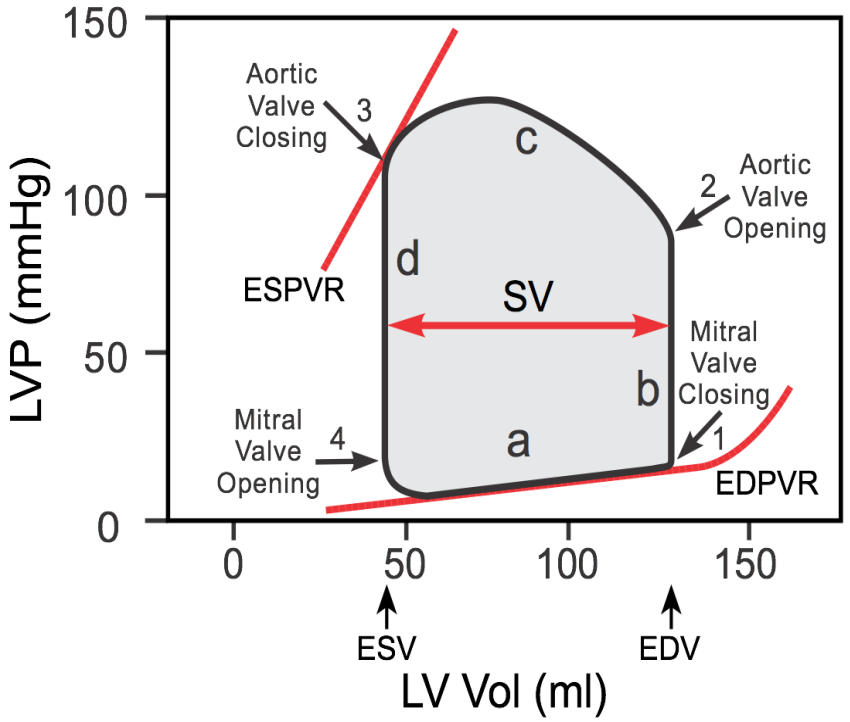
Oxygen Demand - Contractility

Ability of muscle fibers to contract in order to eject blood into the circulation

- Measured by Ejection Fraction (EF)
  - Normal values: 60% - 75%

What does the heart do? – PV LOOP





- PE= Potential energy
- EW= Extra Work
- ESPVR= end-systolic pressure-volume relationship

Thank you for Listening

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