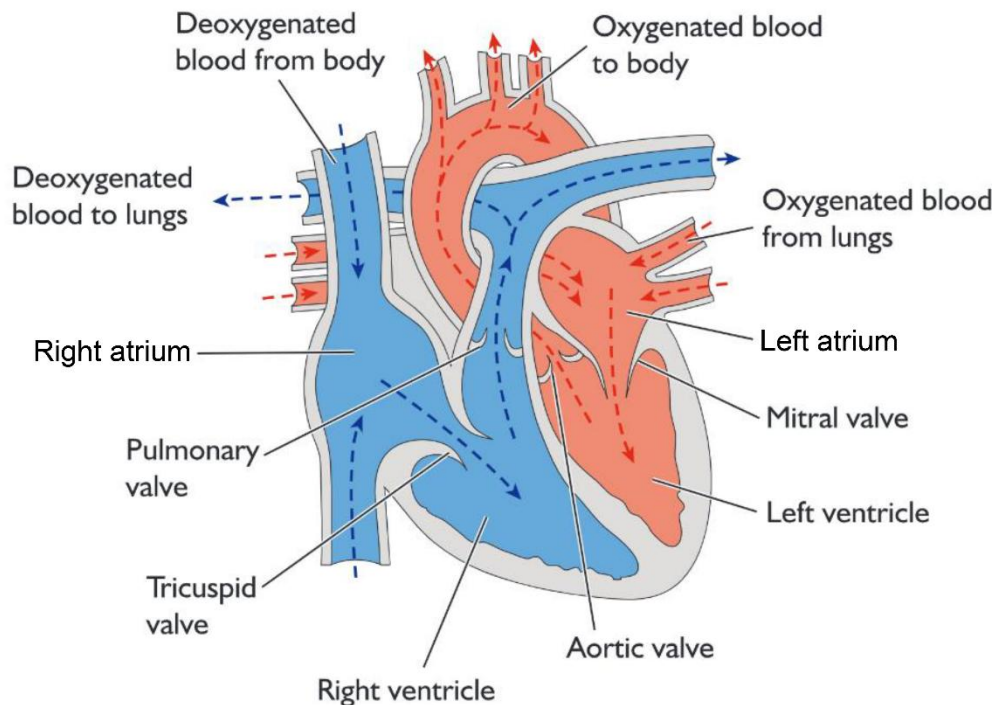


CONCEPT: HEART PHYSIOLOGY

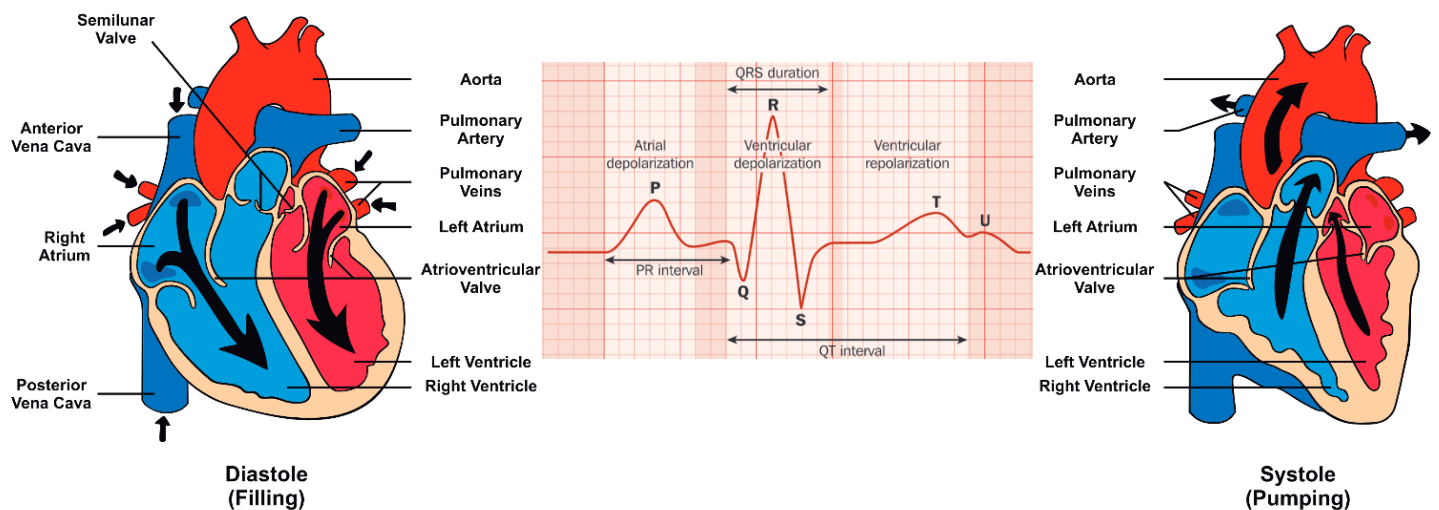
- Heart circulates blood by filling it's chambers up from veins, then pushing the blood through arteries
 - **Atria** – thinner, less muscular walls than ventricles that receive blood from veins
 - **Ventricles** – thicker, more muscular walls than atria for powerful pumping into arteries

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

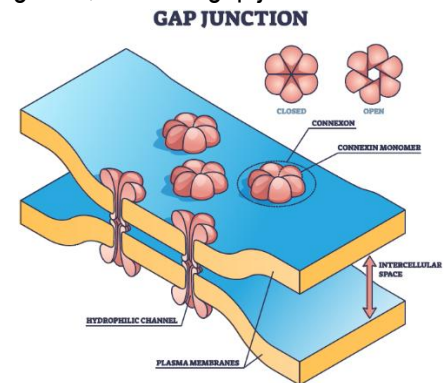
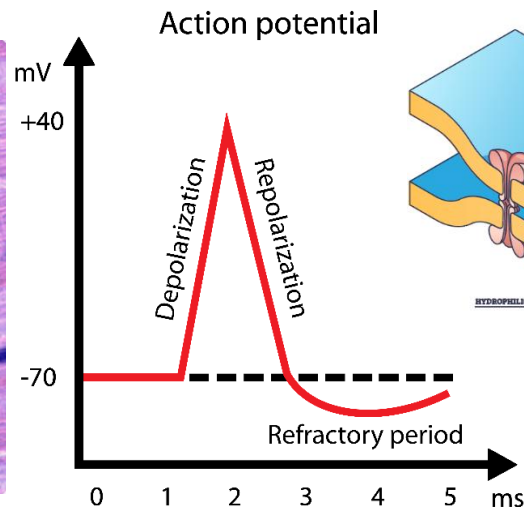
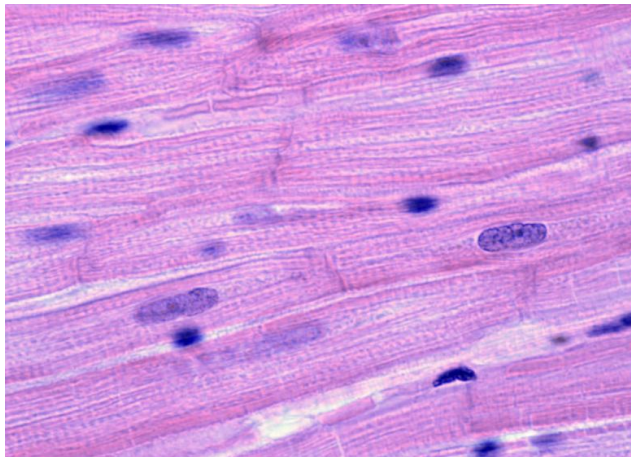
EXAMPLE:



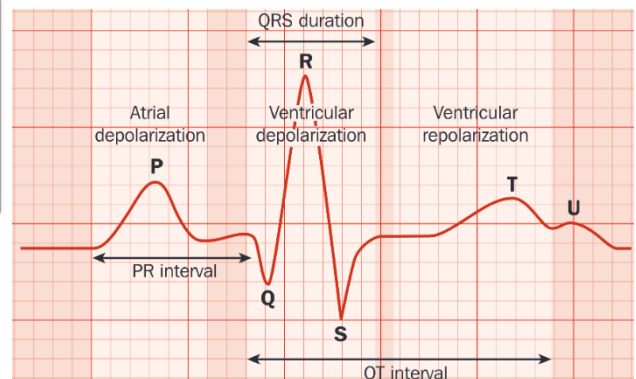
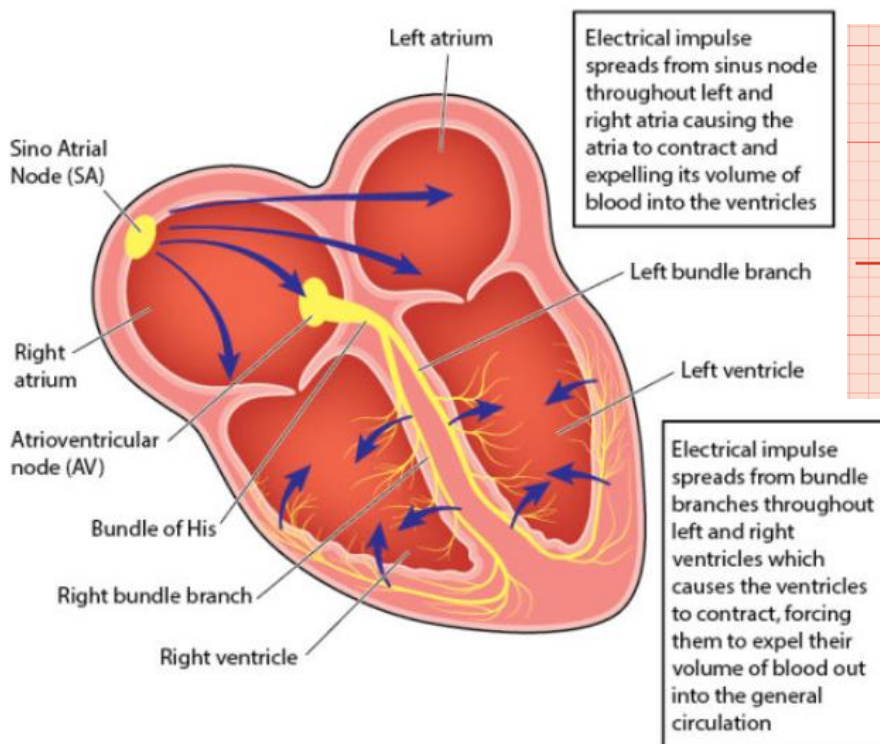
CONCEPT: HEART PHYSIOLOGY

- 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:



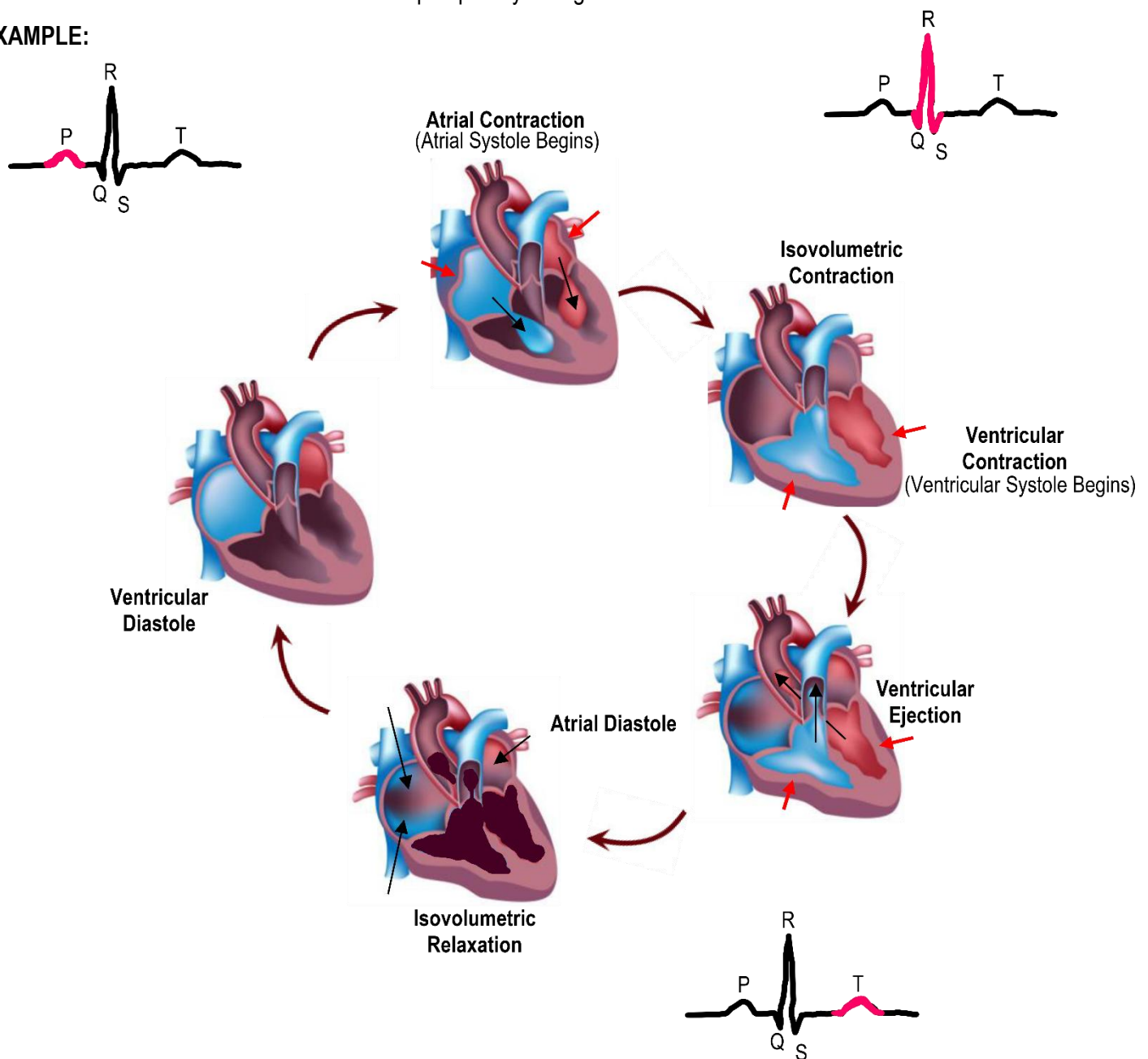
- **Sinoatrial node (SAN)** – group of cells in the right atrium that initiate heart contraction in vertebrates
 - **Pacemaker cells** – cells in SAN node that control rate and timing of heartbeat by starting action potentials
- **Atrioventricular node (AVN)** – group of cells that pass the action potential 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



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 minut
 - **Stroke volume** – volume of blood pumped by a single ventricle contraction

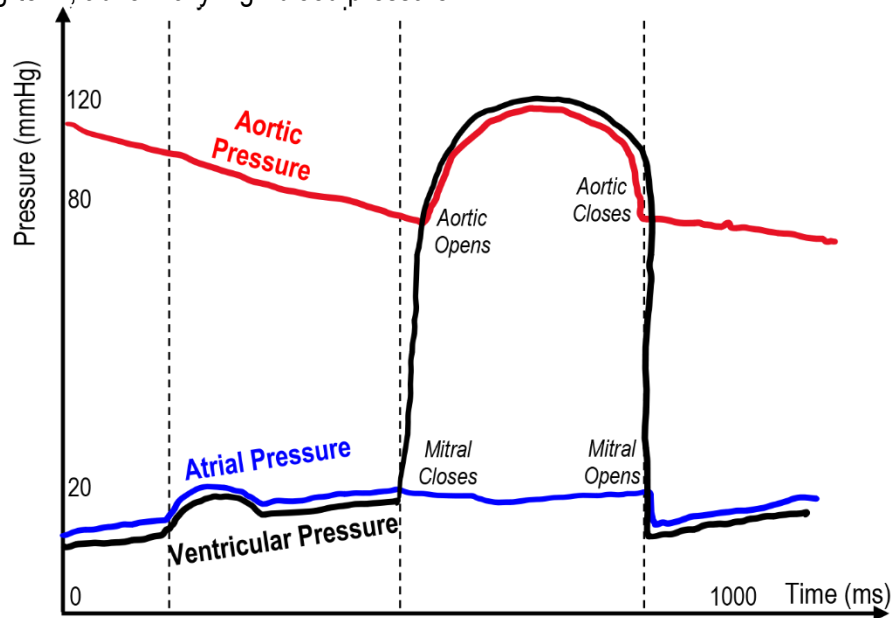
EXAMPLE:



CONCEPT: HEART PHYSIOLOGY

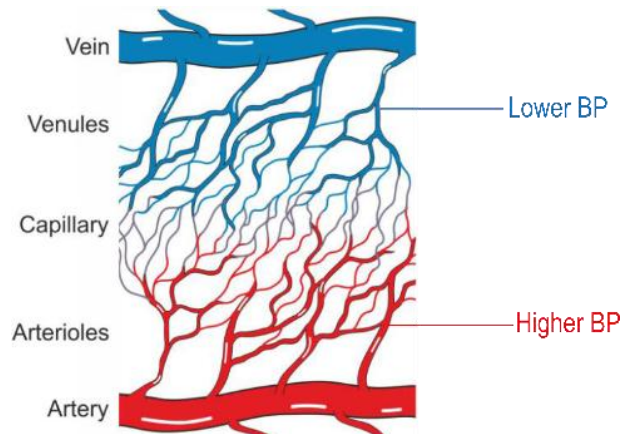
- **Systolic blood pressure** – highest blood pressure, measured at the peak blood pumping out of the ventricles
 - **Pulse** – rhythmic bulging of an artery with heartbeat allowing systolic blood pressure to be measured
- **Diastolic blood pressure** – lower blood pressure measured right before ventricles 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

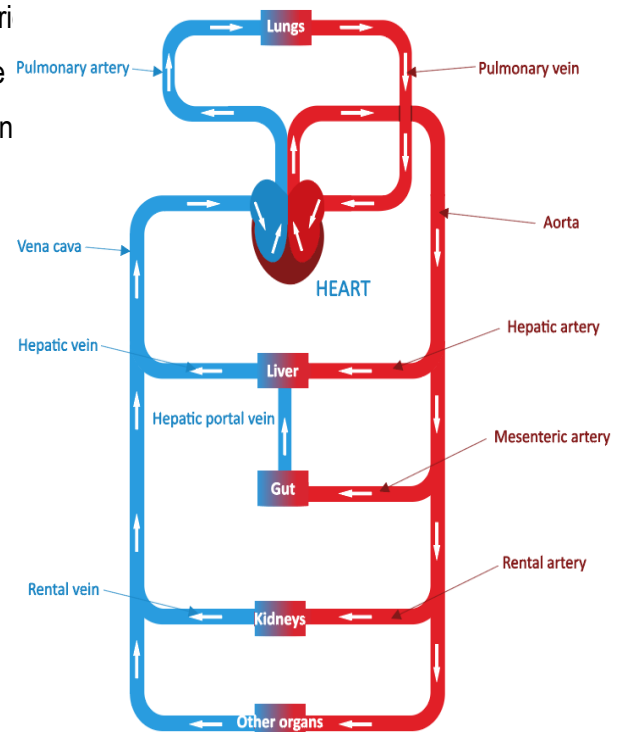
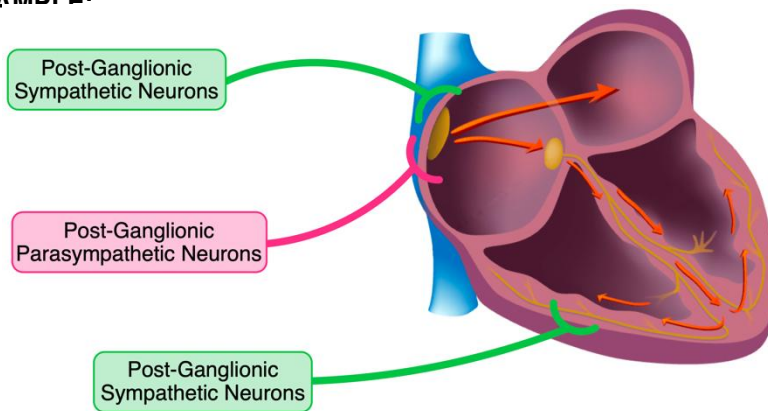
EXAMPLE:



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 organs
 - Veins constrict to divert blood volume to heart and arteries
 - Vasodilation of arteries leads to a drop in blood pressure

EXAMPLE:



- 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 O₂, often due to blocked or ruptured artery

EXAMPLE:

