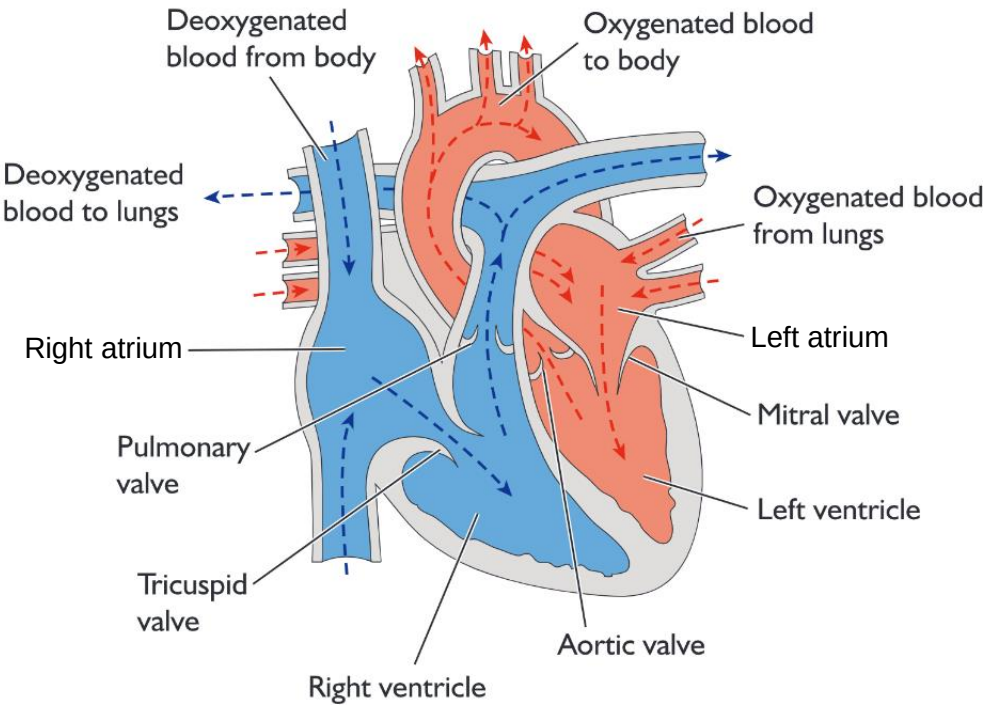
CONCEPT: HEART PHYSIOLOGY

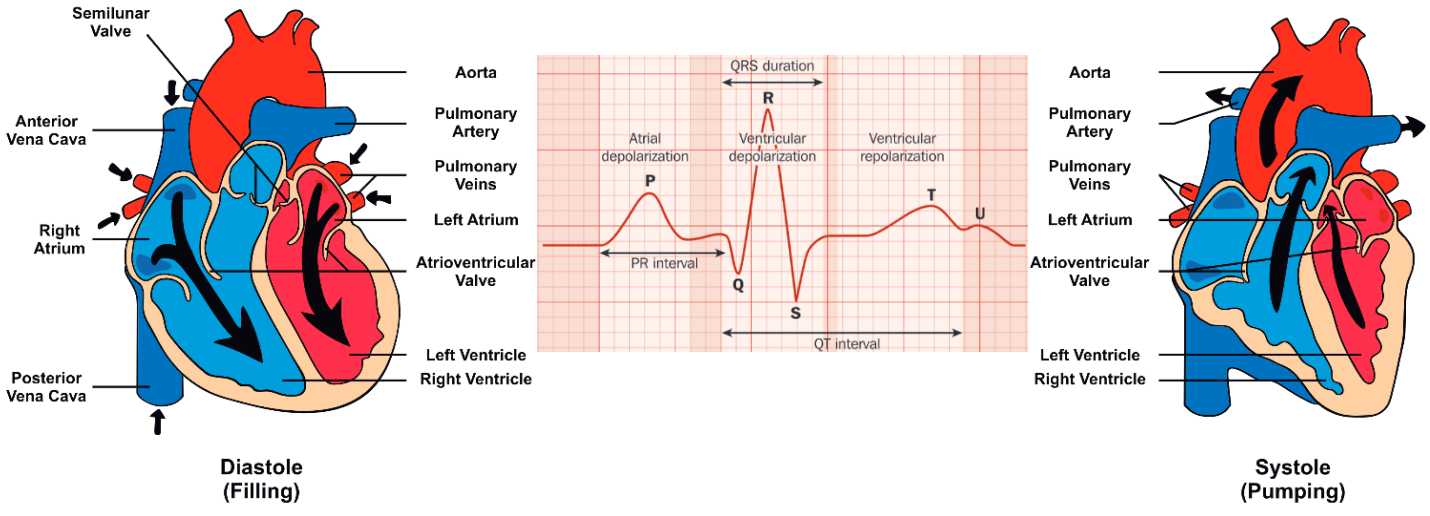
- Heart circulates blood by filling it's chambers up from veins, then pushing the blood through arteries
  - □ ***Atria*** – thinner, less muscular walls than ventricles that receive blood from veins
  - □ ***Ventricles*** – thicker, more muscular walls that atria for powerful pumping into arteries

EXAMPLE:



- ***Cardiac cycle*** – complete cycle of pumping out blood, and filling up with blood
  - □ ***Systole*** – contraction phase of the cardiac cycle
  - □ ***Diastole*** – relaxation phase of the cardiac cycle
  - □ Atria and ventricles in diastole – blood flows into atria and ventricles
  - □ Atria in systole, ventricles in diastole – blood in atria pushed into through AV valves ventricles
  - □ Atria in diastole, ventricles in systole – blood in ventricles pushed into arteries through semilunar valves

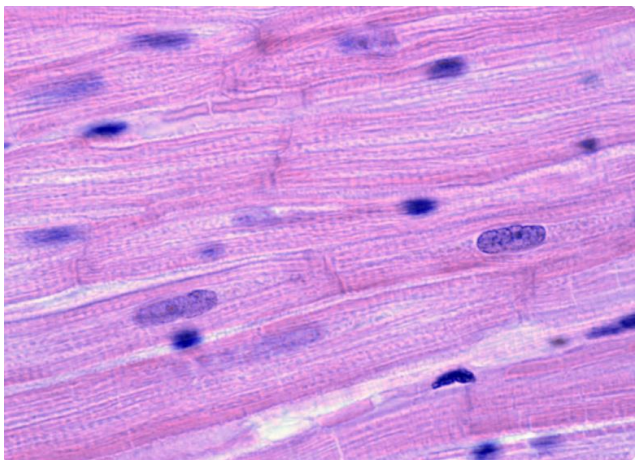
EXAMPLE:

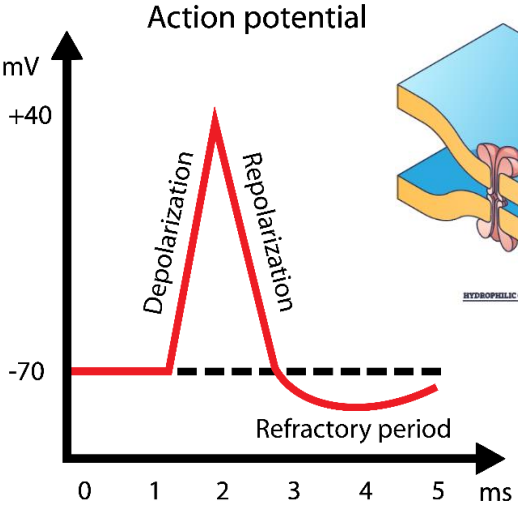


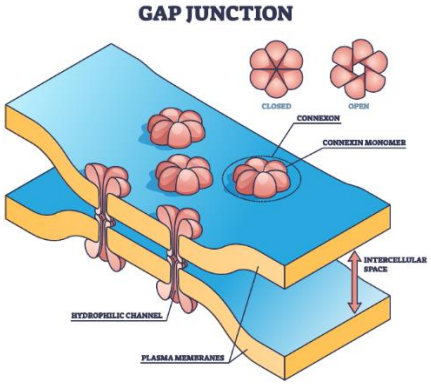
CONCEPT: HEART PHYSIOLOGY

- Heart beats in response to electrical signals call action potentials
    - □ Action potentials are generated by the movement of ions across the membrane
    - □ Action potentials in the heart move between cells through gap junctions
    - □ ***Intercalated discs*** – special structure in heart muscle connecting neighboring cells, contains gap junction

EXAMPLE:

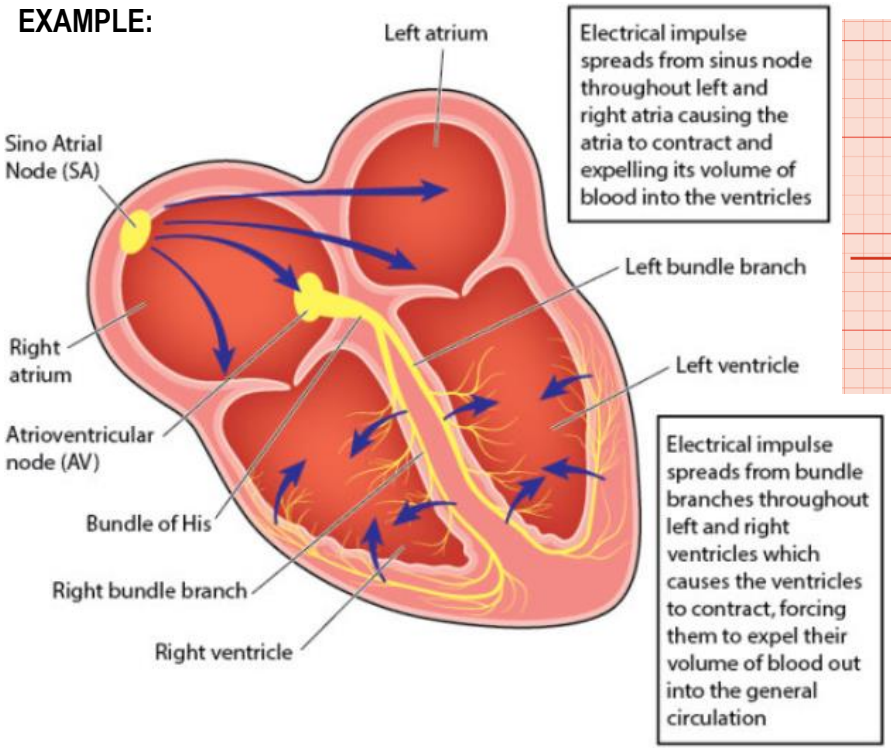


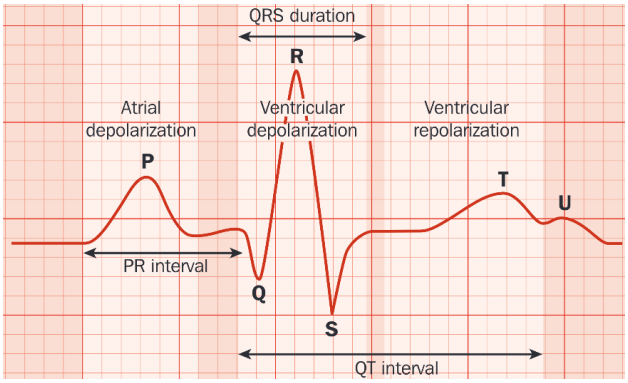




- ***Sinoatrial node*** (***SAN***) – group of cells in the right atrium that initiate heart contraction in vertebrates
    - □ ***Pacemaker cells*** – cells in SAN node that control rate and timing of heartbeat by starting action potentials
- ***Atrioventricular node*** (***AVN***) – group of cells that pass the action potential from the atria to the ventricles
    - □ Slightly delays the signal to give the atria time to empty completely into ventricles
- Purkinje fibers – spread action potential through ventricles from the bottom to the top
- ***Electrocardiogram*** (***EKG***) – records the electrical activity of the cardiac cycle

EXAMPLE:

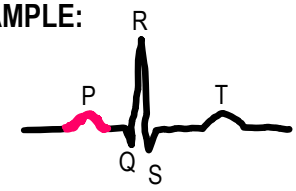


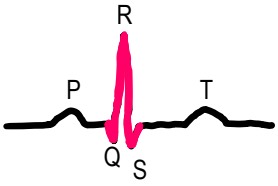


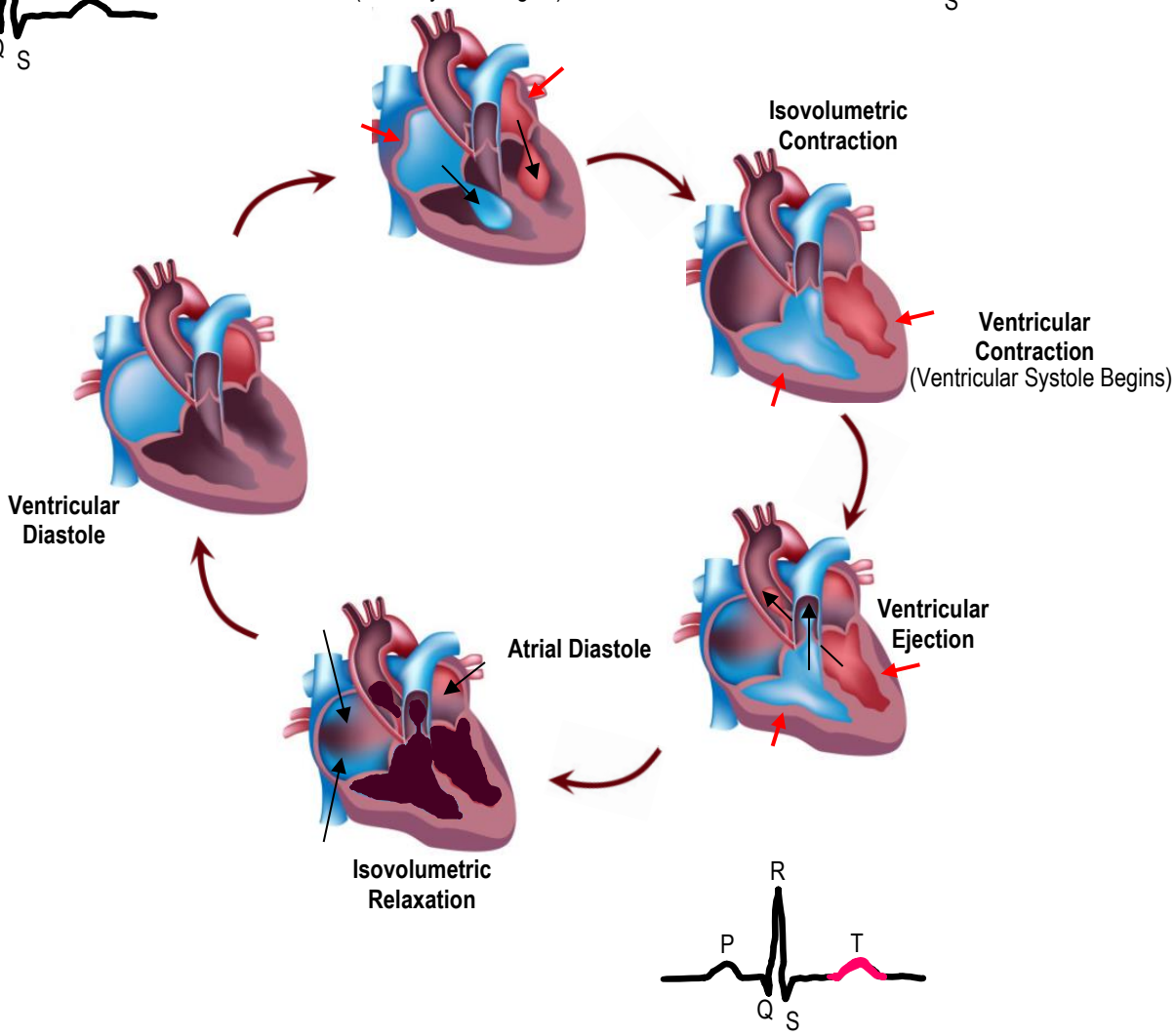
CONCEPT: HEART PHYSIOLOGY

- ***Diastole*** – relaxation of ventricles and atria fills heart with blood
  - □ SAN initiates atrial systole, causing the atria to contract
  - □ AVN delays action potential, allowing atria to completely empty into ventricles
- ***Systole*** – action potential starts at the bottom of the ventricles, and moves up through Purkinje fibers
  - □ Ventricles contract and push blood through arteries
- ***Cardiac output*** – volume of blood per minute that is pumped by the ventricles
  - □ ***Heart rate*** – heartbeats per minute
  - □ ***Stroke volume*** – volume of blood pumped by a single ventricle contraction

EXAMPLE:



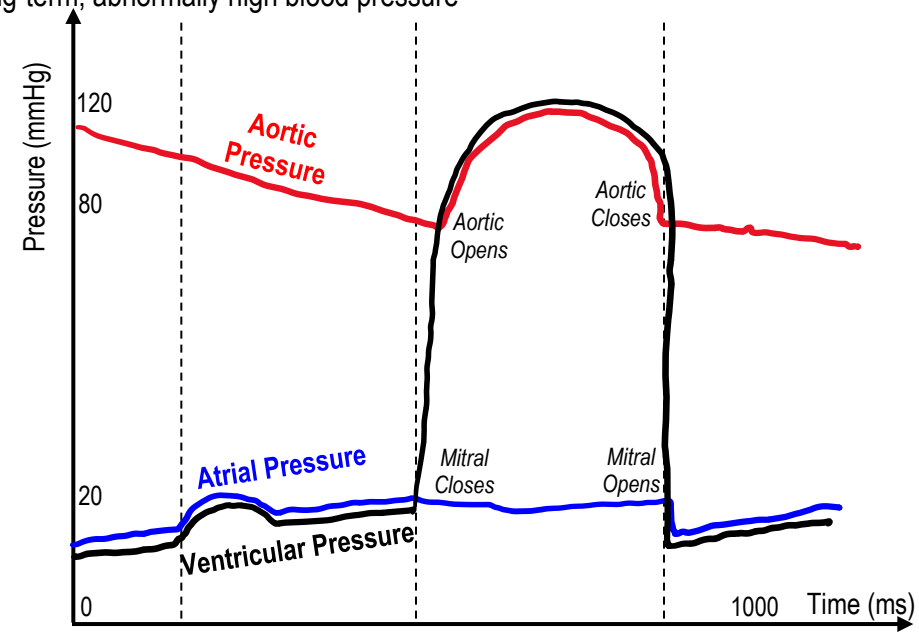




CONCEPT: HEART PHYSIOLOGY

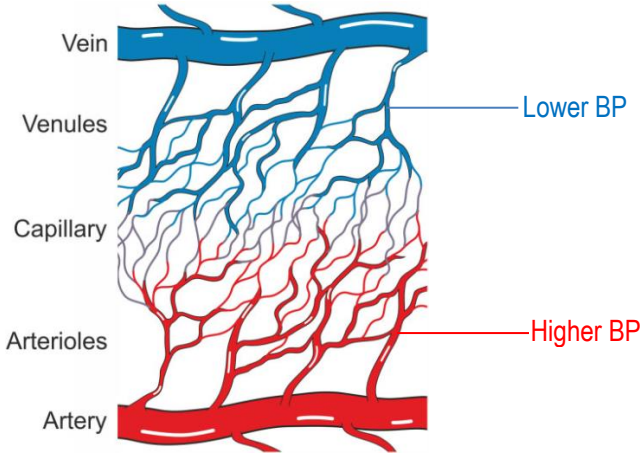
- ***Systolic blood pressure*** – highest blood pressure, measured at the peak blood pumping out of the ventricles
  - □ ***Pulse*** – rhythmic bulging of an artery with heartbeat allowing systolic blood pressure to be measured
- ***Diastolic blood pressure*** – lower blood pressure measured right before ventricles contract and pump out blood
  - □ Doctors give two numbers for blood pressure measurement: systolic bp/diastolic bp
- ***Hypertension*** – long-term, abnormally high blood pressure

EXAMPLE:



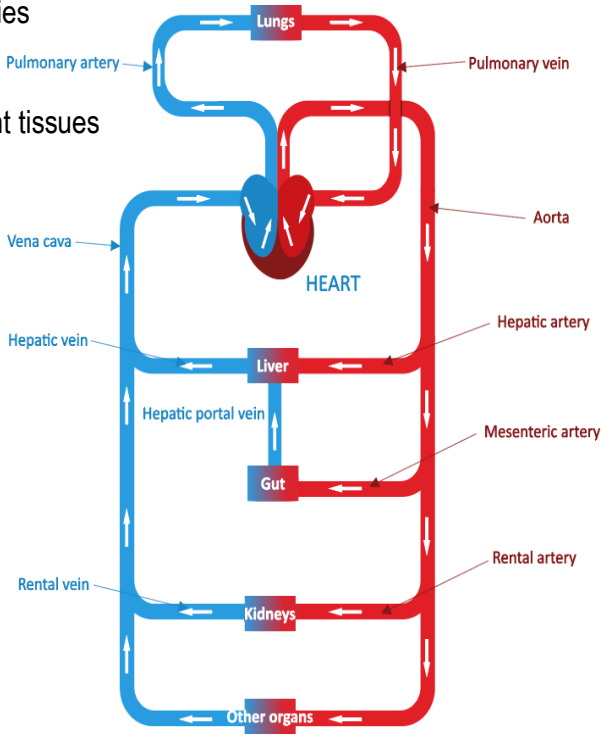
- Arteries have muscle fibers and elastic fibers to deal with the high pressure from ventricle contractions
  - □ Aorta is especially dense with elastic fibers allowing it to withstand immense systolic pressure
- Blood slows as it moves through capillaries, experiencing a substantial drop in velocity and pressure
- Veins have the lowest blood pressure, have valves to prevent backflow
  - □ Veins in extremities pass through skeletal muscles that contract to help push blood toward the heart
- ***Interstitial fluid*** – fluid that leaks from capillaries and enters space outside of cells
  - □ Hydrostatic pressure outward from capillaries to interstitial space due to pressure from heart
  - □ Osmotic gradient inward from interstitial space to capillaries due to solute concentration in blood
  - □ Arteriole end: hydrostatic pressure>osmotic pressure, venous end: hydrostatic pressure<osmotic pressure

EXAMPLE:



CONCEPT: HEART PHYSIOLOGY

- Blood pressure must be regulated through a homeostatic system
    - □ Baroreceptors – pressure sensors found in the heart and arteries
    - □ Cardiac output is increased in response to low blood pressure
    - □ Vasoconstriction of specific arterioles diverts blood to important tissues
    - □ Veins constrict to divert blood volume to heart and arteries
    - □ Vasodilation of arteries leads to a drop in blood pressure



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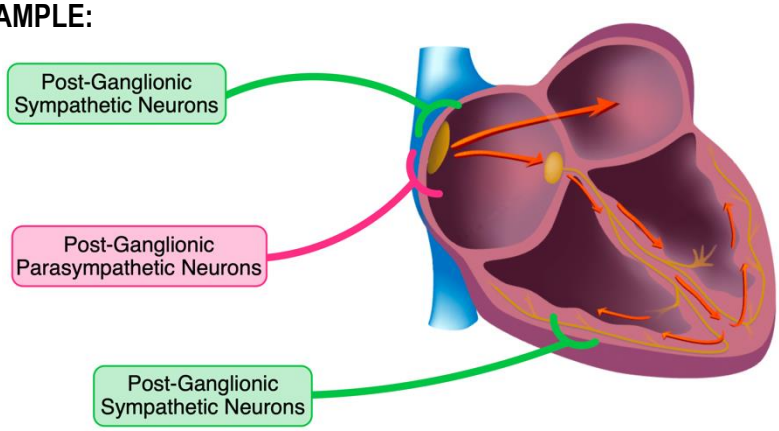

- Cardiovascular disease – disorders that affect the heart or vasculature
- Arteriosclerosis – hardening of arteries due to accumulation of fat deposits
    - □ Cholesterol is transported in blood as low-density lipoprotein (LDL) and high-density lipoprotein (HDL)
        - LDL delivers cholesterol, and HDL scavenges excess cholesterol
- Myocardial infarction – "heart attack" due to blockage of coronary arteries leading to damage of heart muscle tissue
- Stroke – damage to nervous tissue in the brain from lack of O_2, often due to blocked or ruptured artery

EXAMPLE: