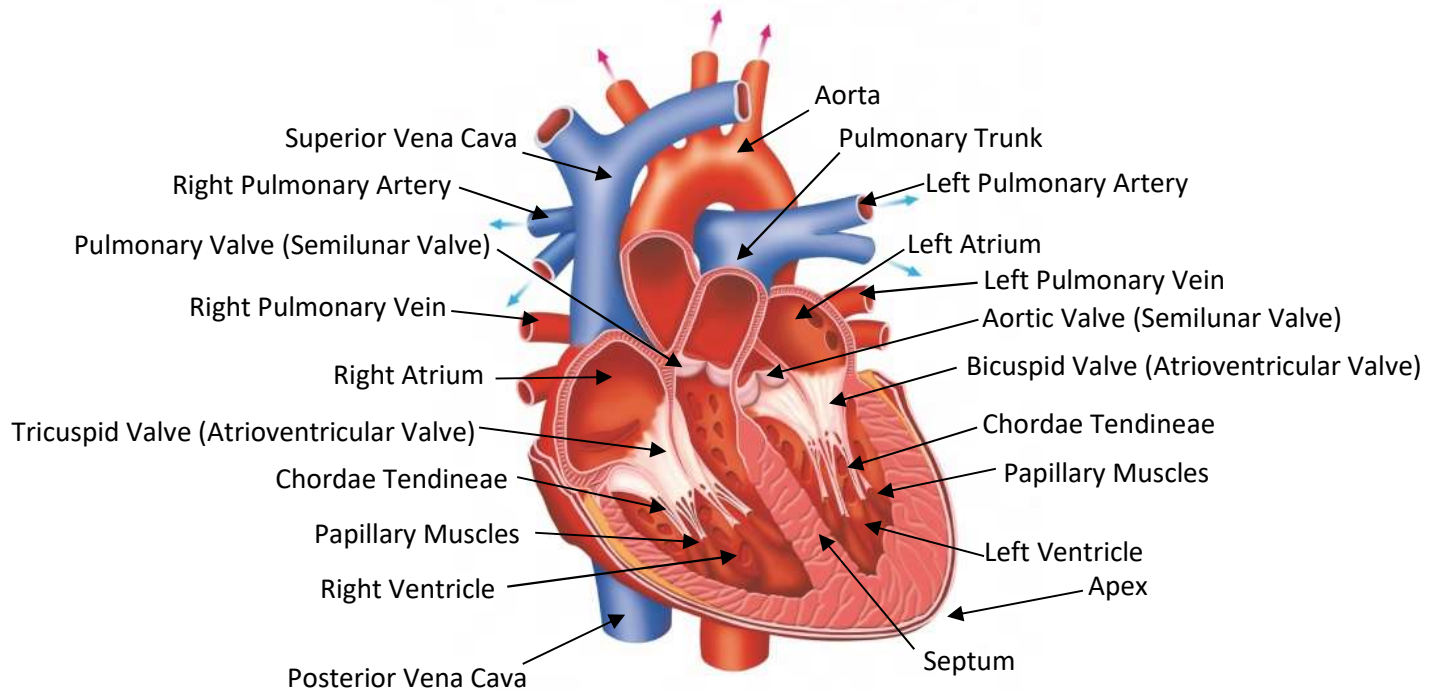


Anatomy & Physiology 12

Circulation – The Heart

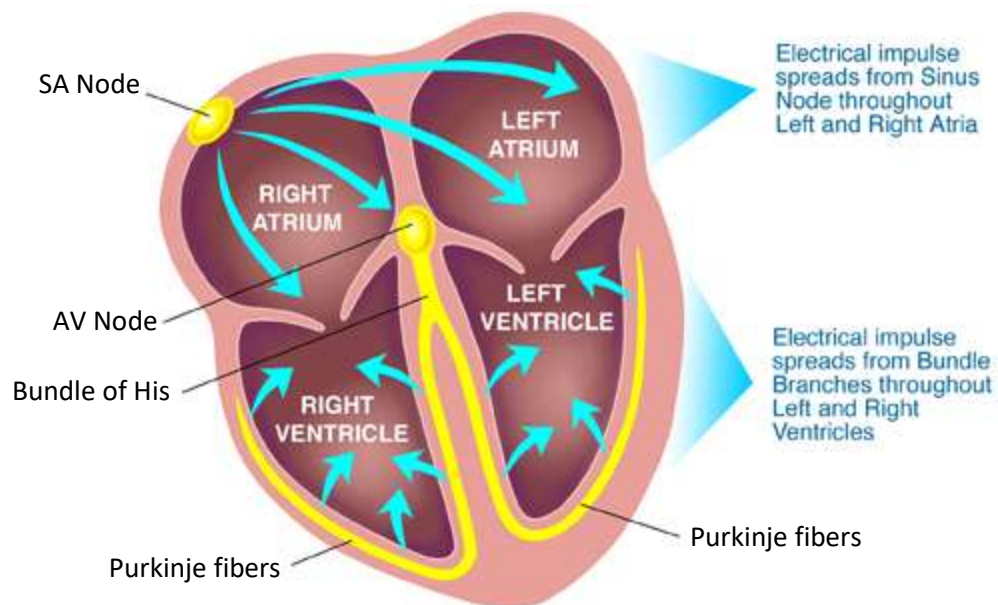
The Heart



- pine cone-shaped organ located in the thoracic cavity between the lungs and behind the sternum
- major portion of the heart is the myocardium which is made up of cardiac muscle
- endocardium is found on the inner surface of the heart
- outside of the heart is covered with an epithelial tissue called pericardium, which forms a sac called the pericardial sac
- separated into two halves by a thick-walled structure called the septum
- inside is separated into four chambers
 - upper chambers are called atria (or auricles) that have thin walls
 - lower chambers are called ventricles that are larger in size and have thicker walls
- heart valves prevent backflow of blood through the chambers
 - atrioventricular valves lie between the atrium and ventricles and are supported by fibrous strings called chordae tendineae that prevent the valves from inverting when the ventricles contract
 - atrioventricular valve on the right side is called the tricuspid valve
 - atrioventricular valve on the left side is called the bicuspid or mitral valve
 - semilunar valves occur between the ventricles and the vessels

Heartbeat

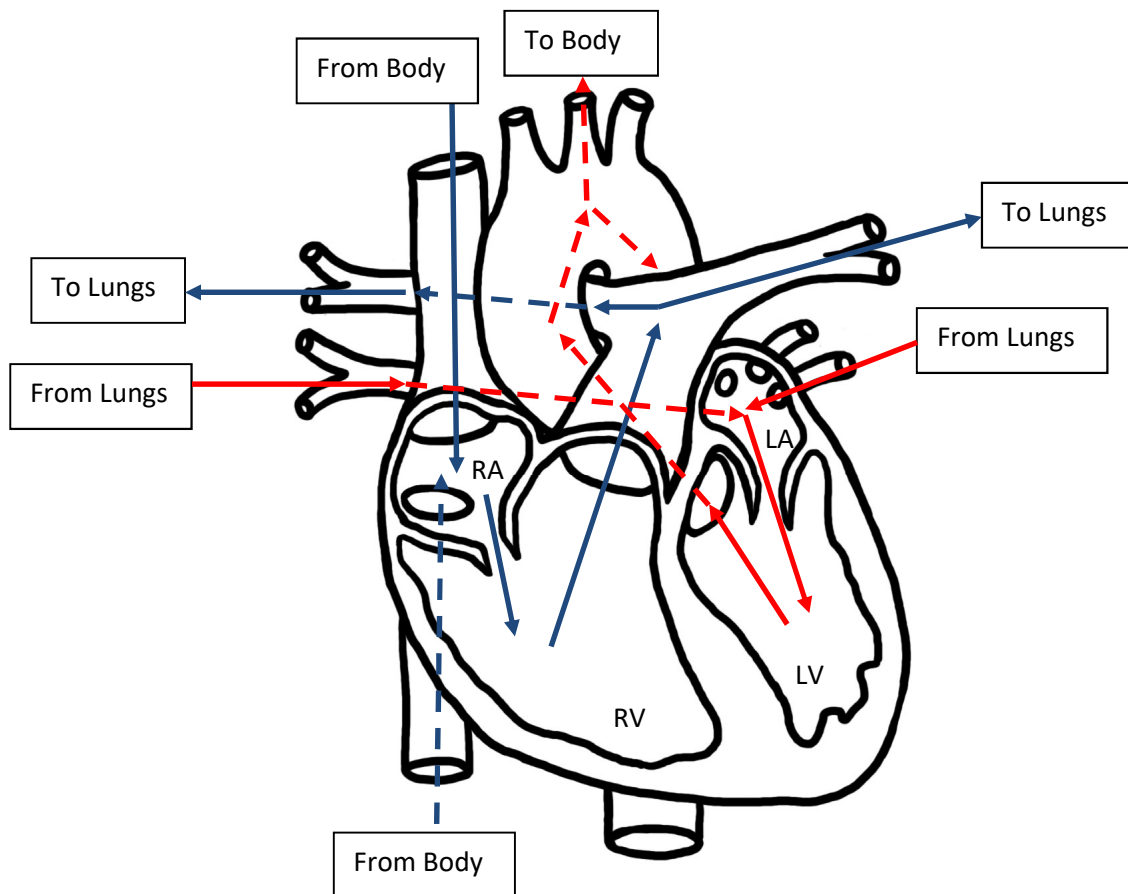
- heartbeat is intrinsic meaning that it can beat independently of any outside nervous stimulation
- a special type of tissue called nodal tissue has characteristics of both muscular and nervous tissue and is responsible for this ability
- 2 nodes that control the heartbeat
 - the pacemaker or sinoatrial (SA) node is found at the upper dorsal wall of the right atrium
 - the atrioventricular (AV) node is found at the base of the right atrium near the septum
- the pacemaker sends out an excitation impulse every 0.85 seconds to cause the atria to contract
- when the impulse reaches the AV node, the ventricles are signaled to contract via atrioventricular and Purkinje fibers
- when the SA node fails to work properly, the heart beats slower or irregularly
 - when this occurs, an artificial pacemaker must be implanted



- the heart beats an average of 72 times per minute - equals 2.65 billion beats in 70 years
- all mammal's hearts (except humans) beat roughly 1 billion times
 - smaller the animal – the faster the heart beats – the shorter the life span

Pathway of Blood Through the Heart

- from the body, blood enters the right atrium of the heart via the superior and inferior vena cava
- blood is pumped into the right ventricle as the atria contract
- when the ventricles contract, blood is pushed out of the heart and into the pulmonary arteries to travel to the lungs where it exchanges carbon dioxide for oxygen
- blood comes back from the lungs through the pulmonary vein and enters the left atrium
- from there, blood travels down into the left ventricle, and then out to the rest of the body through the aorta

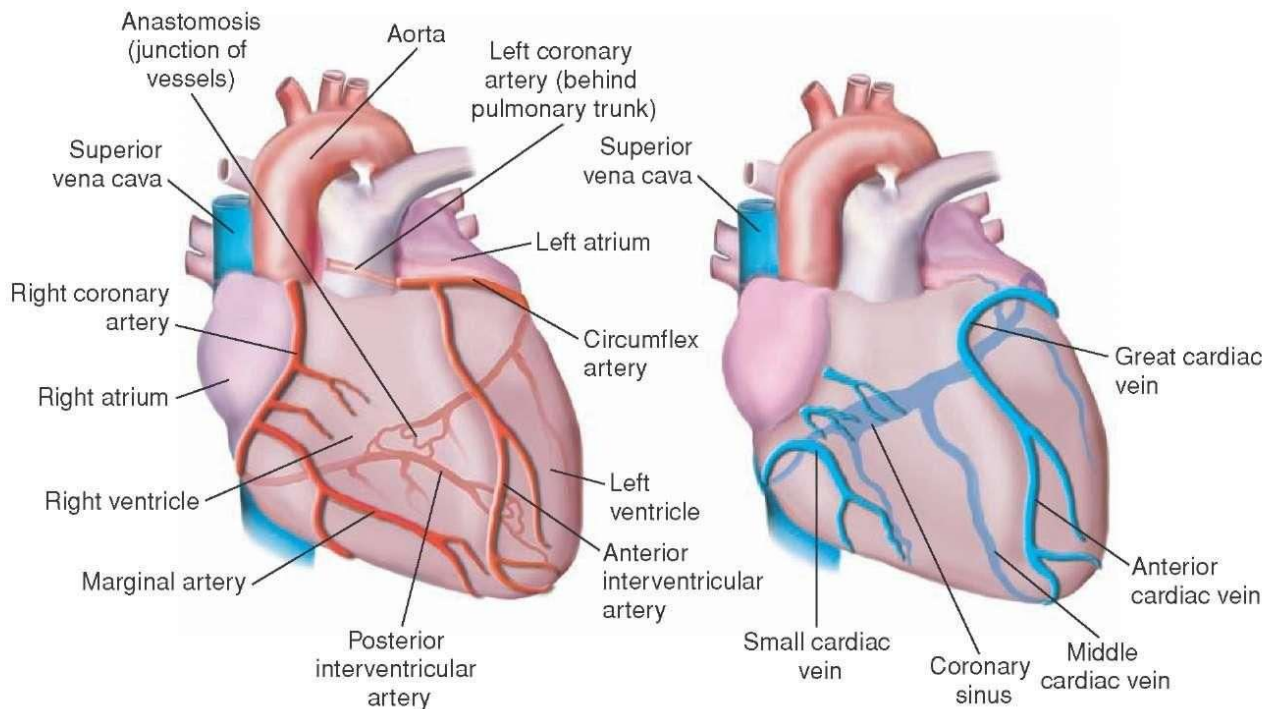


- the contraction of the left ventricle can be felt in the fifth intercostal rib space along the mid-clavicular line

Blood Supply to the Heart

- the heart tissue is supplied with oxygen and nutrients by its own system of blood vessels
- Coronary Arteries (Right and Left)
 - the first two arteries off of the aorta
 - come off just superior to the aortic valve
 - feed the two sides of the heart separately

- **Cardiac Veins**
 - left side of heart drains into the great cardiac vein
 - right side of heart drains into the small cardiac vein
 - both cardiac veins drain into the coronary sinus, which drains directly into the right atrium through a valve



Nervous System Control of the Heartbeat

- the medulla oblongata can alter the heart rate by way of the autonomic nervous system (controls involuntary muscles)
- the autonomic nervous system is made up of two divisions called the parasympathetic and the sympathetic nervous systems
- at times of stress, the sympathetic nervous system regulates the heart rate and speeds it up
- at times of normalcy, the parasympathetic nervous system regulates the heart rate and slows it down
- factors such as low levels of oxygen in the blood will stimulate receptors in the medulla oblongata to increase the heart rate

Blood Pressure

- the pressure of the blood against the wall of a vessel created by the pumping action of the heart is called a pulse
- this pressure is measured by a device called a sphygmomanometer
- two pressures are recorded
 - the systolic pressure indicates the pressure in the arteries when the heart is contracting

- the diastolic pressure and indicates the pressure in the arteries when the heart is relaxed and refilling with blood
- the normal pressure of a person at rest is approximately 120/80
- factors that can affect blood pressure are:
 - a. physical activity
 - CO₂ levels increase, O₂ levels decrease → causes an increase in heartbeat
 - b. distance from the left ventricle
 - more area serviced → decrease in pressure
 - c. diet (eg: salt)
 - increased salt levels → more water moves into blood out of cells → increased blood volume and pressure
 - d. atherosclerosis
 - buildup of plaque on the inside of the arteries → narrowing of the passage for blood → causes increased blood pressure
 - e. arteriosclerosis
 - hardening of the arterial walls (not as elastic) → cannot expand as much during ventricular contraction → increased blood pressure