

11.4: The Cardiac Cycle and Circulation

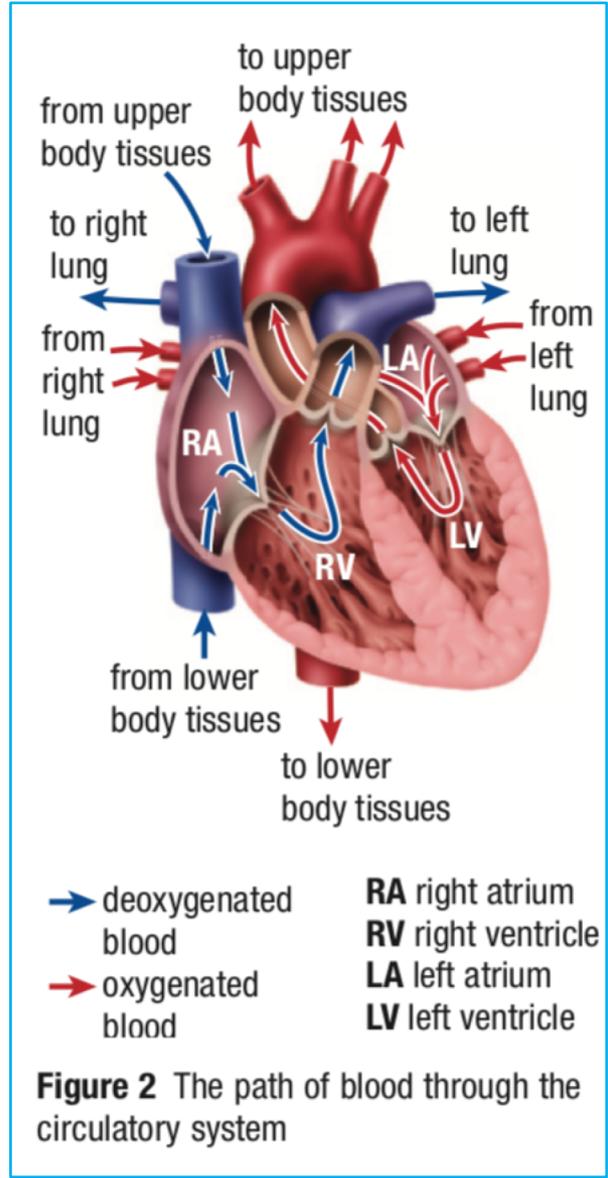
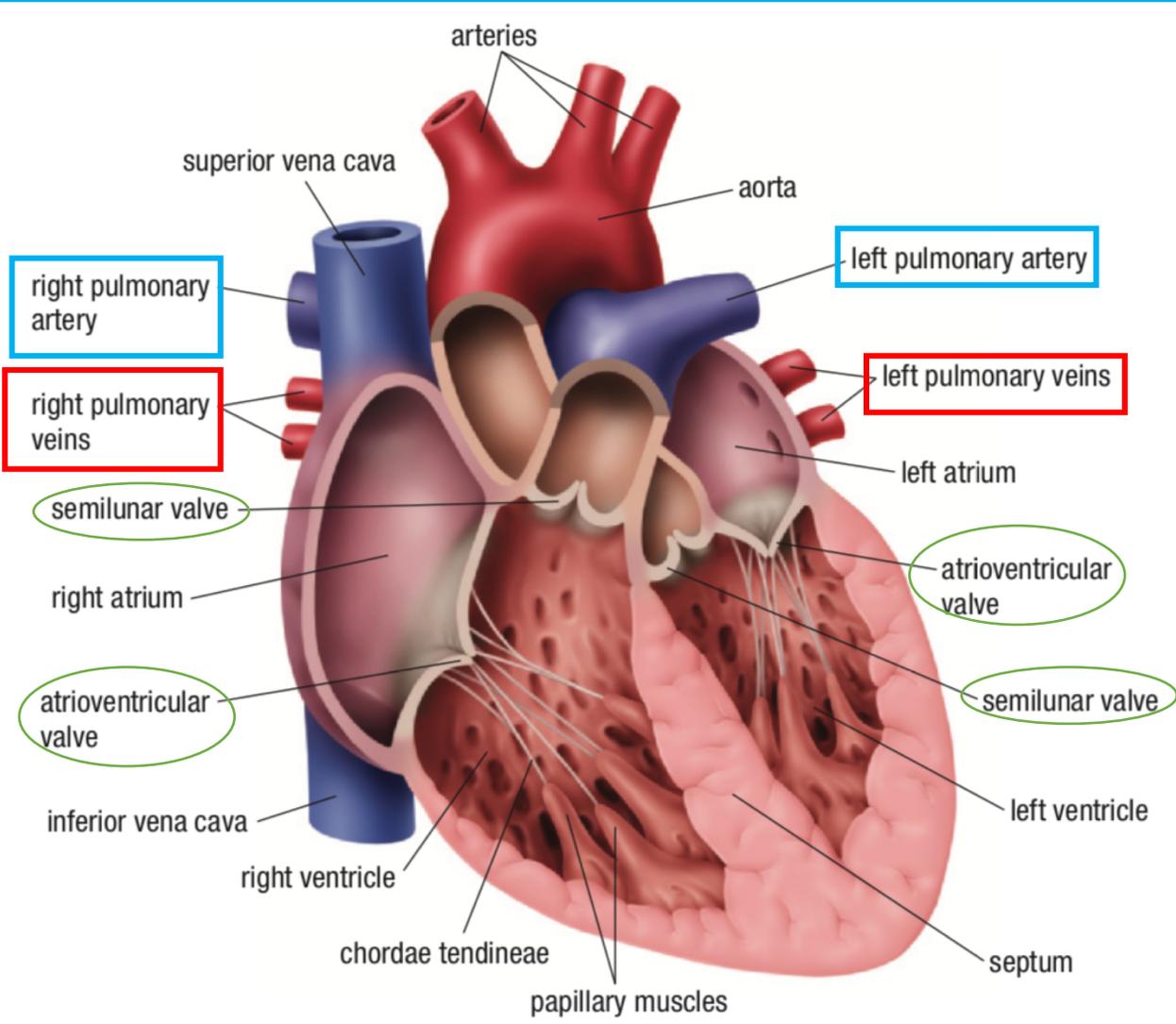
Circulatory system and the heart | Human anatomy and physiology | Health & Medicine | Khan Academy

<https://www.youtube.com/watch?v=QhiVnFvshZg>

<https://www.youtube.com/watch?v=CWFyxn0qDEU>

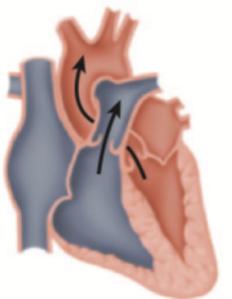
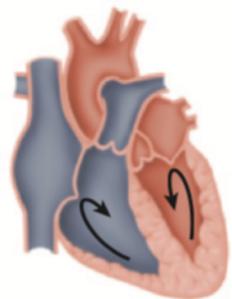
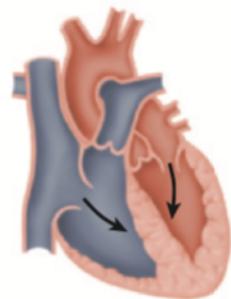
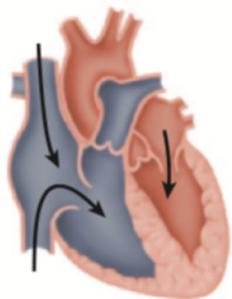
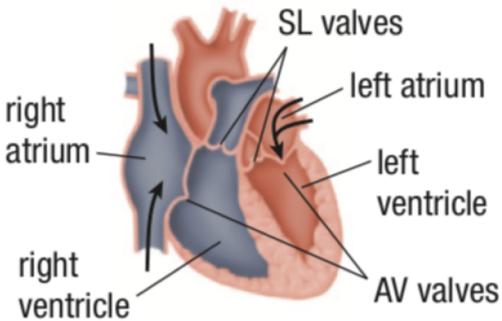
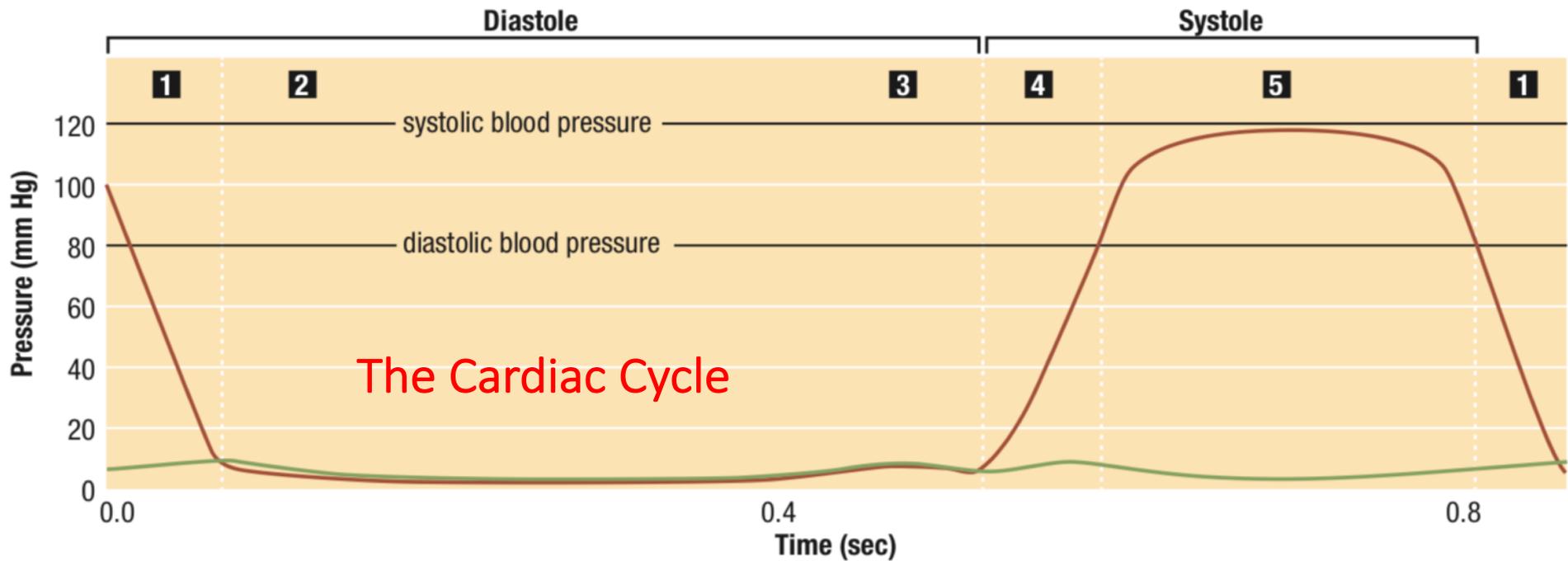
Any blood vessels come in to the heart – vein – normally carry deoxygenated blood
 go out of the heart – artery – oxygenated blood

RA + RV – Pulmonary
 LA + LV – Systemic



- **Pericardium:** a two-layered connective tissue membrane that protects the heart from friction with other tissues and organs
- **Coronary blood vessels:** blood vessels transport oxygen exclusively to muscle cells in heart and remove waste.
- Valves: blood flows in only 1 direction.
- **2 Semilunar (SL) valves:** located at where the ventricles meet the pulmonary arteries and aorta; prevent flows back to ventricles
- **2 atrioventricular (AV) valves:** between atria and ventricles; prevent blood flowing from ventricles back into the atria
- Left atrioventricular valves has 2 flaps – bicuspid valve
- Right atrioventricular valves has 3 flaps – tricuspid valve.

The Cardiac Cycle



1 Heart is fully relaxed; atria begin to fill with blood; atrioventricular (AV) and semilunar (SL) valves are closed.

2 Blood fills atria and pushes AV valves open; ventricles begin to fill.

3 Atria contract, filling ventricles completely.

4 Ventricles begin to contract, forcing AV valves closed; SL valves remain closed.

5 Ventricles contract fully, forcing SL valves open and ejecting blood into arteries.

— ventricular pressure (mm Hg) — atrial pressure (mm Hg) ■ oxygen-poor blood (deoxygenated blood) ■ oxygen-rich blood (oxygenated blood)

Regulation of Heart Beats

- Heart can keep pumping even after it is removed from a live animal.
- Unlike skeletal muscle, heart has a self-contained nerve system.
- Heart muscle can contract/relax on its own without stimulation from external source.
- **Myogenic muscle:** make heart continue beating for a patient has “brain dead”。
- **Sinoatrial (SA) node:** cluster of muscular cells, act as pacemaker, to send electrical signal to initiate heart beat at regular pace.
- **Atrioventricular (AV) node:** located b/w RA and RV, accepting signal from SA node, to cause Purkinje fibers run through septum to contract.

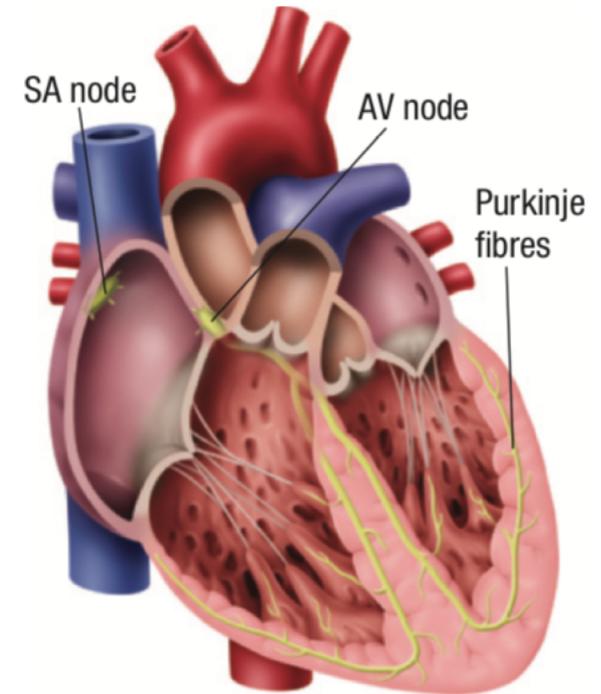


Figure 5 The heart has its own system for conducting electrical stimuli from the SA node to the muscle cells.

Regulating and Analyzing the heartbeat

- Heart beat can increase under emotional stress or physical stress (overweight, exercise, caffeine, nicotine, medicals...)
- Controlled by brain: sympathetic nervous system and parasympathetic nervous system.
- Measured by electrocardiograph
- P – SA node sending electrical stimulus
- QRS complex – AV node accepting signal, moving via Purkinje fibres to cause contraction of ventricle.
- T – ventricle recovery and prepare for the next contraction.

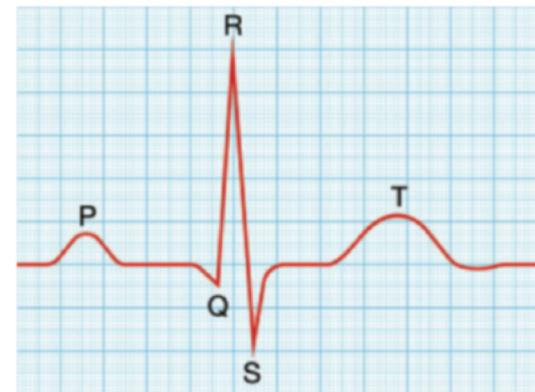


Figure 7 A single heartbeat shown on the ECG includes the P wave, the QRS complex, and the T wave.