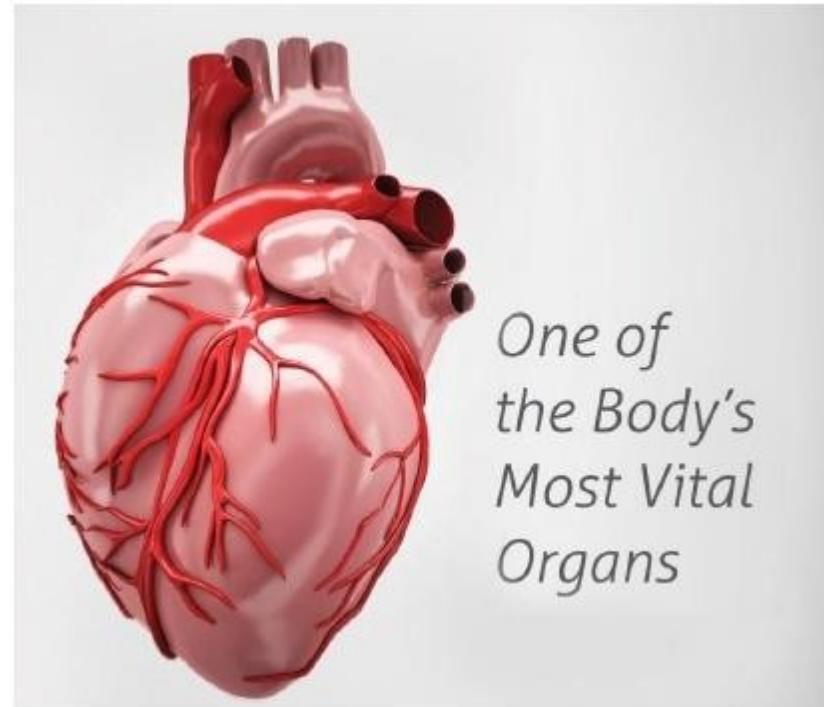


CARDIO VASCULAR SYSTEM

Courtesy,
VIJAYALAKSHMI



CVS

- CARDIOLOGY
- CARDIOLOGIST
- STRUCTURE OF HEART
- STUDY OF BLOOD VESSELS RELATED TO HEART
- CARDIOLOGY DISEASES AND CONDITIONS
- DIAGNOSTIC TESTS AND PROCEDURES
- MEDICAL TERMS AND ABBREVIATIONS

CVS

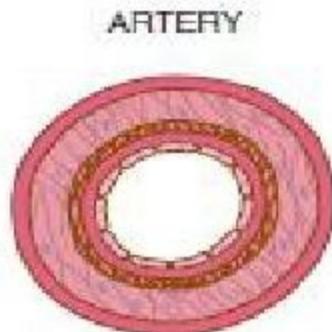
- ALSO CALLED CIRCULATORY SYSTEM
- CONSISTS OF THE HEART, ARTERIES, VEINS, CAPILLARIES

ARTERIES

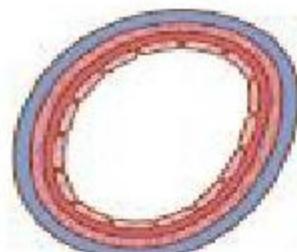
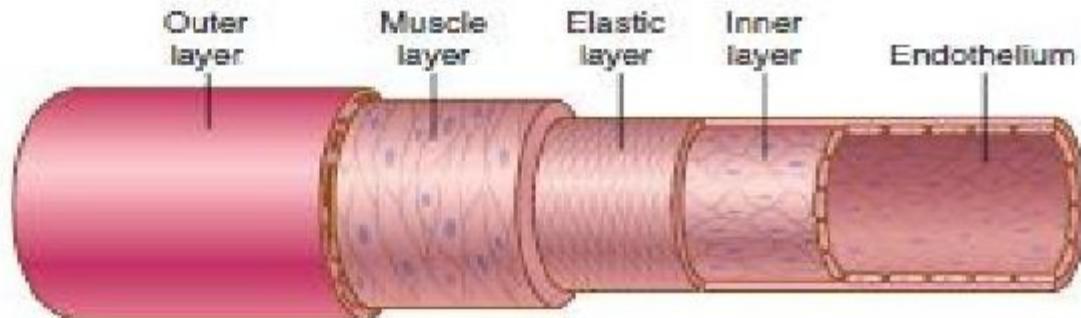
- **Artery** – carries oxygenated blood away from the heart
 - “distributors”
 - Arteriole: small artery
 - Precapillary sphincters: regulate the blood flow into capillaries
- **Vein** – carries deoxygenated blood towards the heart
 - Veins have valves that prevent the backflow of blood and keep the blood moving in one direction. Muscular action also helps the movement of blood in veins
 - Great ability to stretch (*capacitance*)
 - Function as reservoirs: blood pools in the valves then is pushed forward from the pumping pressure
 - Venules: small vein

- **Capillaries** have walls that are only one endothelial cell in thickness
- **Capillaries** - arterial system switches to venous system
 - “primary exchange vessels”
 - Transport materials to and from the cells
 - Microcirculation: blood flow between arterioles, capillaries and venules

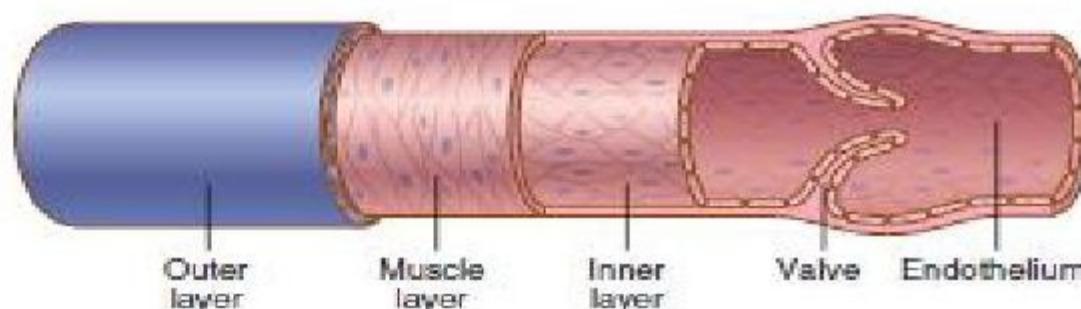
STRUCTURE OF BLOOD VESSELS



ARTERY



VEIN



CAPILLARY



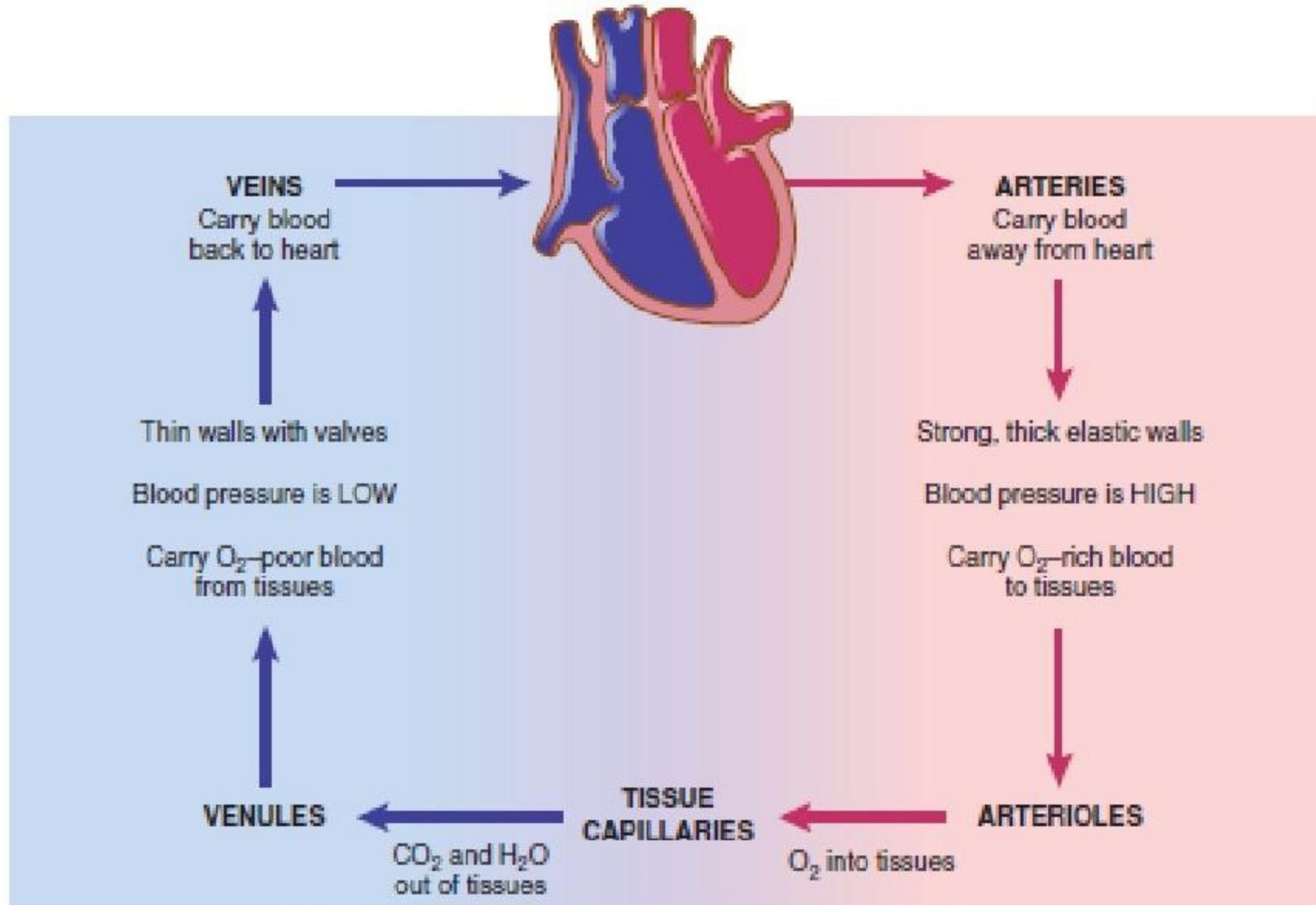
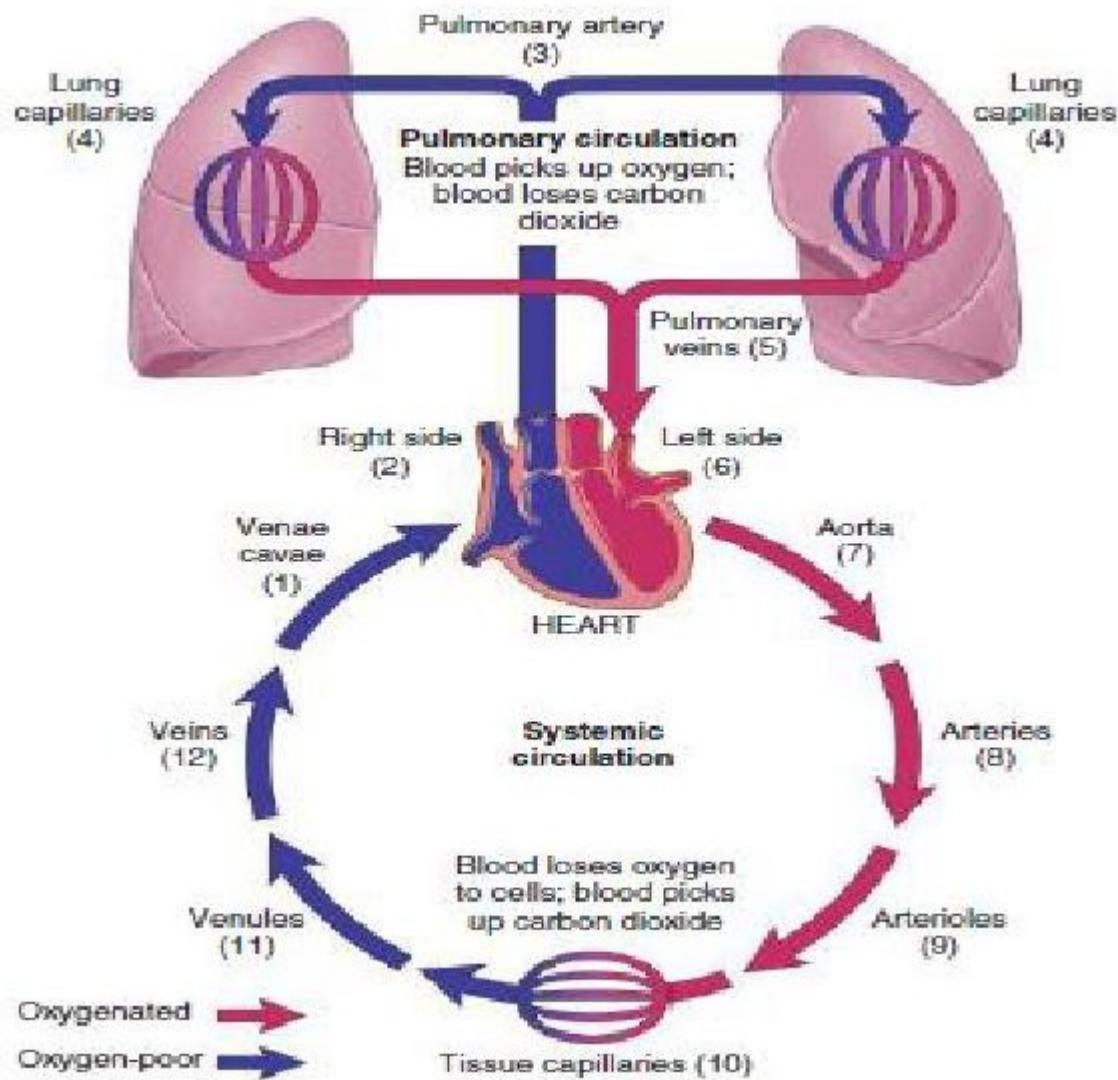


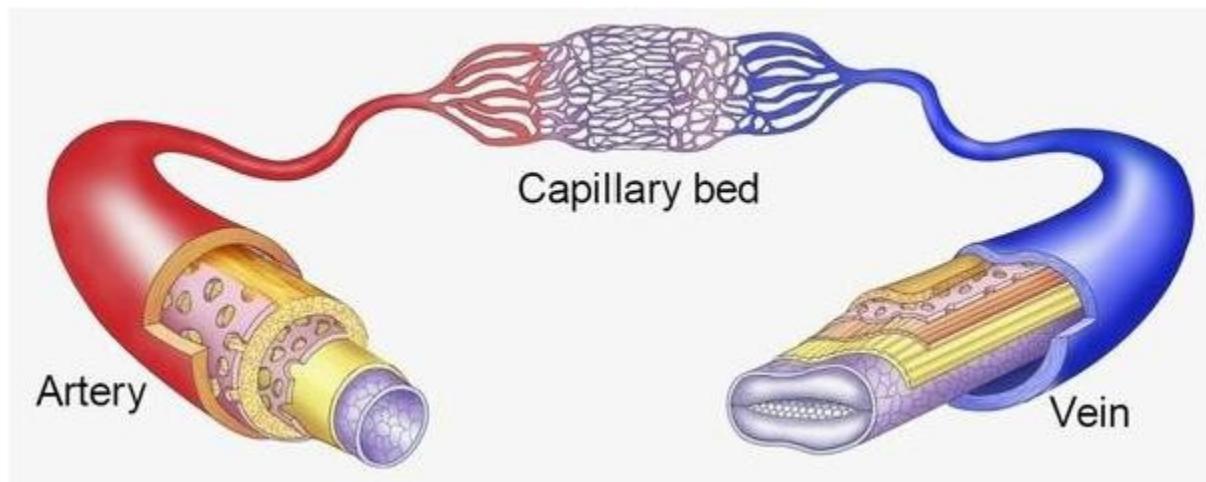
FIGURE 11-2 Relationship and characteristics of blood vessels.

CIRCULATION OF BLOOD

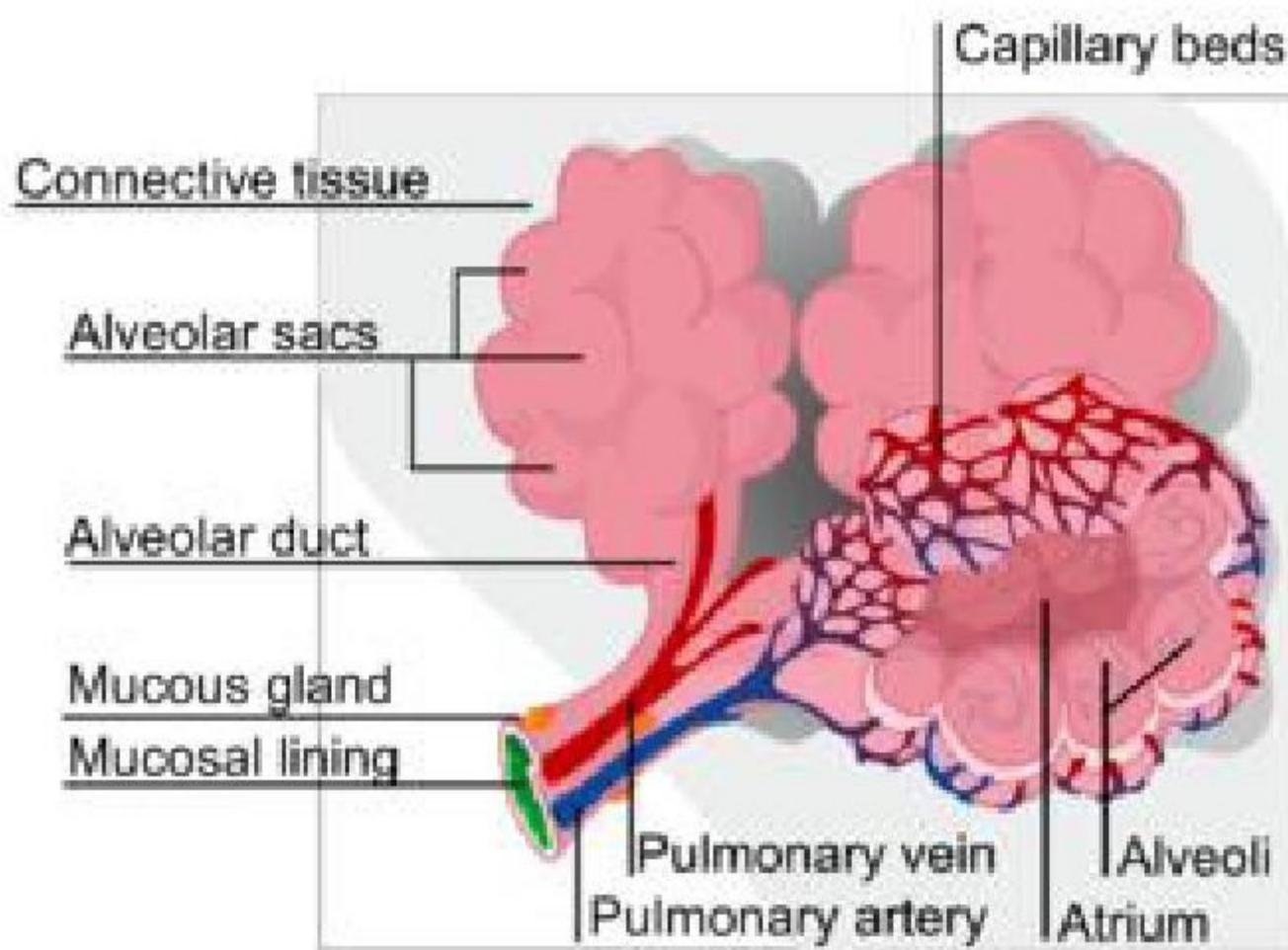


A closely interwoven collection of capillaries that lie next to body tissues is called a capillary bed.

These capillary beds are where the transfer of oxygen and carbon dioxide takes place.

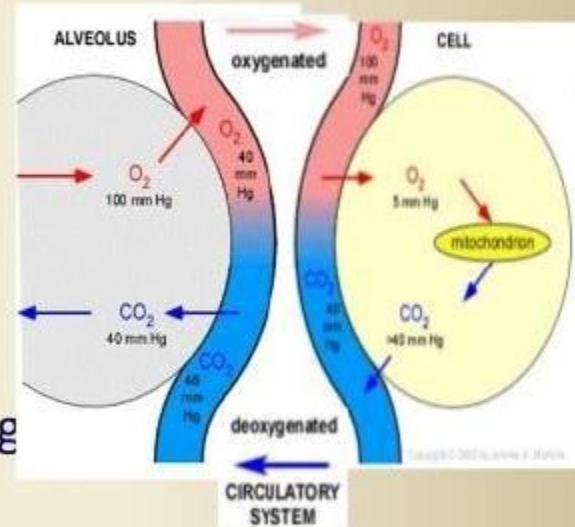


Eg - CAPILLARY BED



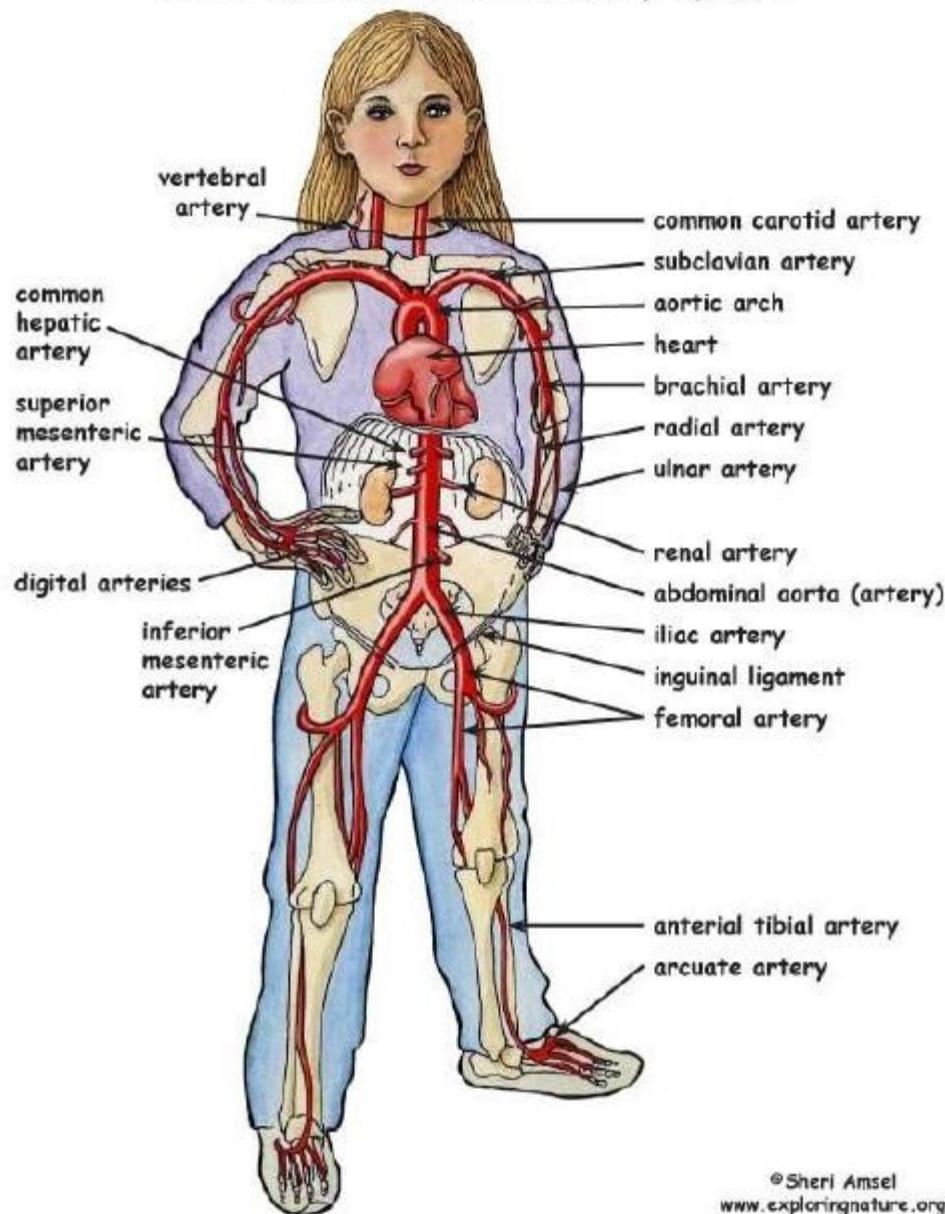
Gas Exchange

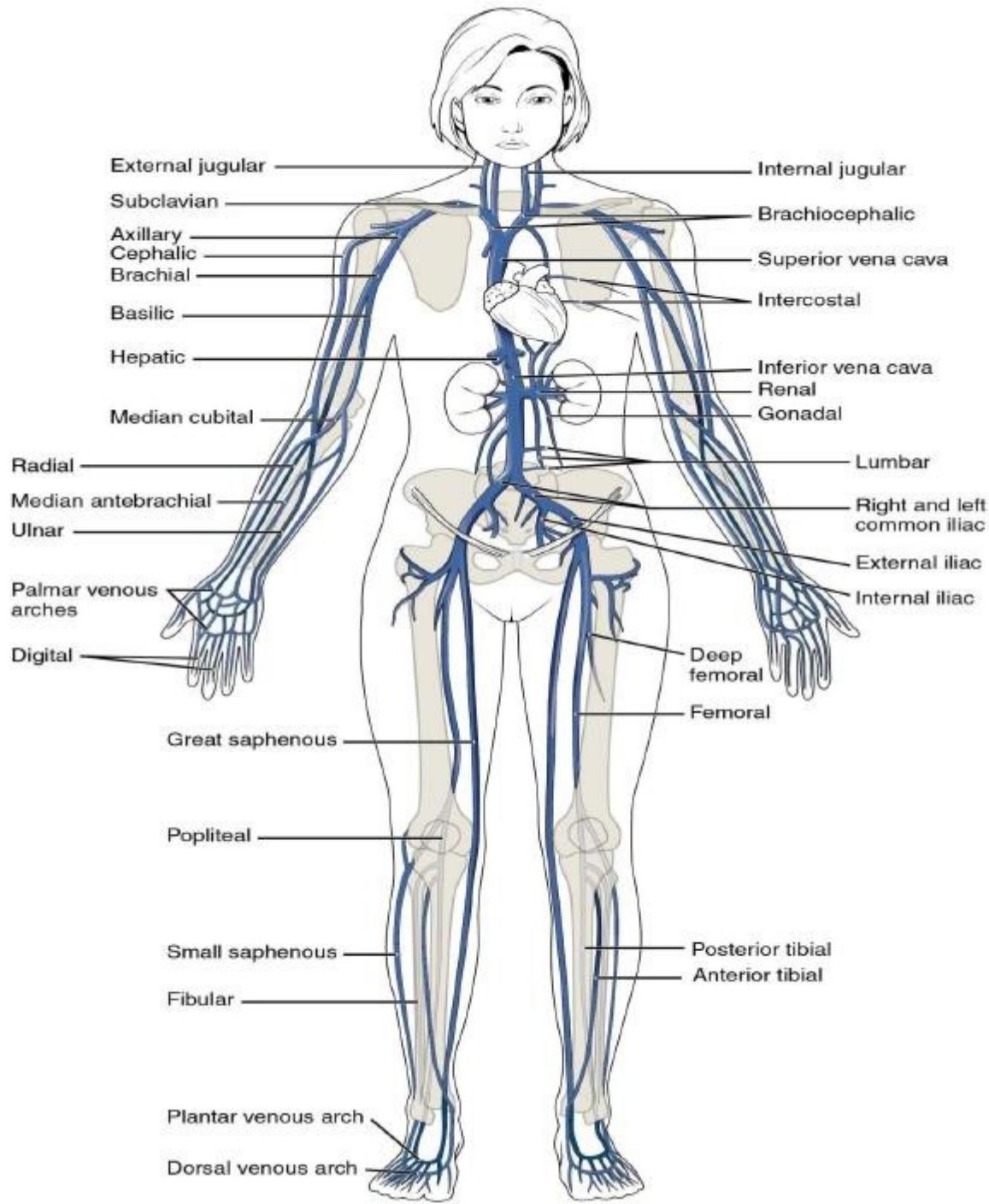
- Sites of Gas exchange:
 - At tissues
(between blood & tissues).
 - At the lungs
(between blood & air).
- Mechanism of Gas exchange
 - Simple diffusion.
 - i.e. down partial pressure gradient.
from high to low partial pressure.



- The circulation of blood through the vessels from the heart to the lungs and then back to the heart again is the **pulmonary circulation**.
- The pathway of blood from the heart to the tissue capillaries and back to the heart is the **systemic circulation**

Blood Vessels of the Circulatory System



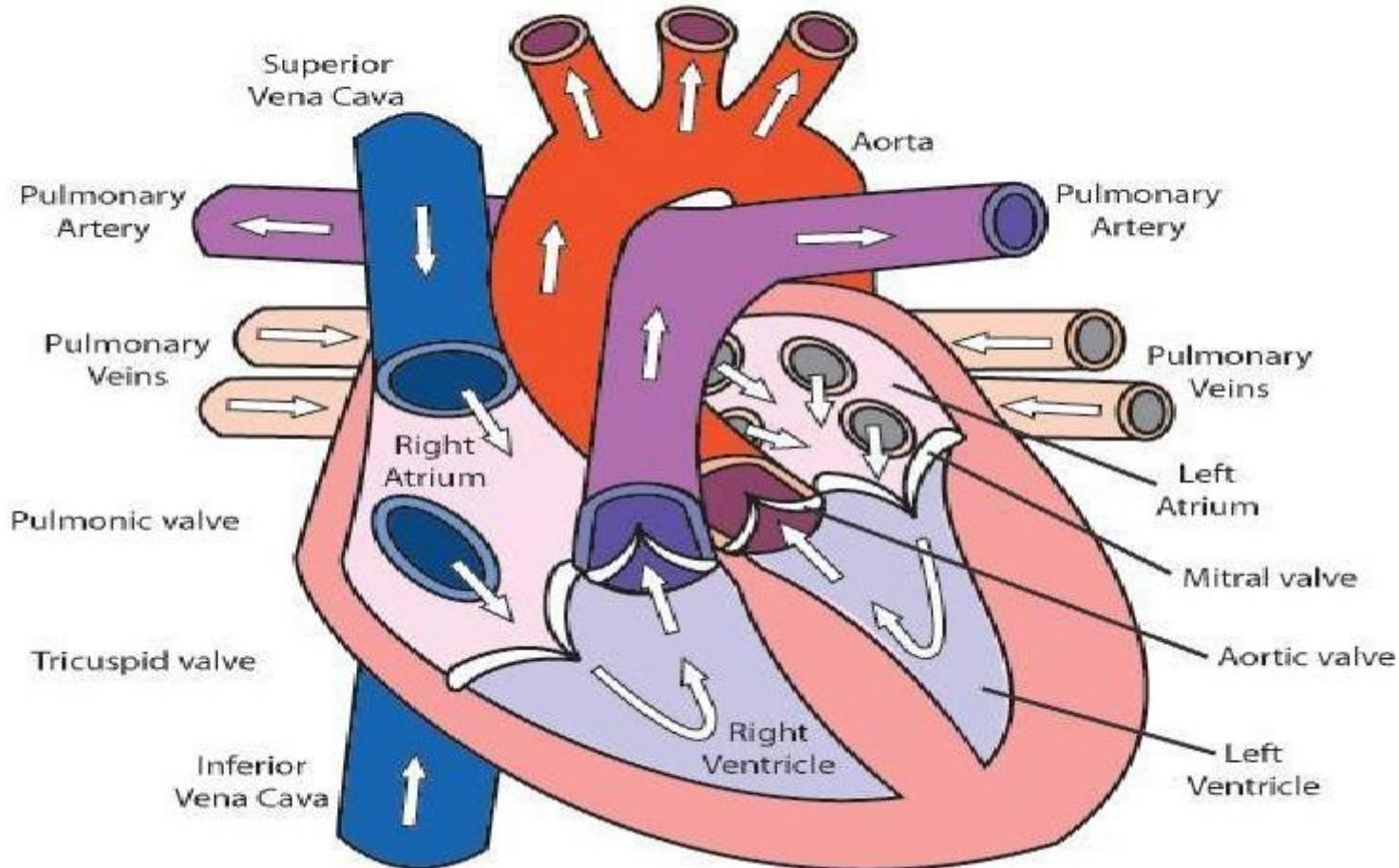


HEART

- **Four chamber muscular pumping organ**
- **Comparable to the size of a closed fist**
- **Located in the mediastinum**
 - Behind sternum
 - Between 2nd and 6th ribs
 - Between T5-T8
- **Apex – base of heart**
 - Located at the 5th intercostal space

STRUCTURE OF HEART

The Heart



CHAMBERS OF HEART

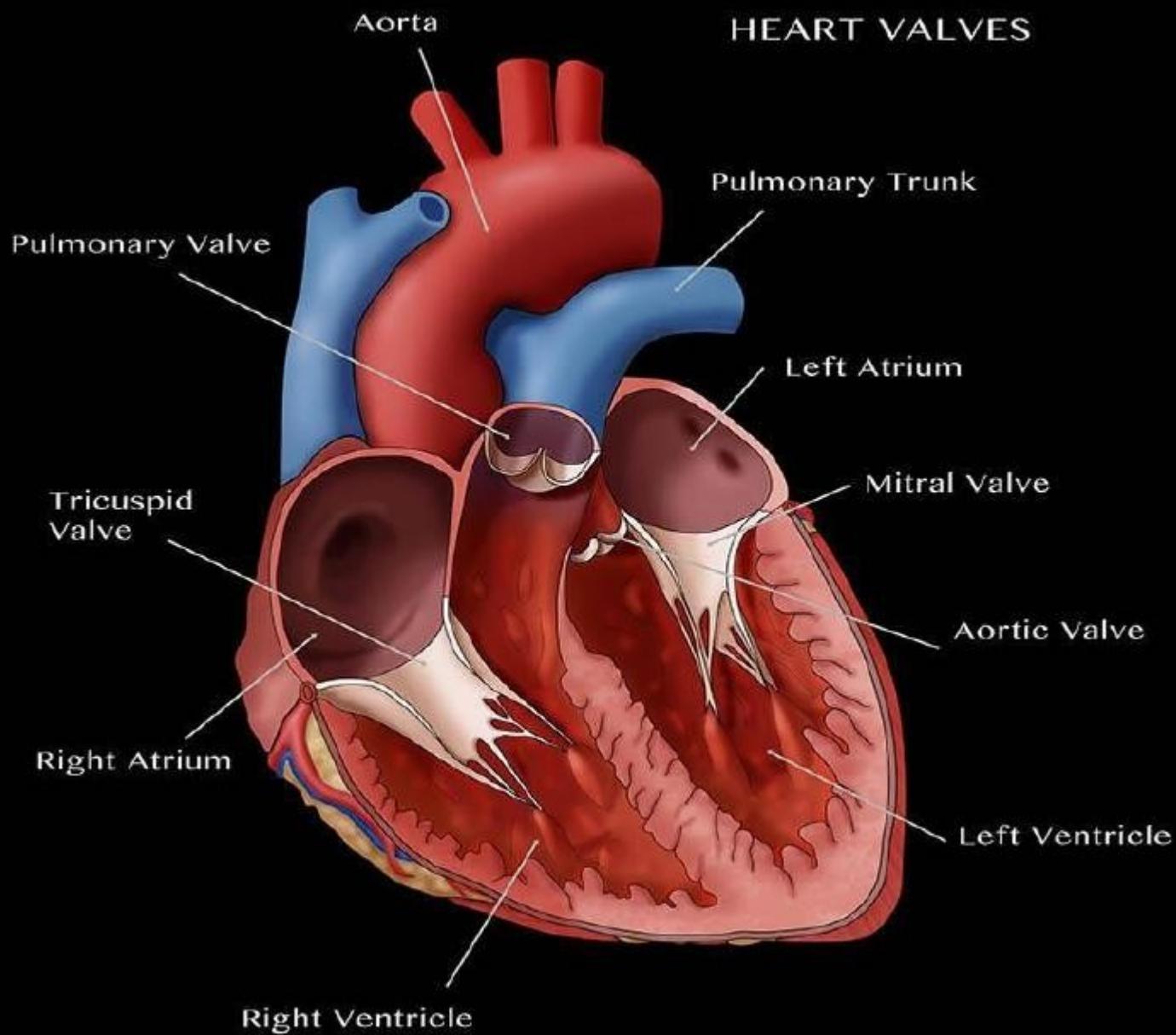
- **Atria** – two superior chambers
 - “Receiving chambers”
 - Blood from veins enters atria
- **Ventricles** – two inferior chambers
 - “pumping chambers”
 - Thick muscular walls to increase force of pumping action
 - Separated by inter ventricular septum

VALVES OF HEART

- Permit blood flow in one direction during circulation
- Atrioventricular valves (AV valves)
 - Also called cuspid valves
 - Between atria and ventricles
- Tricuspid valve
 - B/w RT atrium and ventricle
 - Connected to ventricular papillary muscle via chordae tendinae
- Bicuspid valve
 - B/w LT atrium and ventricle
 - Also called mitral valve

- **Semilunar (SL valves)**
 - Between RT ventricle and pulmonary arteries , LT ventricle and aorta consisting of three cusps or flaps which prevent the flow of blood back into the heart.
- **Pulmonary valve**
 - Btwn RT ventricle and pulmonary trunk
- **Aortic valve**
 - Btwn LT ventricle and aorta

HEART VALVES



SEPTUM

- The four chambers of the heart are separated by partitions called **septa** (*singular*: septum).
- **Inter atrial septum** separates the two upper chambers (atria)
- **Inter ventricular septum**, a muscular wall, lies between the two lower chambers (ventricles).

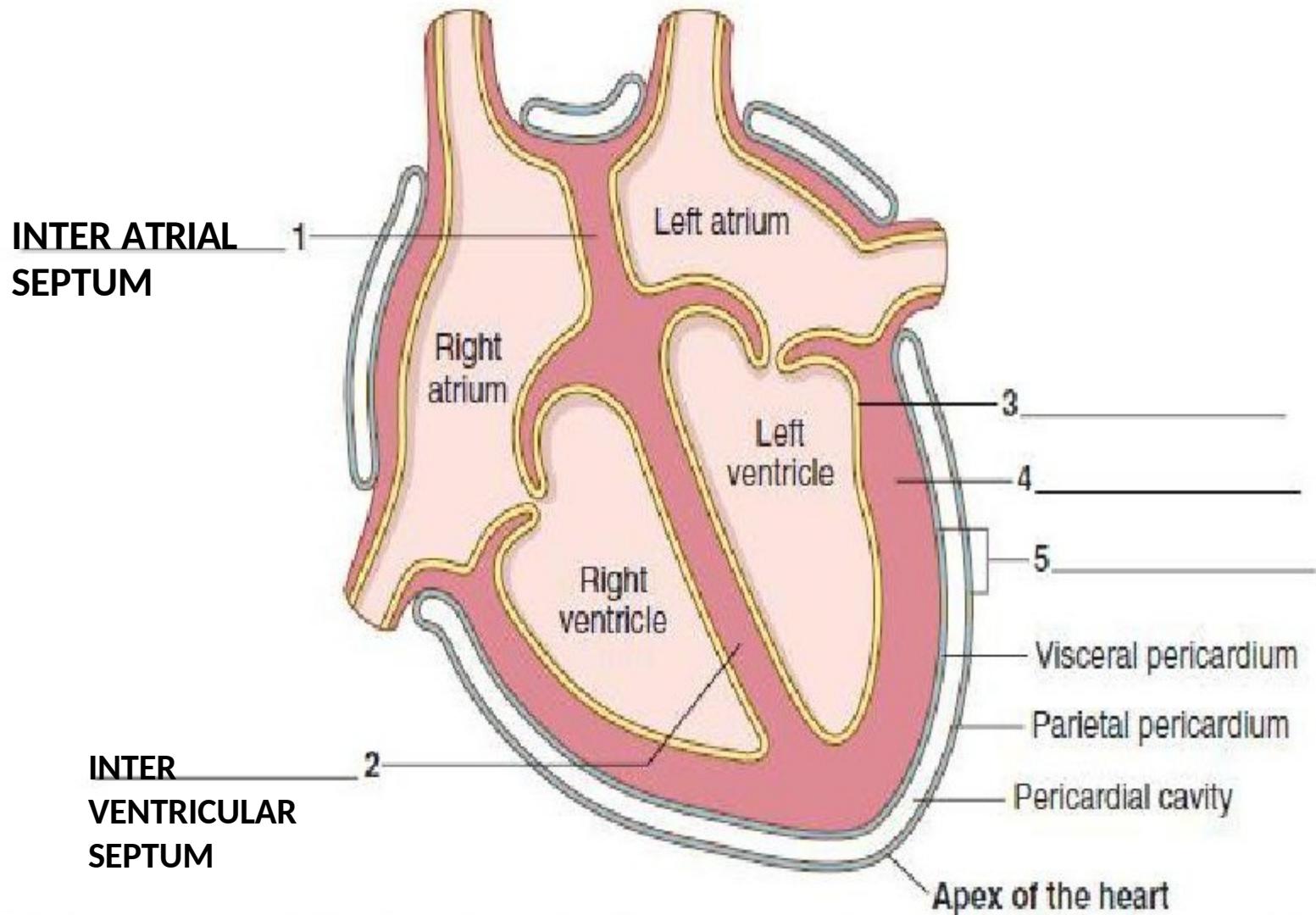


FIGURE 11-6 The walls of the heart and pericardium. Note that the apex of the heart is the conical (shaped like a cone) lower tip of the heart.

LABEL THE PARTS

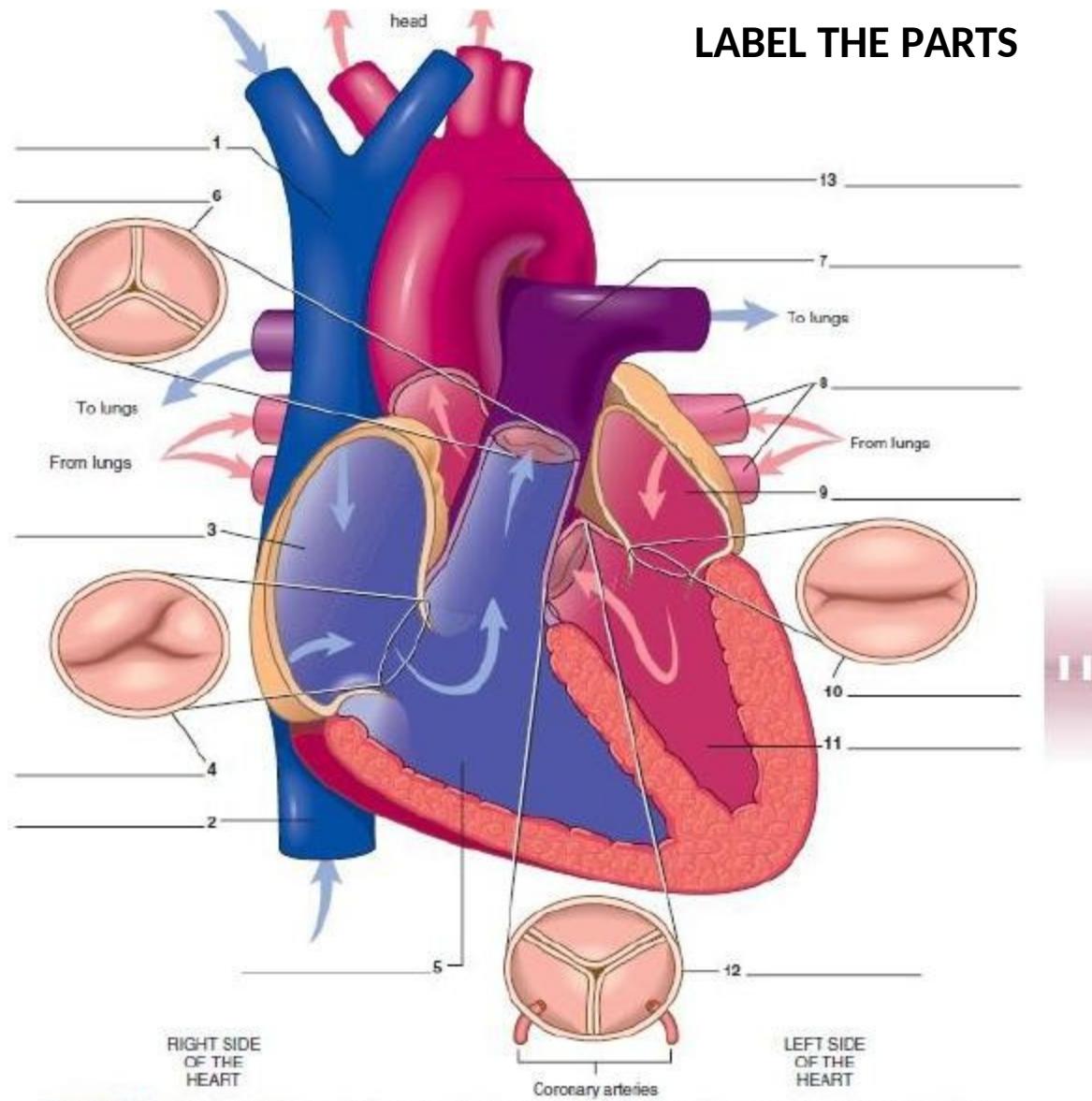


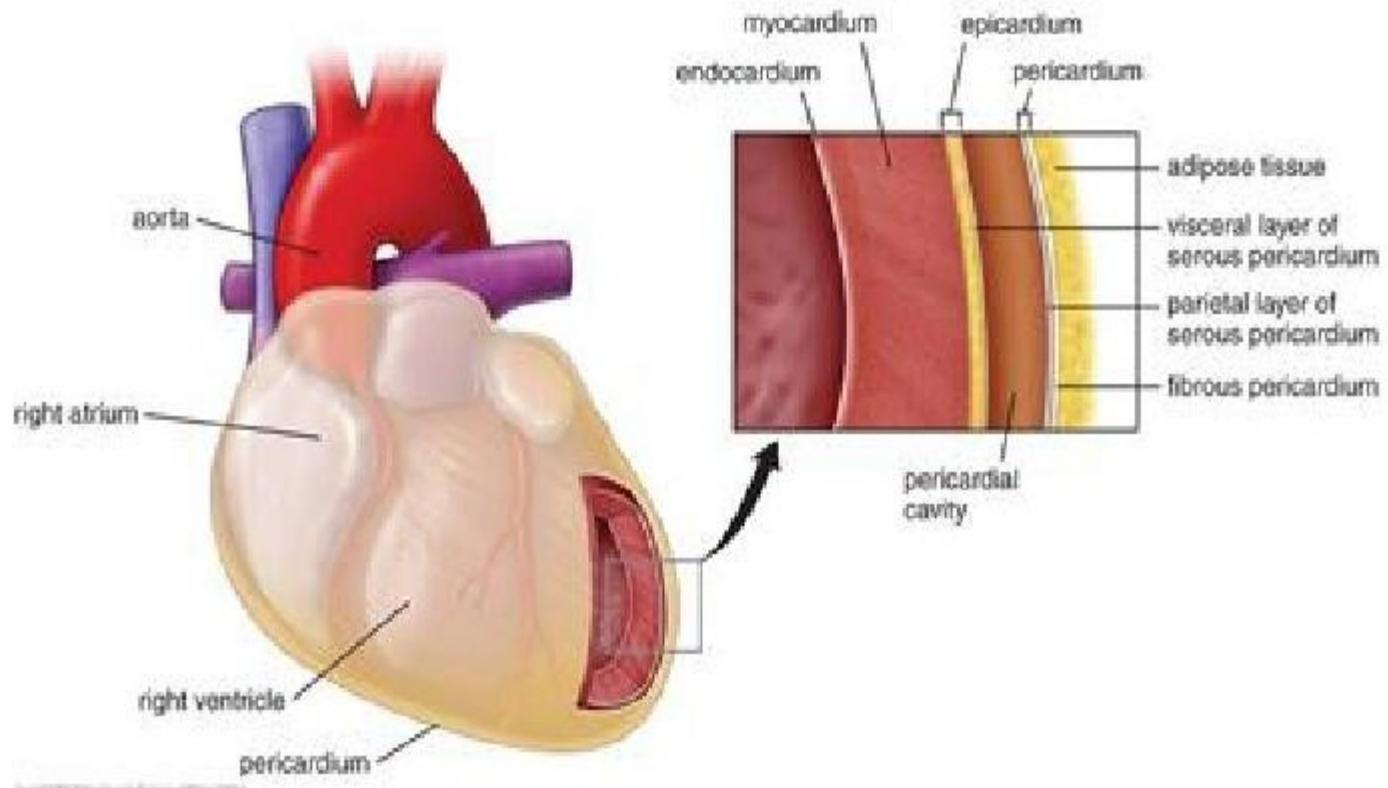
FIGURE 11-5 Structure of the heart. Blue arrows indicate oxygen-poor blood flow. Red arrows show oxygenated blood flow.

MEMBRANE

- Pericardium – fitting sac (**MEMBRANE**) surrounding the heart
 - Fibrous pericardium – tough, loose-fitting, inelastic
 - Serous pericardium
 - Parietal layer: lines the inside of the fibrous pericardium
 - Visceral layer: adheres to outside of the heart
 - Pericardial space: between parietal and visceral layer
 - Filled with 10-15mL of pericardial fluid
 - Decreases friction

3 LAYERS OF CARDIAC WALL

- **Epicardium** – outer layer
 - Epicardium = serous pericardium
- **Myocardium** – thick, contractile layer composed of cardiac muscle cells
 - Intercalated disks contain many gap junctions
 - Allow cardiac muscle cells to function as a single unit  *syncytium*
- **Endocardium** – interior of cardiac wall
 - Endothelial tissue
 - Covers projections of myocardial tissue called *trabeculae*



PATHWAY OF BLOOD THROUGH HEART

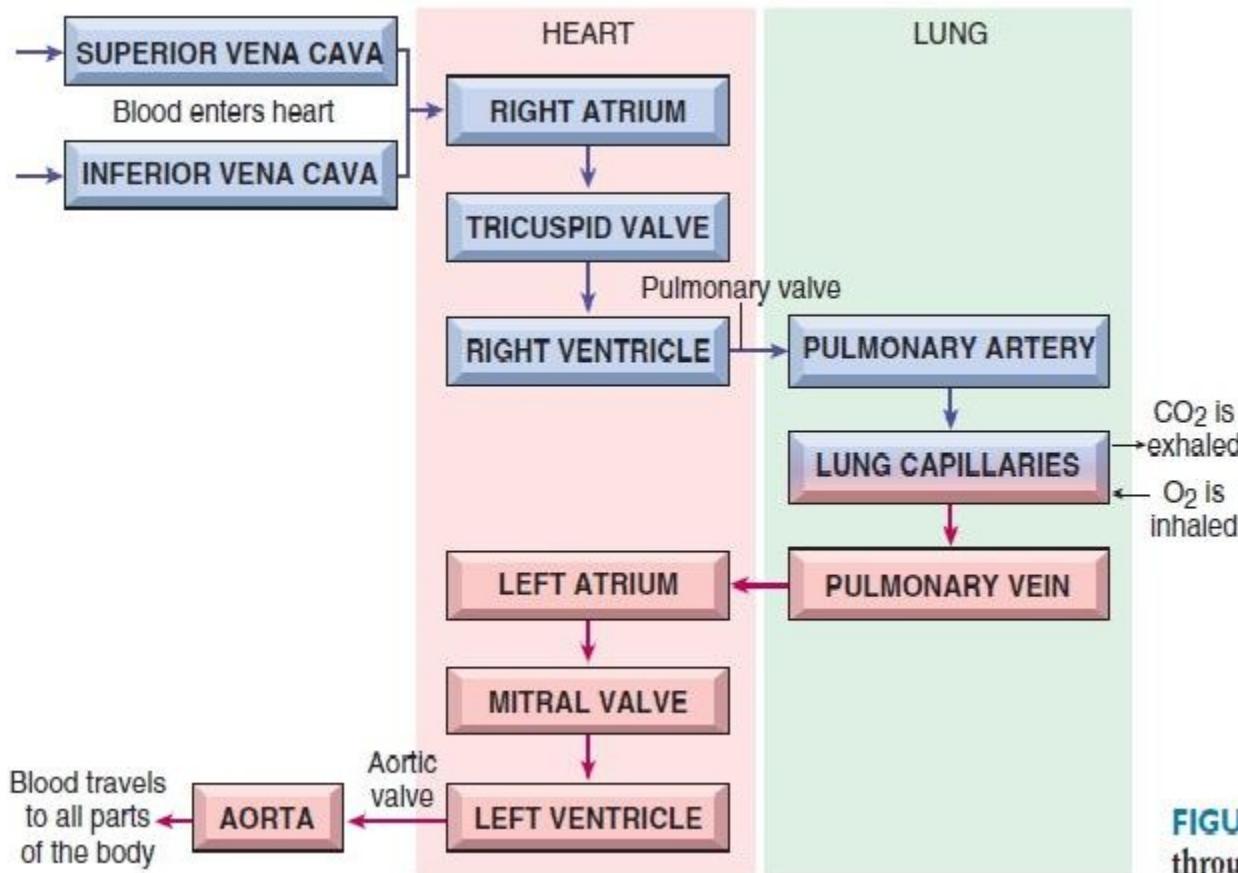


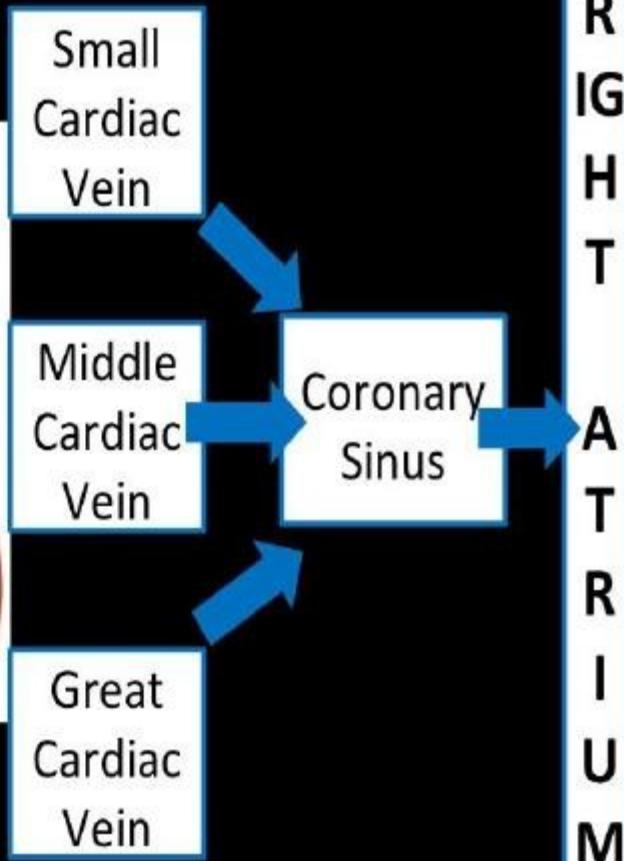
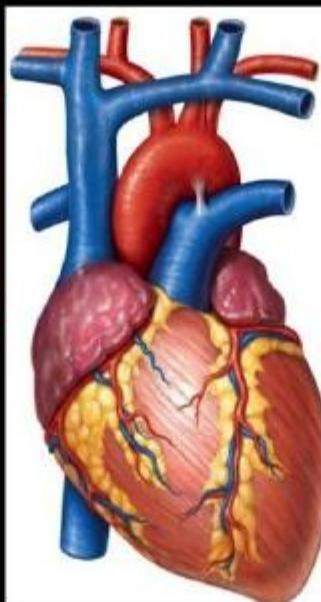
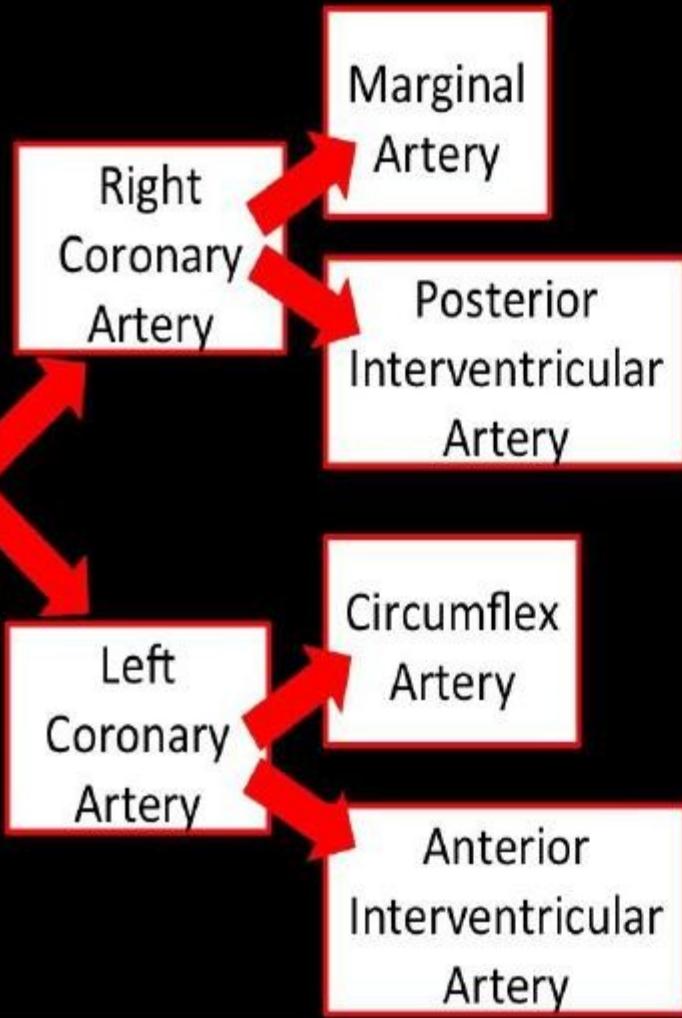
FIGURE 11-7 Pathway of blood through the heart.

BLOOD SUPPLY TO THE HEART

- Right and left coronary arteries
 - First branches off aorta
 - Right coronary artery ☾ right marginal artery & posterior interventricular artery
 - Left coronary artery ☾ circumflex artery & anterior interventricular artery
 - Most of the blood goes to the LT ventricle

- **Anastomosis:** Connections between blood vessels that allow for collateral circulation
- In presence of an obstruction in a large artery ischemia will result to a large area of tissue
 - Myocardial infarction (MI) (aka heart attack)
- Anastomoses do exist between smaller branches of the R and L coronary arteries
- After traveling through the capillaries of the heart, blood empties into the R atrium via the *coronary sinus*
- The coronary sinus collects the majority of the cardiac venous blood

A
O
R
T
A



PHYSIOLOGY OF HEART

- **HEARTBEAT AND HEART SOUNDS**
- **Two phases of the heartbeat:** diastole (relaxation) and systole (contraction).
- **Diastole** occurs when the ventriclewalls relax and blood flows into the heart from the venacavae and the pulmonary veins - tricuspid and mitral valves open in diastole
- **Systole** - the walls of the right and left ventricles contract to pump blood into the pulmonary artery and the aorta- the tricuspid and the mitral valves are closed

- Heart beats **70 and 80 times per minute**
- The heart pumps about 3 ounces of blood with each contraction.
- Closure of the heart valves is associated with audible sounds, such as "**Iubb-dubb**,"
- The "**Iubb**" is associated with closure of the tricuspid and mitral valves at the beginning of systole, and the "**dubb**" with the closure of the aortic and pulmonary valves at the end of systole.
- What is **Murmur**?
- What is **ECG**?
- What is **blood pressure**?
- Sphygmomanometer – device used to check the BP
- **apical impulse / point of maximum impulse?**

CONDUCTION SYSTEM OF HEART

- Heart – contains a **conductive tissue**
- Modified cardiac muscle tissue
- **Generates rhythmic electrical impulses** without any electrical stimulation
- **Four masses** of conductive tissue

CONDUCTION SYSTEM OF HEART

SINOATRIAL(SA)NODE /PACEMAKER- UPPERPART OF RT ATRIUM- ATRIATO CONTRACT
ATRIOVENTRICULARNODE (AVNODE) IN INTERatrial SEPTUM

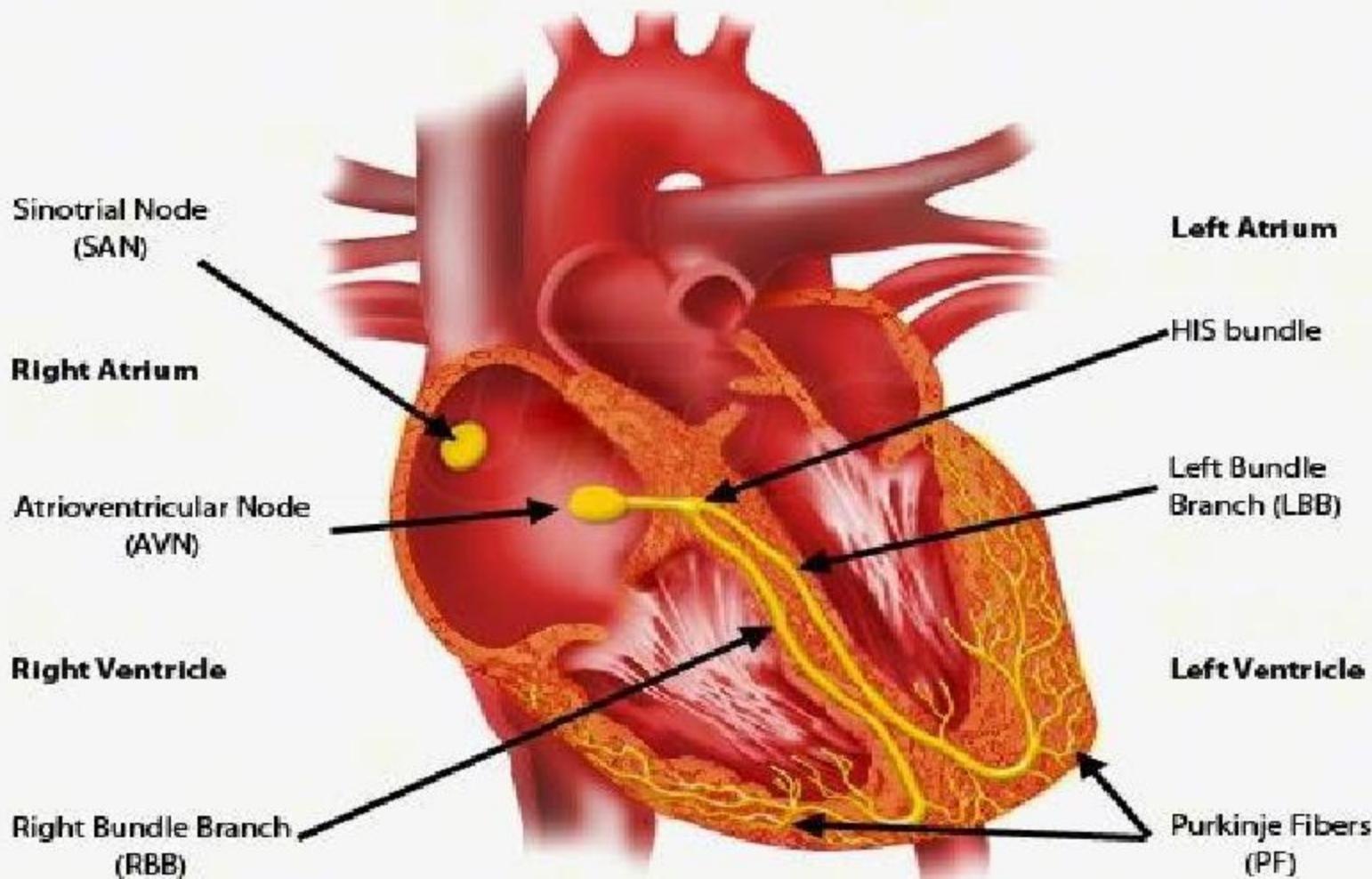
AVBUNDLE / BUNDLE OF HIS

RT AND LEFT BRANCHES

PURKINJEFIBRES(VENTRICULARWALLScontract)

FORCES BLOOD OUT OF AORTA AND PULMONARY ARTERY

Cardiac Conduction system

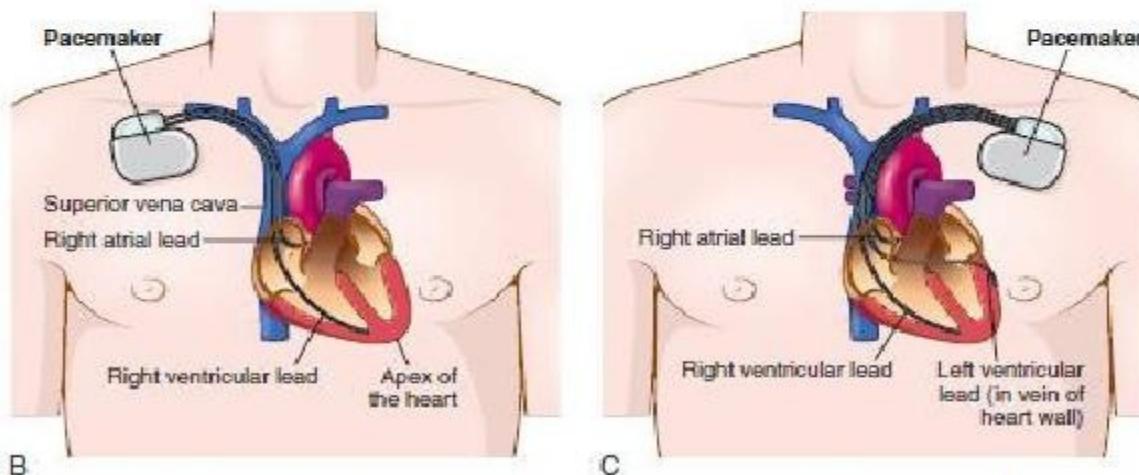


PATHOLOGY: THE HEART AND BLOOD VESSELS

- **arrhythmias** - Abnormal heart rhythms (dysrhythmias).
- **bradycardia** - Heart rate slower than 60 beats per minute.
- **heartblock (atrioventricular block)**- Failure of proper conduction of impulses from the SA node through the AV node to the atrioventricular bundle (bundle of His).
- **flutter** - Rapid but regular contractions, usually of the atria.
- **fibrillation** - Very rapid, random, inefficient, and irregular contractions of the heart (350 beats or more per minute).
- **bundle branch block (BBB)** - A partial or complete interruption in the conduction of one of the two main branches of the bundle of His.



A



B

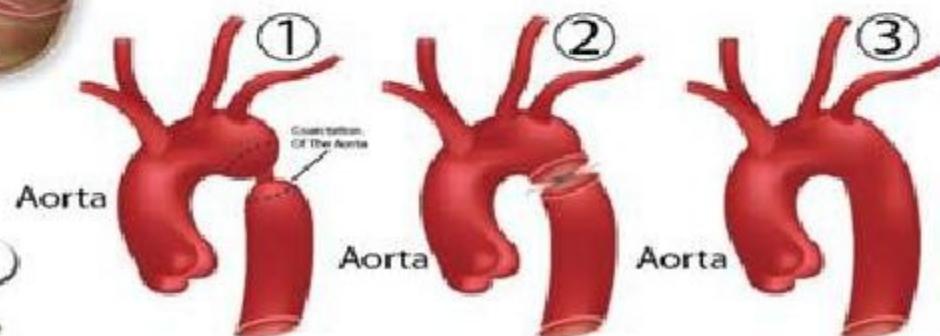
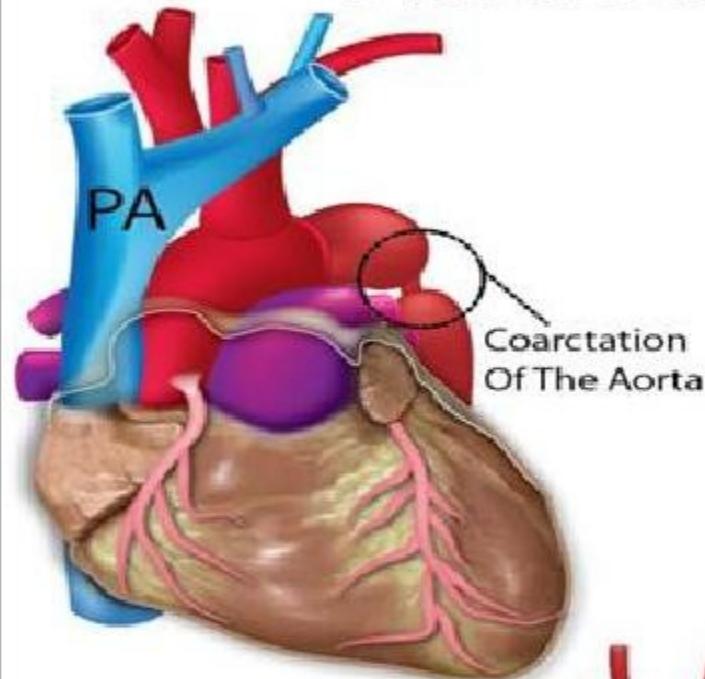
C

FIGURE 11-13 A, A dual-chamber, rate-responsive pacemaker (*actual size shown*) is designed to detect body movement and automatically increase or decrease paced heart rates based on levels of physical activity. B, Cardiac pacemaker with leads in the right atrium and right ventricle enable it to sense and pace in both heart chambers. C, Biventricular pacemaker with leads in the right atrium and the right and left ventricles to synchronize ventricular contractions.

CONGENITAL HEART DISEASE

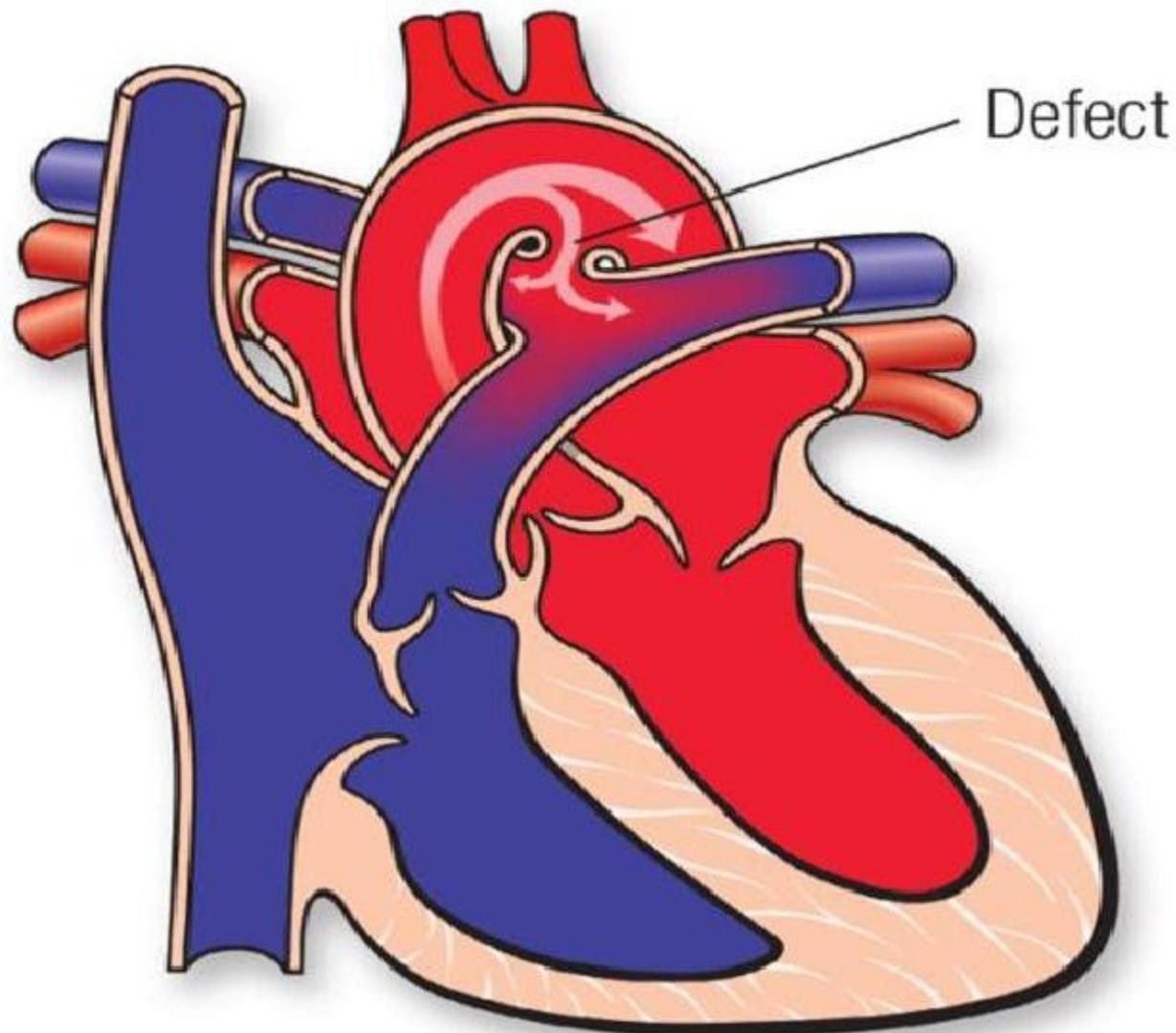
- **congenital heart disease** - Abnormalities in the heart at birth.
- **coarctation of the aorta -(CoA)** - Narrowing (coarctation) of the aorta.
- **patent ductus arteriosus (PDA)** - Passageway (ductus arteriosus) between the aorta and the pulmonary artery remains open (patent) after birth
- **septal defects** - Small holes in the wall between the atria (atrial septal defects) or the ventricles (ventricular septal defects).

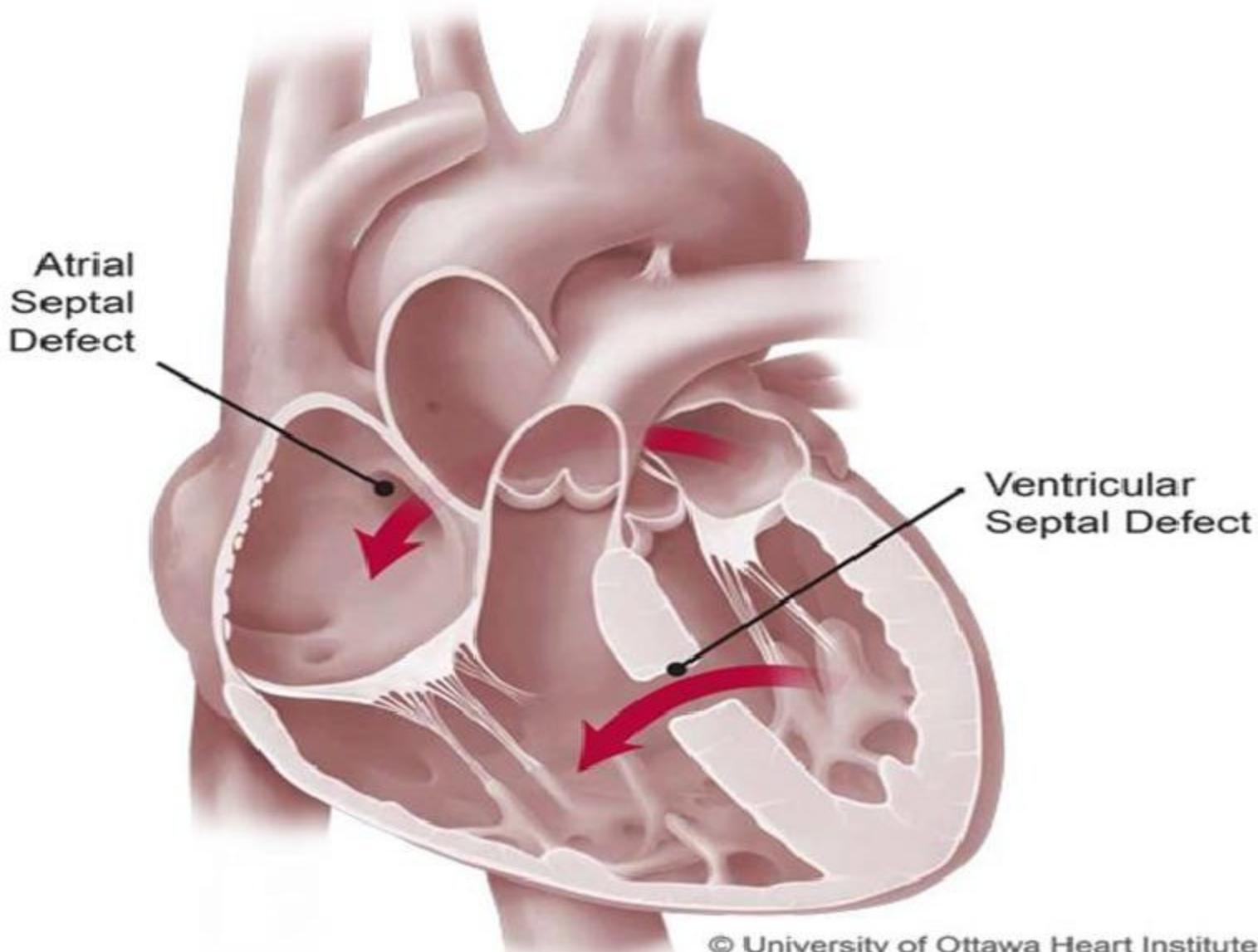
Aortic coarctation



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Patent Ductus Arteriosus

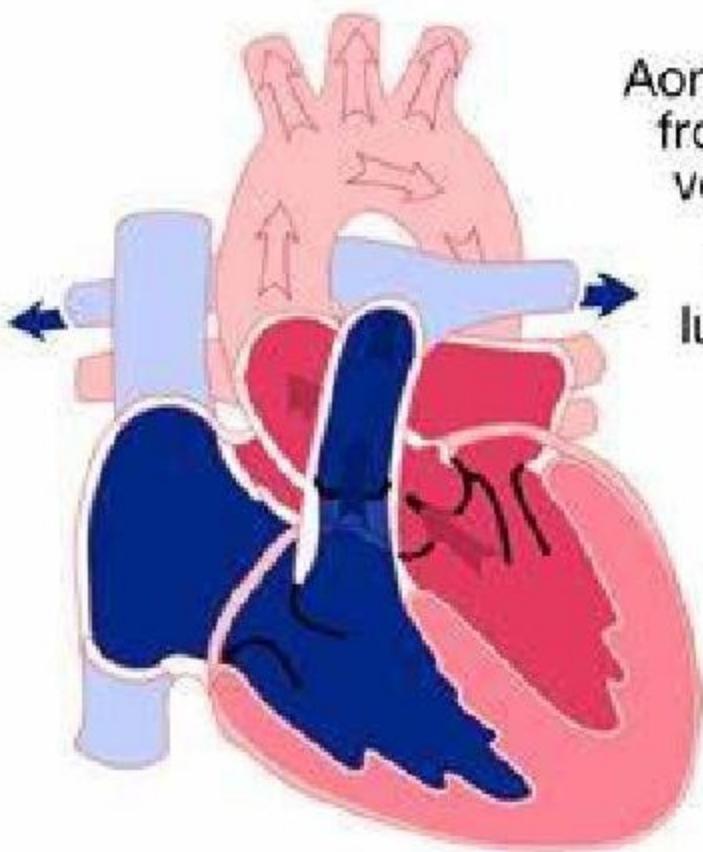




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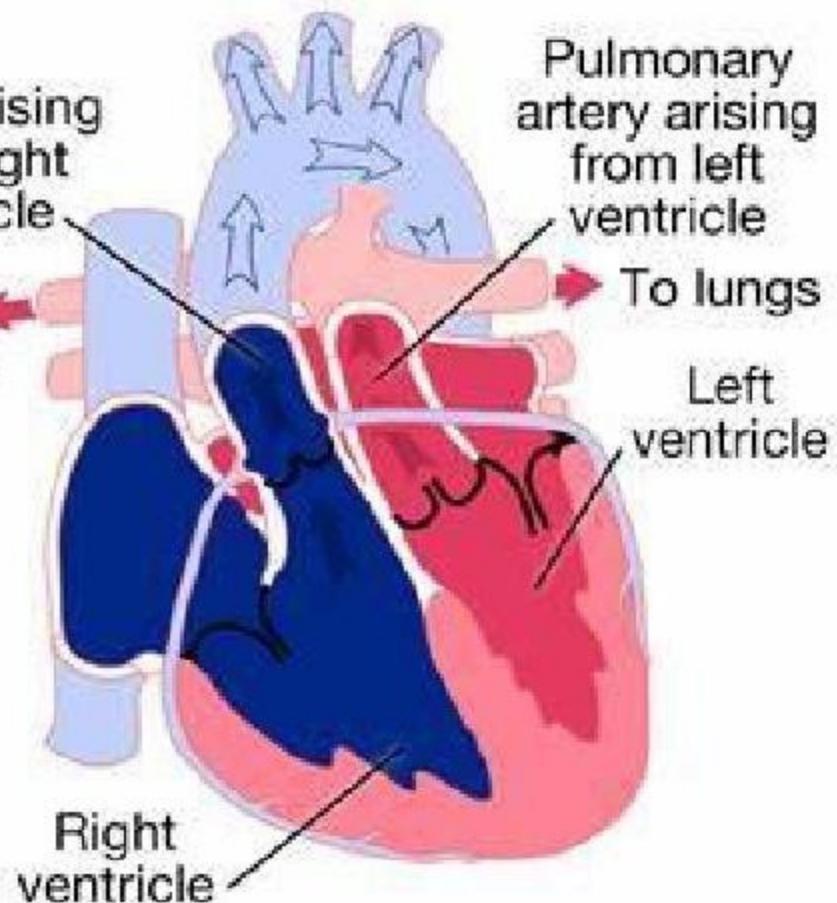
- **tetralogy of Fallot** - Congenital malformation involving four (tetra-) distinct heart defects.
 - **Pulmonary artery stenosis** - Pulmonary artery is narrow or obstructed.
 - **Ventricular septal defect** - Large hole between two ventricles lets venous blood pass from the right to the left ventricle and out to the aorta without oxygenation.
 - **Shift of the aorta to the right** - Aorta overrides the interventricular septum. Oxygen-poor blood passes from the right ventricle to the aorta.
 - **Hypertrophy of the right ventricle**
- **transposition of the great arteries (TGA)** - pulmonary artery arises from the left ventricle and the aorta from the right ventricle cause cyanosis and hypoxia.

Normal Heart

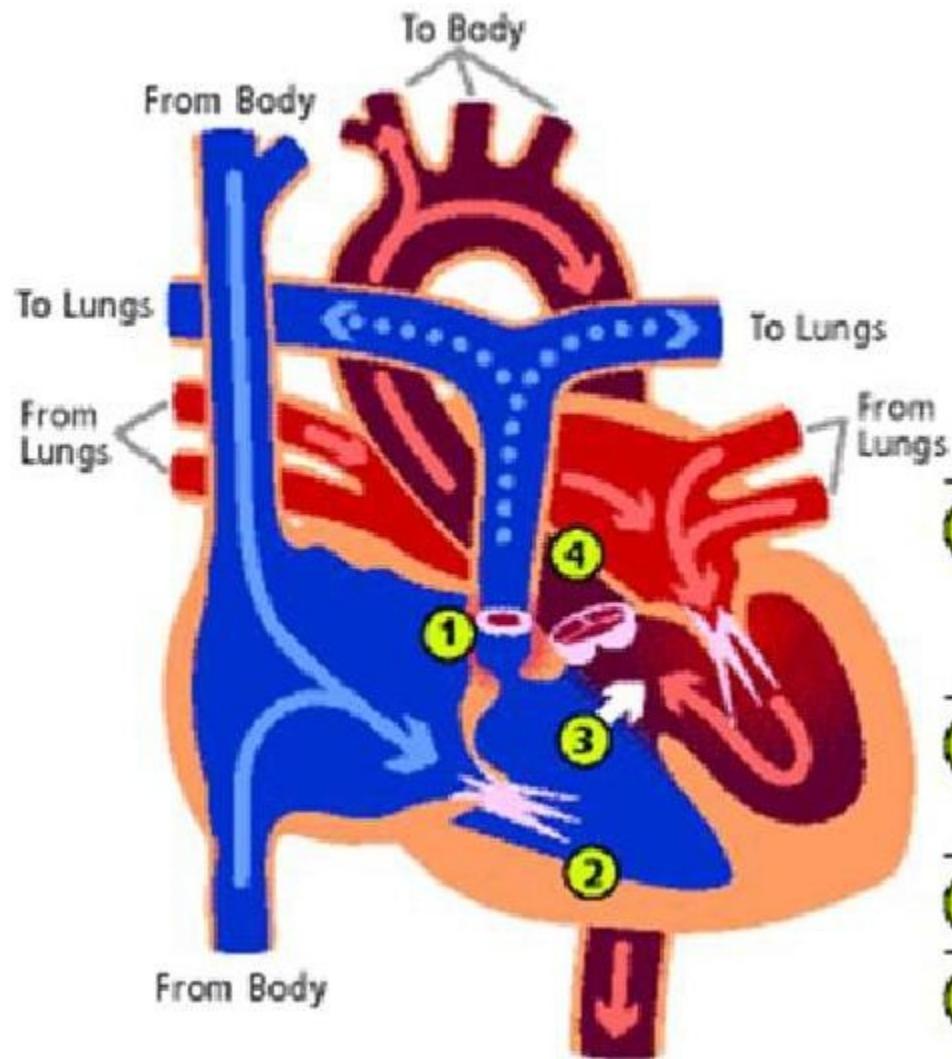


Transposition of the Great Vessels

To Body



TETRALOGY OF FALLOT



- 1 Pulmonary stenosis (thickened, narrow pulmonary outflow tract)
- 2 Thickened right ventricle wall
- 3 Ventricular septal defect
- 4 Aorta overrides septal defect

- **General Principles:**

- **Congenital defect:** decreased pumping efficiency
- **Incompetent valve leak:** allows backflow into previous chamber
- **Stenosed valves:** narrowed valve; slowing blood from out of chamber

- **CONGESTIVEHEART FAILURE(CHF)** - Heart is unable to pump its required amount of blood.
- **coronary artery disease (CAD)** - Disease of the arteries surrounding the heart – MAINLY OF ATHEROSCLEROSIS
- **endocarditis** - Inflammationof the inner lining of the heart.
- **hypertensive heart disease** - High blood pressure affecting the heart.
- **cardiac sarcoma** - A malignant tumor of the heart muscle.
- **Cardiomyopathy** - Any disease of the heart muscle.
- **cardiac arrest (CA)** - Failure of the systemic circulatorysystem due to absent or inadequate contractionof the ventricles
- **cor pulmonale** - Right ventricularenlargement that is caused by a lung disorder.It leads to hypertension in the pulmonary artery.

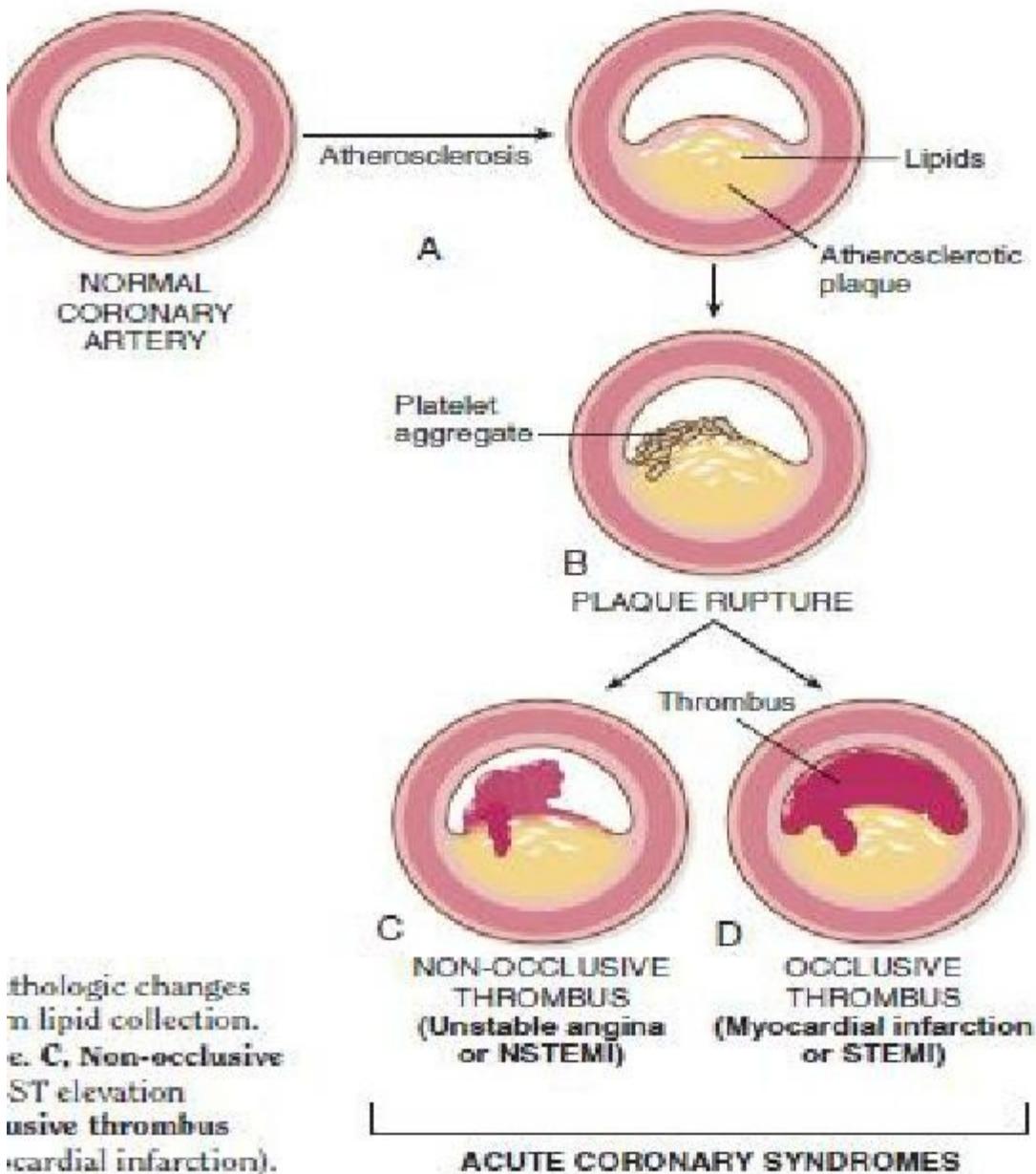
- **Mitral Valve Prolapse (MVP)**
 - Flaps of mitral valve extend back into L atrium causes leaking
 - Mostly genetic basis
 - 1 in 20 people
 - most asymptomatic; chest pain, fatigue
 - Treatment: valvuloplasty
- **Murmur** - Extra heart sound, heard between normal beats
- **Pericarditis** - Inflammation of the membrane (pericardium) surrounding the heart
- **rheumatic heart disease** - Heart disease caused by rheumatic fever.

- **Aortic Regurgitation**

- Blood leaks back into LT ventricle during ejection into the aorta
- Volume overload in LT ventricle, hypertrophy, dilation of LT ventricle
- Complications: myocardial ischemia
- Treatment: valvuloplasty

- **Atherosclerosis**

- Type of arteriosclerosis
- Lipids build up on the inside of vessel walls calcify vessels hard & brittle
- Risk factors: cigarette smoking, high fat/cholesterol diet, hypertension



thologic changes in lipid collection.
e. **C.** Non-occlusive ST elevation non-thrombotic myocardial infarction).

- **Myocardial Infarction**
 - “Heart Attack”
 - **Coronary thrombosis:** clot
 - **Coronary embolism:** mobilized clot
 - **Occlude coronary artery** ☽ heart tissue deprived of oxygen ☽ cell death
 - ***Angina pectoris*** – severe chest pain resulting from inadequate oxygen to myocardium
 - Treatment: **Coronary Bypass Surgery**
 - Veins are harvested from other areas of the body and used to bypass obstructions

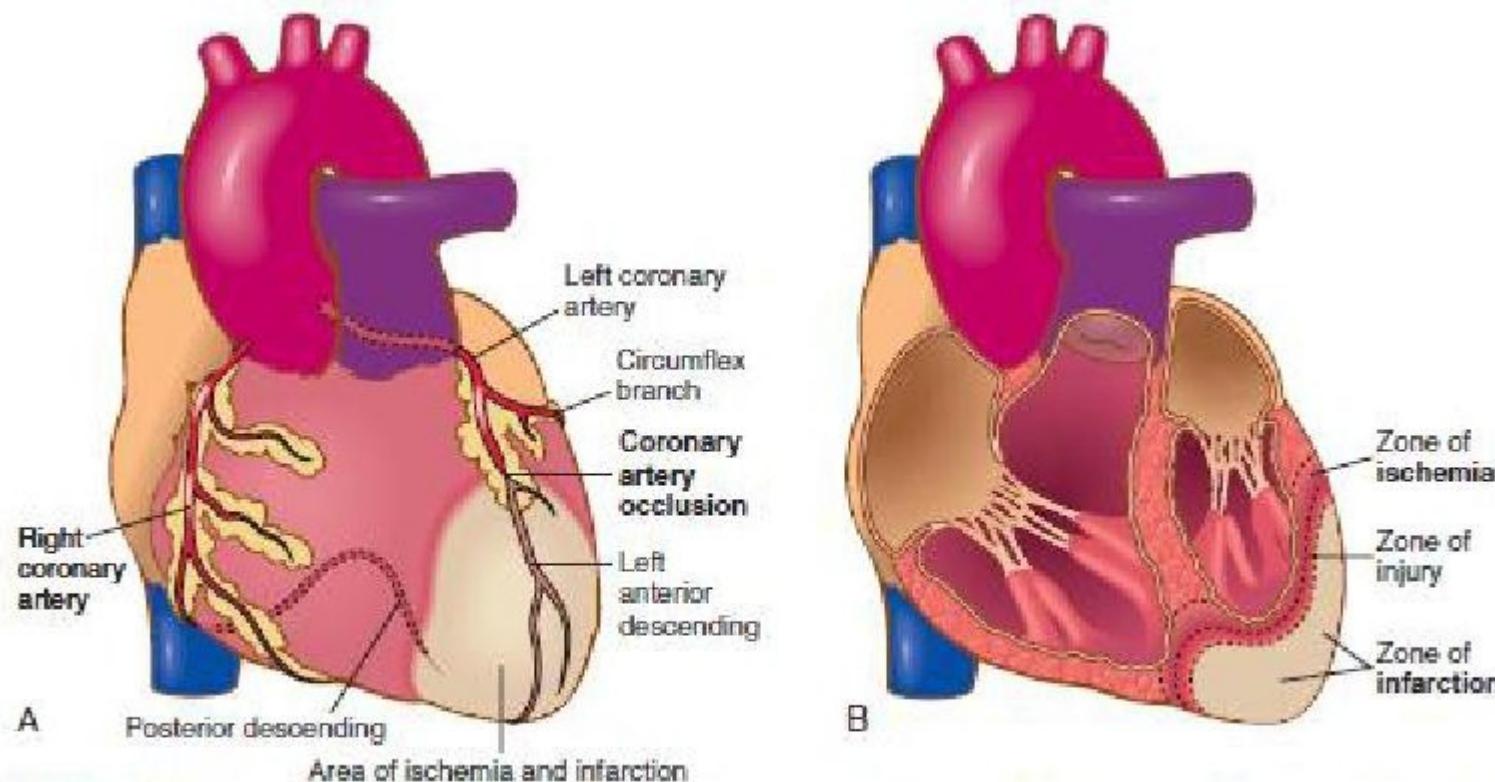


FIGURE 11-16 A, Ischemia and infarction produced by coronary artery occlusion. B, Internal view of the heart showing an area damaged by myocardial infarction.

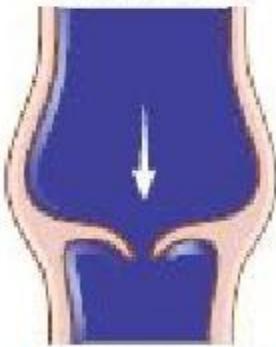
- **Arteriosclerosis**
 - Arteries become occluded, weak and hardened
 - Complications: ischemia, necrosis, gangrene
 - Risk factors: age, diabetes, high fat/cholesterol diet, hypertension, smoking
 - Treatment: vasodilators, angioplasty, stent placement, bypass surgery
 - Complications: aneurysm
- **Varicose Veins**
 - Enlarged veins caused by pooling
 - Results in varicositis or varices (“spider veins”)
 - Risk factors: standing for long periods
 - Semilunar valves widen ☺ more pooling
 - Treatment: compression stockings, surgical removal

NORMAL VEIN



Functional valves aid in flow of venous blood back to the heart

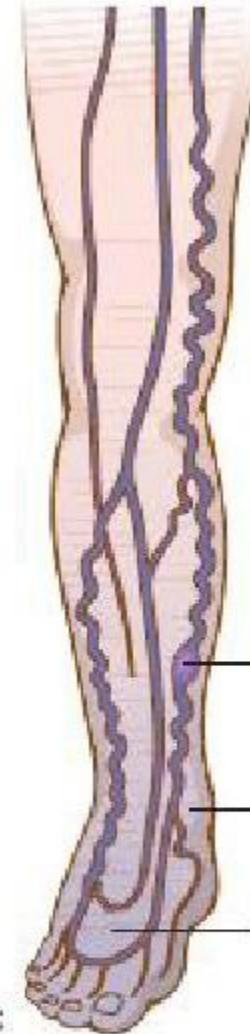
VARICOSE VEIN



A Failure of valves and pooling of blood in superficial veins



B



C

Thrombophlebitis

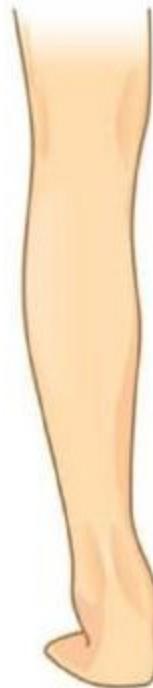
Edema

Pigmented skin

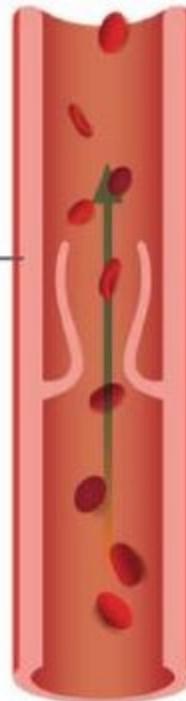
FIGURE 11-21 A, Valve function in normal vein and varicose vein. B, Varicose veins. C, The slow flow in veins increases susceptibility to thrombophlebitis (clot formation), edema, and pigmented skin (blood pools in the lower parts of the leg and fluid leaks from distended small capillaries). If a thrombus becomes loosened from its place in the vein, it can travel to the lungs (pulmonary embolism) and block a blood vessel there.

- **Phlebitis** – vein inflammation
 - Causes: irritation by IV catheter
- **VENOUS STASIS ULCERS**
 - ✓ Result of chronic vein insufficiency
 - ✓ Lack of oxygen to peripheral tissues
 - ✓ Elevate leg & apply pressure
 - ✓ Irregular edges
- **aneurysm** - Local widening (dilation) of an arterial wall - the brain (berry aneurysms),
- **Aortic Aneurysms and Marfan Syndrome**
- **deep vein thrombosis (DVT)** - Blood clot (thrombus) forms in a large vein, usually in a lower limb. This condition may result in a pulmonary embolism (clot travels to the lung) if not treated effectively.

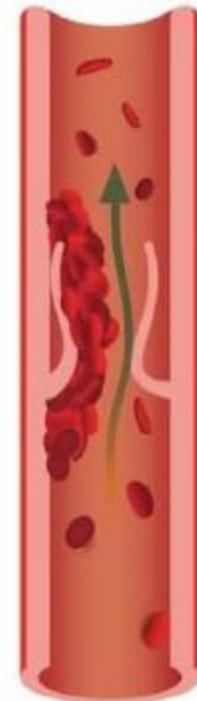
Deep Veins of the Leg



Normal Blood Flow



Deep Vein Thrombosis



Embolus



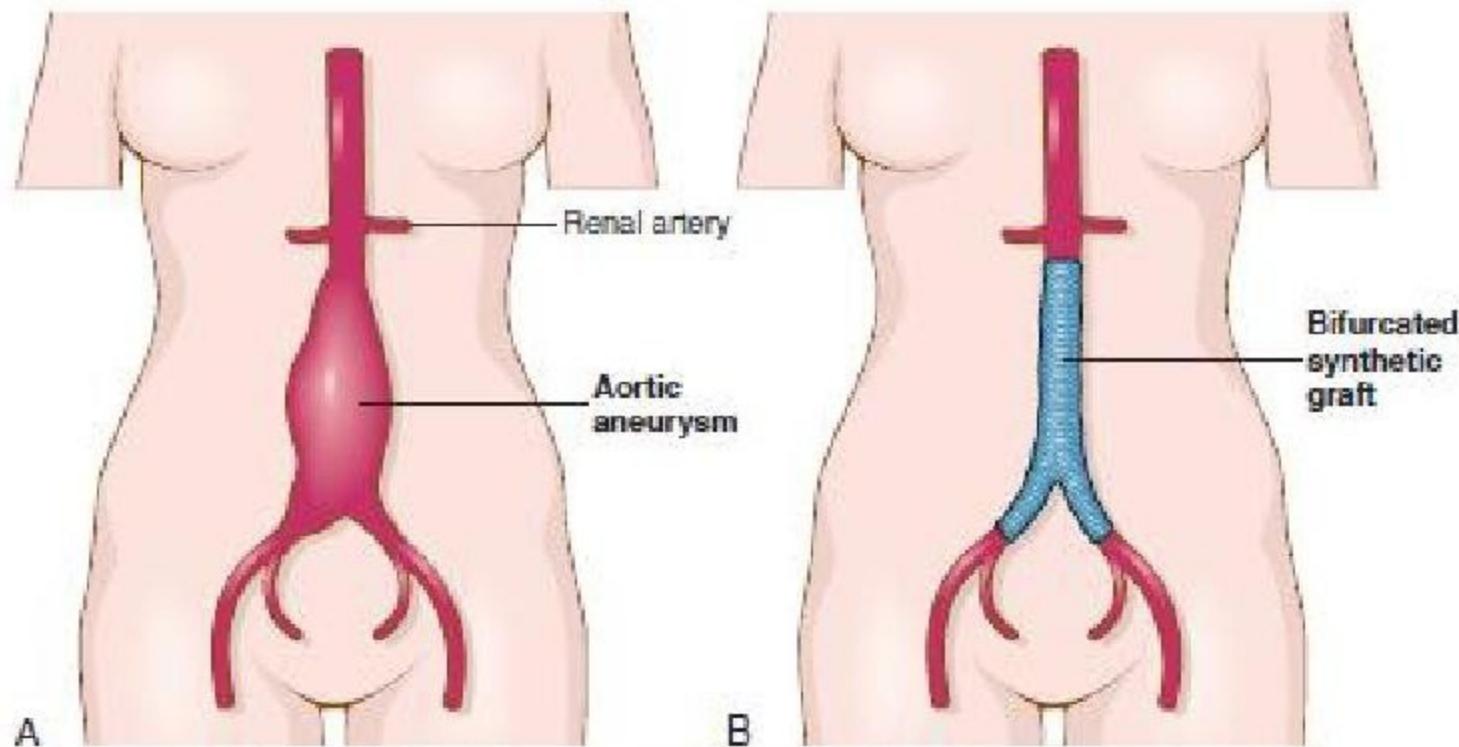


FIGURE 11-20 A. Abdominal aortic aneurysm (AAA). A dissecting aortic aneurysm is a splitting or dissection of the wall of the aorta by blood entering a tear or hemorrhage within the walls of the vessel. B. Bifurcated synthetic graft in place. Stent graft procedures for AAA are EVAR (endovascular aneurysm repair) and TEVAR (thoracic endovascular aneurysm repair).

- **hypertension (HTN)** - High blood pressure.
- **essential hypertension** – NO CAUSE
- **secondary hypertension**
- **PERIPHERAL ARTERY DISEASE (PAD)** -
Blockage of arteries carrying blood to the legs, arms, kidneys and other Organs
- **Raynaud (rā-NŌ) disease** - Recurrent episodes of pallor and cyanosis primarily in fingers and toes.

RAYNAUD'S DISEASE



- **hypercholesterolemia** - Abnormally high levels of serum cholesterol.
- **Hyperlipidemia**- Several types of disorders characterized by increased plasmalipoprotein levels. Also called *hyperlipoproteinemia*.
- **hypertriglyceridemia**- Abnormally high levels of serum triglycerides.
- **Intermittent claudication** - Intense pain, cramping, weakness, and/or numbness in the lower extremities. It is usually intermittent and indicates impaired circulation to the extremities
- **Lipedema**- Swelling due to fluid and subcutaneous fat deposition in tissues. Also called *painful fat syndrome*.
- **lymphedema**- Swelling and localized accumulation of lymph in tissues that occur when lymphatic channels are obstructed
- **Shock** - A state in which blood flow to peripheral tissues is inadequate.
- **Syncope** - A sudden, temporary loss of consciousness. Also called *fainting*.
- **Tamponade** - Compression of the heart due to abnormally excessive fluids filling the pericardium.
- **Thromboangiitis obliterans** - Inflammation of the walls of small- and medium-sized blood vessels that is associated with thrombotic occlusion. Also called *Buerger disease*

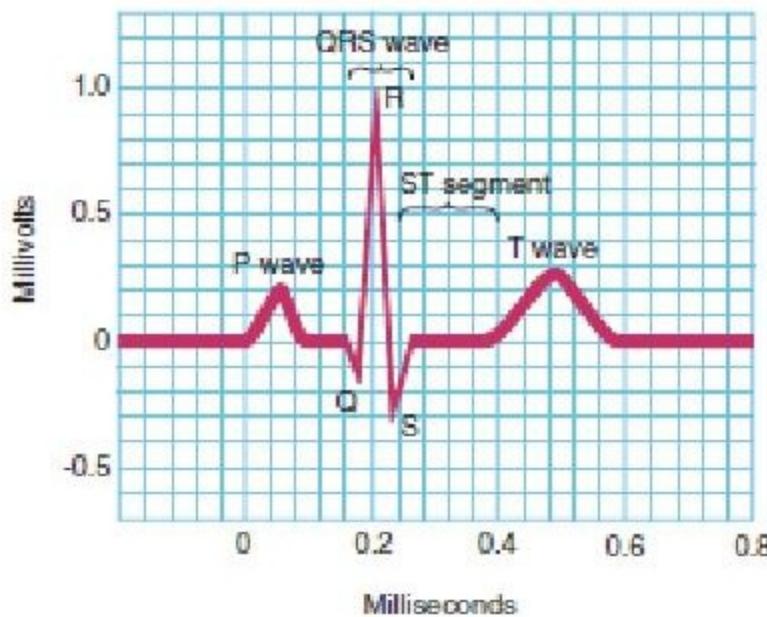
LABORATORY TESTS AND CLINICAL PROCEDURES

- **LABORATORY TESTS**
- **BNP test** - Measurement of BNP (brain natriuretic peptide) in blood.
- **cardiac biomarkers** - Chemicals are measured in the blood as evidence of a heart attack
- **lipid tests (lipid profile)**- Measurement of cholesterol and triglycerides (fats) in a blood sample
- **lipoprotein electrophoresis**- Lipoproteins (combinations of fat and protein) are physically separated AND measured in a blood sample. – LDL , HDL

- **Angiography / angiocardiology (ACG)** - X-ray imaging of blood vessels after injection of contrast material.
- **Arteriography** - x-ray imaging of arteries after injection of contrast via a catheter into the aorta or an artery.
- computed tomography angiography (CTA)
- digital subtraction angiography (DSA)
- electron beam computed tomography (EBCT or EBT)
- Doppler ultrasound studies - Sound waves measure blood flow within blood vessels. An instrument focuses sound waves on blood vessels, and echoes bounce
- **echocardiography (ECHO)**

- positron emission tomography (PET) scan
- technetium Tc 99m sestamibi scan
- thallium 201 scan - cardiac MRI Images of the heart are produced using radiowave energy in a magnetic field
- **cardiac catheterization** - Thin, flexible tube is guided into the heart via a vein or an artery.
- **electrocardiography (ECG)** - Recording of electricity flowing through the heart.
- **Holter monitoring** - An ECG device is worn during a 24-hour period to detect cardiac arrhythmias.
- **stress test Exercise tolerance test (ETT)** - determines the heart's response to physical exertion (stress).

FIGURE 11-10 Electrocardiogram. P wave = spread of excitation wave over the atria just before contraction; QRS wave = spread of excitation wave over the ventricles as the ventricles contract; T wave = electrical recovery and relaxation of ventricles. A heart attack or myocardial infarction (MI) can be recognized by an elevation in the ST segment of the electrocardiographic tracing. Thus, one type of MI is an ST elevation MI (STEMI).



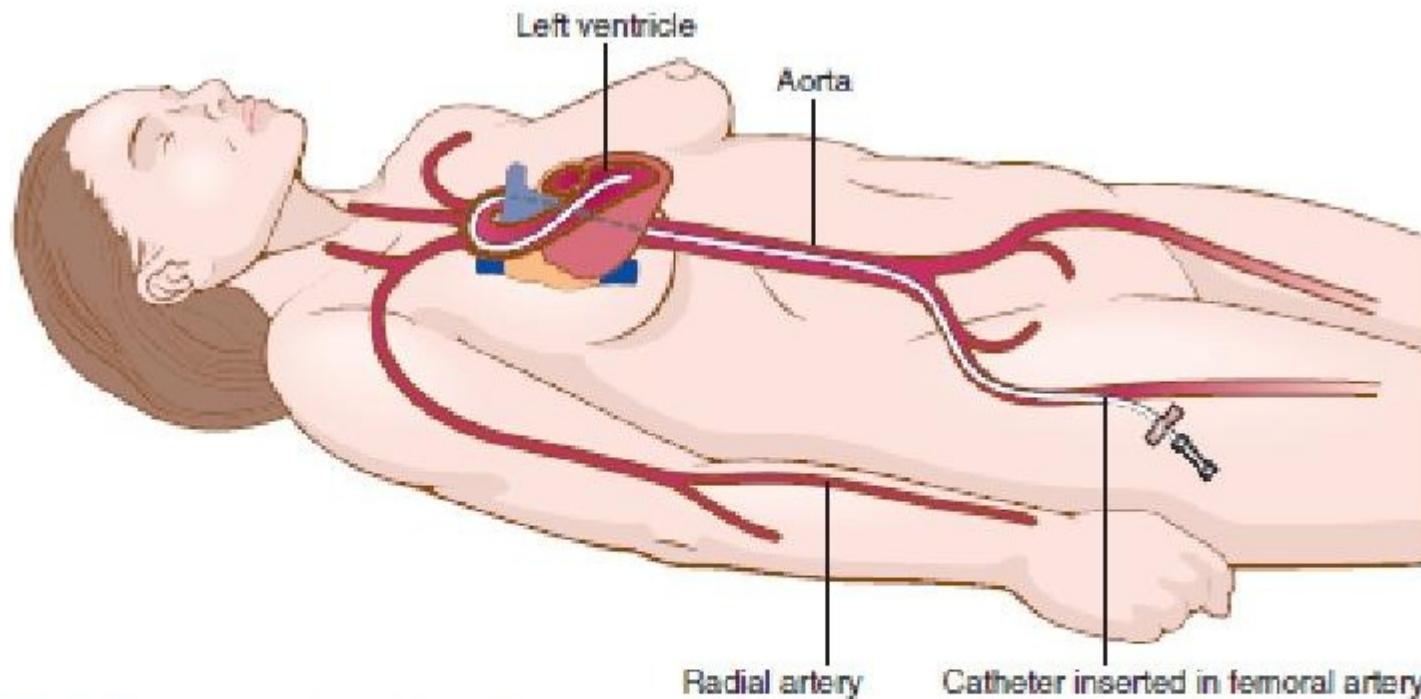


FIGURE 11-24 Left-sided cardiac catheterization. The catheter is passed retrograde (backward) from the femoral artery into the aorta and then into the left ventricle. Catheterization also is performed using the radial artery by an increasing number of interventional cardiologists. For right-sided cardiac catheterization, the cardiologist inserts a catheter through the femoral vein and advances it to the right atrium and right ventricle and into the pulmonary artery.

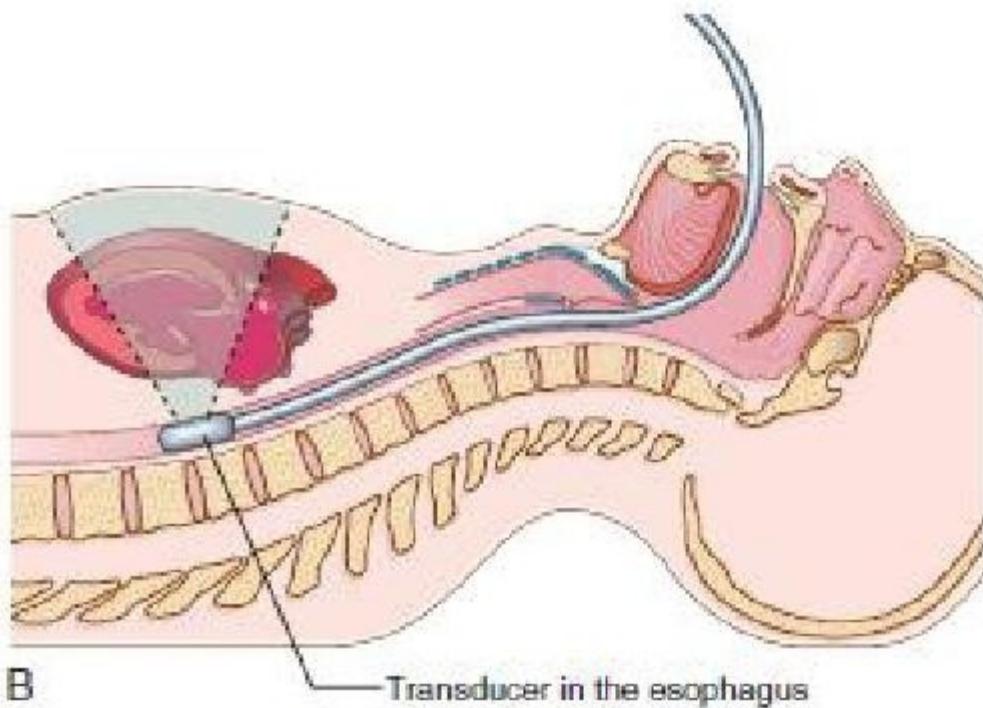


FIGURE 11-23 A, Echocardiogram. Notice that in this view, the ventricles are above the atria.
B, Transesophageal echocardiography.

TREATMENT

- **catheter ablation** - Brief delivery of radiofrequencyenergy to destroy areas of heart tissue that may be causing arrhythmias
- **coronaryartery bypass grafting (CABG)** - Arteries and veins are anastomosed to coronary arteries to detour around blockages.
- **Defibrillation** - Brief discharges of electricity are applied across the chest to stop dysrhythmias (ventricular fibrillation).
- For patients at high risk for sudden cardiac death from ventricular dysrhythmias, an **implantable cardioverter-defibrillator(ICD)** or **automatic implantable cardioverter-defibrillator (AICD)** is placed in the upper chest.
- **Cardioversion** is another technique using lower energy to treat atrial fibrillation, atrial flutter, and supraventricular tachycardia.

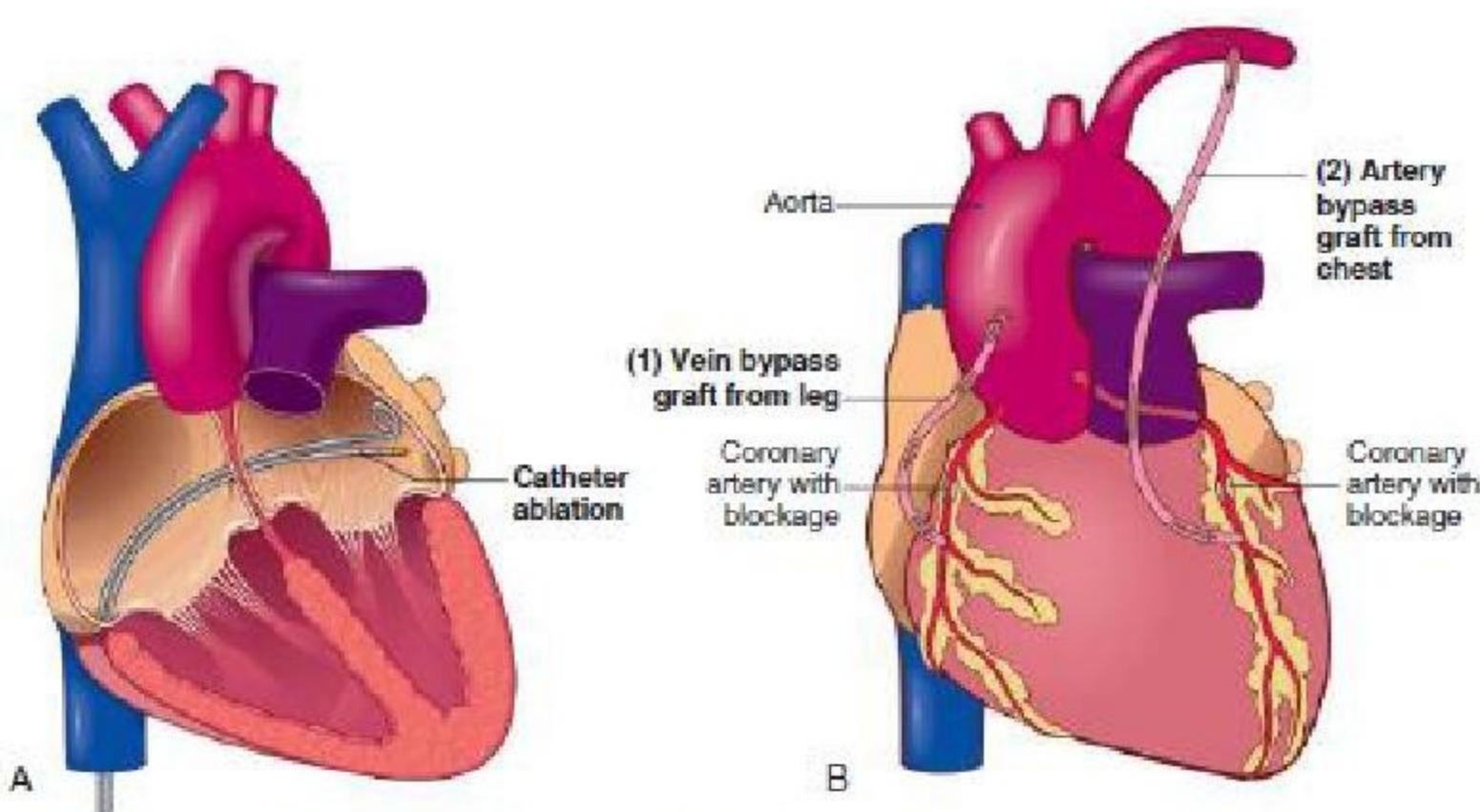
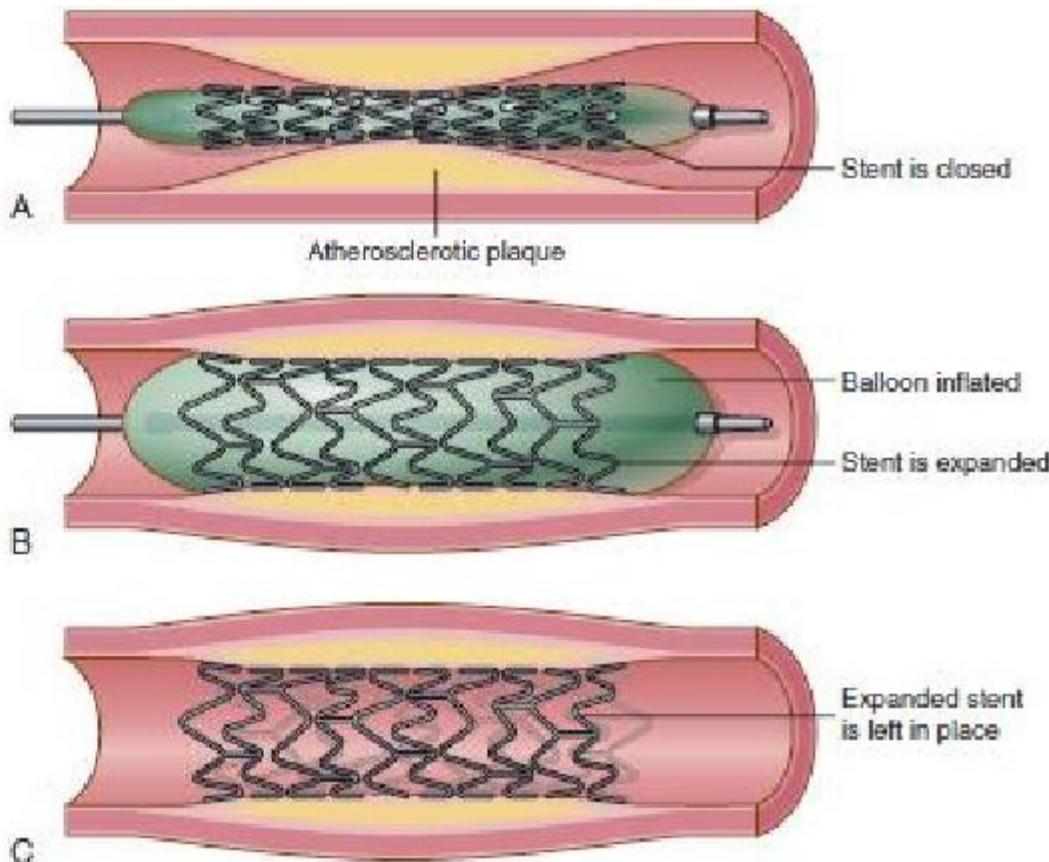


FIGURE 11-26 A, Catheter ablation. SVT, atrial flutter, AF, and VT may be treated with ablation when clinically indicated. B, Coronary artery bypass grafting (CABG) surgery with anastomosis of vein and arterial grafts. (1) A section of a vein is removed from the leg and anastomosed (upside down because of its directional valves) to a coronary artery, to bypass an area of arteriosclerotic blockage. (2) An internal mammary artery is grafted to a coronary artery to bypass a blockage.

- **endarterectomy** -Surgical removal of plaque from the inner layer of an artery
- **extracorporeal circulation** - Extracorporeal circulation is a medical procedure where blood is pumped out of the body, cleaned or treated and then pumped back in again. EG : HEART – LUNG MACHINE
- **Heart-lung machine** diverts blood from the heart and lungs while the heart is repaired.
- **heart transplantation** - A donor heart is transferred to a recipient.
- **percutaneous coronary intervention (PCI)** - Balloon-tipped catheter is inserted into a coronary artery to open the artery; **stents** are put in place.
- **thrombolytic therapy** - Drugs to dissolve clots are injected into the bloodstream of patients with coronary thrombosis.
- **transcatheter aortic valve replacement (TAVR)** - Placement of a balloon-expandable aortic heart valve into the body via a catheter

FIGURE 11-27 Placement of an intracoronary artery drug-eluting stent. A, The stent is positioned at the site of the lesion. B, The balloon is inflated, expanding the stent and compressing the plaque. C, When the balloon is withdrawn, the stent supports the artery and releases a drug to reduce the risk of restenosis. Stents are stainless-steel scaffolding devices that help hold open arteries, such as the coronary, renal, and carotid arteries.



Condition or Disease	Description
aneurysm	An abnormal dilation or bulging out of an artery wall due to a congenital or acquired weakness in the wall.
angina pectoris	An attack of severe and often constricting chest pain. It is usually caused by blockage of the coronary arteries due to atherosclerosis. Other causes include coronary embolism.
aortic dissection	A tear in the innermost layer of the aorta which allows blood to surge into the aortic wall, creating a false lumen within the aorta.
arrhythmia	An irregular heartbeat.
arteriosclerosis	A generic term for several conditions characterized by thickening of the walls of arteries. The arteries lose their elasticity, making them less efficient in pumping blood. Commonly called <i>hardened arteries</i> .
arteriovenous fistula	Abnormal passage of blood between an artery and a vein, bypassing capillary beds.
arteritis	Inflammation of one or several arteries.
atherosclerosis	A type of arteriosclerosis characterized by patchy lipid (fat) deposits inside large- and medium-sized arteries.
atrial septal defect (ASD)	A congenital defect in which there is an abnormal opening in the septum between the left and right atria.
bruit	An abnormal heart sound heard on auscultation that often has a harsh or musical quality.
bundle branch block (BBB)	A partial or complete interruption in the conduction of one of the two main branches of the bundle of His.

cardiac arrest (CA)	Failure of the systemic circulatory system due to absent or inadequate contraction of the ventricles.
cardiac sarcoma	A malignant tumor of the heart muscle.
cardiomyopathy	Any disease of the heart muscle.
coarctation	A constriction of a blood vessel, usually the aorta.
congestive heart failure (CHF)	The inability of the heart to pump adequate amounts of blood. It results in congestion and edema of tissues and is frequently a result of myocardial infarction.
cor pulmonale	Right ventricular enlargement that is caused by a lung disorder. It leads to hypertension in the pulmonary artery.
coronary artery disease (CAD)	A broad term used to cover any condition that affects the coronary arteries.
embolism	Any blockage or occlusion of a vessel by a mass such as a thrombus (blood clot) or a foreign body.
endocarditis	Inflammation of the endocardium.
fibrillation	Rapid, irregular contractions of the atrial or ventricular muscles. Ventricular fibrillation leads to virtually no cardiac output and is extremely serious.
flutter	Regular, rapid contractions of the atrial or ventricular muscles.
hypercholesterolemia	Abnormally high levels of serum cholesterol.

mitral valve prolapse (MVP)	A bulging into the left atrium during left ventricular systole of one or more of the flaps (called <i>leaflets</i>) that make up the mitral valve.
myocardial infarction (MI)	A sudden insufficiency of the blood supply to an area of the heart muscle. It is most commonly caused by an occlusion of a coronary artery.
nonatheromatous arteriosclerosis	A type of arteriosclerosis primarily caused by the aging process in which fibrous tissue develops in arterial walls with loss of elasticity and some thickening. Arterial muscle atrophies resulting in a widening of the lumen, possibly leading to aneurysms or dissections (splitting apart of arterial walls).
occlusion of the abdominal aorta	Blockage of the abdominal aorta or a major branch. It can be caused by an embolism, a narrowed artery, or aortic dissection.
palpitation	Unusually forceful, rapid, and/or irregular heartbeats of which the patient is aware.
pericarditis	Inflammation of the pericardium.
peripheral arterial occlusion	Blockage of the blood supply to an extremity caused by an embolism or plaque caused by atherosclerosis.
phlebitis	Inflammation of a vein.

Raynaud disease	Spasms of arterioles, along with cyanosis or pallor. There is bilateral involvement, and no underlying cause can be determined.
Raynaud phenomenon	Spasms of the arterioles, along with cyanosis or pallor. Unlike Raynaud disease, an underlying cause can be determined.
shock	A state in which blood flow to peripheral tissues is inadequate.
syncope	A sudden, temporary loss of consciousness. Also called <i>fainting</i> .
tamponade	Compression of the heart due to abnormally excessive fluids filling the pericardium.
thromboangiitis obliterans	Inflammation of the walls of small- and medium-sized blood vessels that is associated with thrombotic occlusion. Also called <i>Buerger disease</i> .
thromboembolism	An obstruction of a blood vessel caused by a thrombus. Tissues supplied by the vessel or its branches become necrotic from lack of blood supply.
thrombophlebitis	Inflammation of a vein caused by thrombus formation.
thrombus	A clot formed from blood components and found in the cardiovascular system.

valvular heart disease	Any condition in which a heart valve improperly functions.
valvular regurgitation	Backward flow of blood through an incompetent heart valve. Also called <i>valvular insufficiency</i> or <i>valvular incompetence</i> .
valvular stenosis	Narrowing of a cardiac valve.
varicose veins	Veins with damaged valves that allow blood to backflow in the veins. Varicose veins may occur anywhere but are most commonly found in the legs, esophagus (<i>varices</i>), and anus (<i>hemorrhoids</i>).
venous thrombosis	A thrombus in a vein.

TABLE 13-4 Blood Pressure Classifications for Adults*

Classification	Systolic (mmHg)	Diastolic (mmHg)
normal	< 130	< 85
high normal	130-139	85-89
stage 1 hypertension (mild)	140-159	90-99
stage 2 hypertension (moderate)	160-179	100-109
stage 3 hypertension (severe)	180-209	110-119
stage 4 hypertension (very severe)	>209	>120

Procedure	Description
aneurysmectomy	Excision of an aneurysm.
angioplasty	Restoration of the integrity of a blood vessel using a stent, mechanical stripping of the vessel wall, balloon dilation within the compromised area of the vessel, and/or injection of fibrinolytic drug such as tissue plasminogen activators (tPA) or thrombolytic enzymes.
atherectomy	Removal of an atheroma (lipid deposit) from an artery. Can be accomplished by surgery or by catheterization.
atriotomy	Formation of an opening into an atrium.
cardiopulmonary resuscitation (CPR)	The use of artificial respiration and techniques such as closed chest compressions in an attempt to restore normal breathing and heart functioning.
cardioversion	Restoration of normal heart rhythm by using very brief electrical

	shocks. Also referred to as <i>defibrillation</i> .
commissurotomy	Division of a commissure or fibrous band using surgery or a balloon catheter technique. One notable cardiac commissurotomy is a <i>mitral commissurotomy</i> , undertaken for relief of mitral valve stenosis.
coronary arterial bypass surgery	Grafting the internal mammary artery or segments of an autologous saphenous vein to coronary arteries, in order to detour a coronary artery obstruction. Also called <i>coronary artery bypass graft (CABG) surgery</i> .
cutdown	Incision or dissection of a vein to insert a cannula, needle, or catheter. Used when percutaneous catheter insertion cannot be accomplished. Also called <i>venous cutdown</i> or <i>venostomy</i> .
embolectomy	Excision of an embolus (a detached thrombus obstructing a blood vessel).
endarterectomy	Excision of atherosomas in which the innermost layer of the artery is removed. Sometimes a tubular graft or patch is inserted to restore the integrity of the artery.
femoropopliteal bypass surgery	Grafting a shunt that detours around an obstruction in the femoral artery. The shunt may be made from autologous or heterologous tissue or from synthetic material.
greater saphenous vein ligation and stripping	Excision of the greater saphenous vein and its tributaries, currently performed on patients with severe varicose veins secondary to venous valvular incompetence.

heart transplantation	Replacement of the heart with the healthy heart of a donor. The heart typically comes from a brain-dead donor who is on life support.
median sternotomy	Incision of the anterior chest through the midline of the sternum.
pacemaker implantation	Implantation of an electronic device that electrically stimulates the heart to keep it beating properly.
percutaneous transluminal coronary angioplasty (PTCA)	Reconstruction of a coronary artery by inserting a balloon-tipped catheter into the artery at the site of the obstruction and inflating it, rupturing the obstruction and thereby dilating the artery. Also called <i>coronary angioplasty</i> , <i>coronary artery angioplasty</i> , and <i>balloon angioplasty</i> .
portosystemic shunt	Diversion of portal venous blood into the inferior vena cava to relieve portal hypertension.
stent implantation	Implantation of a stent (a metallic meshlike tube) into a blood vessel at the site of an obstruction. The stent is intended to remain permanently to keep the vessel open.
surgical resection of an artery	Excision of a diseased portion of an artery.
thrombectomy	Excision of a thrombus (an attached blood clot in a vessel or heart wall).
valve replacement surgery	Excision and replacement of a defective heart valve either with an artificial valve or a valve from an animal donor, typically a porcine (pig) valve.
valvotomy	Incision of a stenotic cardiac valve. Also called <i>valvulotomy</i> .

TERMINOLOGY

COMBINING FORM	MEANING	TERMINOLOGY	MEANING
angl/o	vessel	<u>angiogram</u> _____	
		<u>angioplasty</u> _____	
aort/o	aorta	<u>aortic</u> stenosis _____	

arter/o, arteri/o artery

arteriosclerosis _____

arterial anastomosis _____

From the Greek anastomoiēn, providing a mouth.

arteriography _____

endarterectomy _____

See page 431.

COMBINING FORM	MEANING	TERMINOLOGY	MEANING
ather/o 	yellowish plaque, fatty substance (Greek <i>atherē</i> means porridge)	<u>atheroma</u> <i>The suffix -oma means mass or collection. Atheromas are collections of plaque that protrude into the lumen (opening) of an artery, weakening the muscle lining.</i>	
		<u>atherosclerosis</u> <i>The major form of arteriosclerosis in which deposits of yellow plaque (atheromas) containing cholesterol and lipids are found within the lining of the artery (Figure 11-12).</i>	
		<u>atherectomy</u>	
atri/o	atrium, upper heart chamber	<u>atrial</u>	
brachi/o	arm	<u>atrioventricular</u>	
cardi/o	heart	<u>brachial</u> artery	
		<u>cardiomegaly</u>	
		<u>cardiomyopathy</u> <i>One type of cardiomyopathy is hypertrophic cardiomyopathy—abnormal thickening of heart muscle, usually in the left ventricle. The ventricle has to work harder to pump blood. The condition may be inherited or develop over time because of high blood pressure or aging. Often the cause is unknown (idiopathic).</i>	
		<u>bradycardia</u> <i>Slower than 60 beats per minute. Normal pulse is about 60 to 80 beats per minute. Brady- means slow.</i>	
		<u>tachycardia</u> <i>Faster than 100 beats per minute. Supraventricular tachycardia (SVT) involves rapid beats coming from the atria (above the ventricles) and causing palpitation (abnormal sensations in the chest). Tachy- means fast.</i>	
		<u>cardiogenic shock</u> <i>Results from failure of the heart in its pumping action. Shock is circulatory failure associated with inadequate delivery of oxygen and nutrients to body tissues.</i>	
cholesterol/o	cholesterol (a lipid substance)	<u>hypercholesterolemia</u> <i>Statins are drugs that work by blocking a key enzyme in the production of cholesterol by the liver.</i>	
coron/o	heart	<u>coronary arteries</u> <i>These arteries come down over the top of the heart like a crown (corona); see Figure 11-22A, page 426.</i>	

COMBINING FORM	MEANING	TERMINOLOGY	MEANING
cyan/o	blue	<u>cyanosis</u> _____ <i>This bluish discoloration of the skin indicates diminished oxygen content of the blood.</i>	
myx/o	mucus	<u>myxoma</u> _____ <i>A benign tumor derived from connective tissue, with cells embedded in soft mucoid stromal tissue. These rare tumors occur most frequently in the left atrium.</i>	
ox/o	oxygen	<u>hypoxia</u> _____ <i>Inadequate oxygen in tissues. Anoxia is an extreme form of hypoxia.</i>	
pericard/i/o	pericardium	<u>pericardiocentesis</u> _____	
phleb/o	vein	<u>phlebotomy</u> _____ <i>A phlebotomist is trained in opening veins for phlebotomy.</i>	
		<u>thrombophlebitis</u> _____ <i>Often shortened to phlebitis. If the affected vein is deep within a muscle, the condition is deep vein thrombosis (DVT).</i>	
rrhythm/o	rhythm	<u>arrhythmia</u> _____ <i>Dysrhythmia is also used to describe an abnormal heart rhythm. Notice that one "r" is dropped.</i>	
sphygm/o	pulse	<u>sphygmomanometer</u> _____ <i>A sphygmomanometer measures pressure.</i>	
steth/o	chest	<u>stethoscope</u> _____ <i>A misnomer because the examination is by ear, not by eye. Auscultation means listening to sounds within the body, typically using a stethoscope.</i>	
thromb/o	clot	<u>thrombolysis</u> _____	

COMBINING FORM	MEANING	TERMINOLOGY	MEANING
valvul/o, valv/o	valve	<u>valvuloplasty</u> _____ <i>A balloon-tipped catheter dilates a cardiac valve.</i>	
		<u>mitral valvulitis</u> _____ <i>Commonly associated with rheumatic fever, an inflammatory disease caused by inadequate treatment of a streptococcal infection. An autoimmune reaction occurs, leading to inflammation and damage to heart valves. (See Figure 11-19, page 420.)</i>	
		<u>valvotomy</u> _____	
vas/o	vessel	<u>vasoconstriction</u> _____ <i>Constriction means to tighten or narrow.</i>	
		<u>vasodilation</u> _____	
vascul/o	vessel	<u>vascular</u> _____	
ven/o, ven/l	vein	<u>venous</u> _____ <i>A venous cutdown is a small surgical incision to permit access to a collapsed vein. An intravenous infusion is delivery of fluids into a vein.</i>	
		<u>venipuncture</u> _____ <i>This procedure is performed for phlebotomy or to start an intravenous infusion.</i>	
ventricul/o	ventricle, lower heart chamber	<u>interventricular septum</u> _____	

ABBREVIATIONS



ABBREVIATIONS

AAA	abdominal aortic aneurysm	CCU	coronary care unit
ACE inhibitor	angiotensin-converting enzyme inhibitor	Cath	catheterization
ACLS	advanced cardiac life support; CPR plus drugs and defibrillation	CHF	congestive heart failure
ACS	acute coronary syndrome	CK	creatinine kinase; released into the bloodstream after injury to heart or skeletal muscles
ADP	adenosine diphosphate; ADP blockers are used to prevent cardiovascular-related death, heart attack, and strokes and after all stent procedures	CoA	coarctation of the aorta
AED	automatic external defibrillator	CPR	cardiopulmonary resuscitation
AF, a-fib	atrial fibrillation	CRT	cardiac resynchronization therapy; biventricular pacing
AICD	automatic implantable cardioverter-defibrillator	CTNI or cTnI; CTNT or cTnT	cardiac troponin-I and cardiac troponin-T; troponin is a protein released into the bloodstream after myocardial injury
AMI	acute myocardial infarction	DES	drug-eluting stent
ARVD	arrhythmogenic right ventricular dysplasia	DSA	digital subtraction angiography
AS	aortic stenosis	DVT	deep vein thrombosis
ASD	atrial septal defect	ECMO	extracorporeal membrane oxygenation
AV, A-V	atrioventricular	ECC; also seen as EKG	electrocardiography
AVR	aortic valve replacement	ECHO	echocardiography
BBB	bundle branch block	EF	ejection fraction; measure of the amount of blood that pumps out of the heart with each beat
BNP	brain natriuretic peptide; elevated in congestive heart failure	EPS	electrophysiology study; electrode catheters are inserted into veins and threaded into the heart and electrical conduction is measured (tachycardias are provoked and analyzed)
BP	blood pressure		
CABC	coronary artery bypass grafting		
CAD	coronary artery disease		

ETT	exercise tolerance test	PDA	patent ductus arteriosus; posterior descending artery
ETT-MIBI	exercise tolerance test combined with a radioactive tracer (sestamibi) scan	PE	pulmonary embolus
EVAR	endovascular aneurysm repair	PVC	premature ventricular contraction
HDL	high-density lipoprotein; high blood levels are associated with lower incidence of coronary artery disease	SA, S-A node	sinoatrial node
HTN	hypertension (high blood pressure)	SCD	sudden cardiac death
IABP	intra-aortic balloon pump; used to support patients in cardiogenic shock	SOB	shortness of breath
ICD	implantable cardioverter-defibrillator	SPECT	single photon emission computed tomography; used for myocardial imaging with sestamibi scans
LAD	left anterior descending (coronary artery)	STEMI	ST elevation myocardial infarction
LDL	low-density lipoprotein	SVT	supraventricular tachycardia; rapid heartbeats arising from the atria and causing palpitations, SOB, and dizziness
LMWH	low-molecular-weight heparin	TAVR	transcatheter aortic valve replacement
LV	left ventricle	TEE	transesophageal echocardiography
LVAD	left ventricular assist device	TEVAR	thoracic endovascular aneurysm repair
LVH	left ventricular hypertrophy	TGA	transposition of the great arteries
MI	myocardial infarction	tPA	tissue-type plasminogen activator; a drug used to prevent thrombosis
MUGA	multiple-gated acquisition scan; a radioactive test of heart function	UA	unstable angina; chest pain at rest or of increasing frequency
MVP	mitral valve prolapse	VF	ventricular fibrillation
NSR	normal sinus rhythm	VSD	ventricular septal defect
NSTEMI	non-ST elevation myocardial infarction	VT	ventricular tachycardia
PAC	premature atrial contraction	WPW	Wolff-Parkinson-White syndrome; an abnormal ECG pattern often associated with paroxysmal tachycardia
PAD	peripheral arterial disease		
PCI	percutaneous coronary intervention		

- EDP -end-diastolic pressure
- EDV - end-diastolic volume
- EPS - electrophysiologic study
- ICA - internal carotid artery
- IMA - internal mammary artery
- JVP - jugular venous pressure
- LAD - left anterior descending coronary artery
- LCA - left coronary artery
- LCCA - left circumflex coronary artery
- LIMA - left internal mammary artery
- LMCA - left main coronary artery
- LPA - left pulmonary artery
- MI - myocardial infarction
- MPA - main pulmonary artery
- MRA - magnetic resonance angiography
- MS - mitral stenosis
- MVP - mitral valve prolapse
- OM --obtuse marginal (artery)

- PA - pulmonary artery
- PAT - paroxysmal atrial tachycardia
- PAWP - pulmonary artery wedge pressure
- PDA - posterior descending artery; patent ductus arteriosis
- PMI - point of maximal impulse
- PTCA - percutaneous transluminal coronary angioplasty
- PVC - premature ventricular contraction
- RCA - right coronary artery
- RPA - right pulmonary artery
- SFA - superficial femoral artery
- TIMI - thrombolysis in myocardial infarction
- tPA - tissue plasminogen activator

THANK YOU