

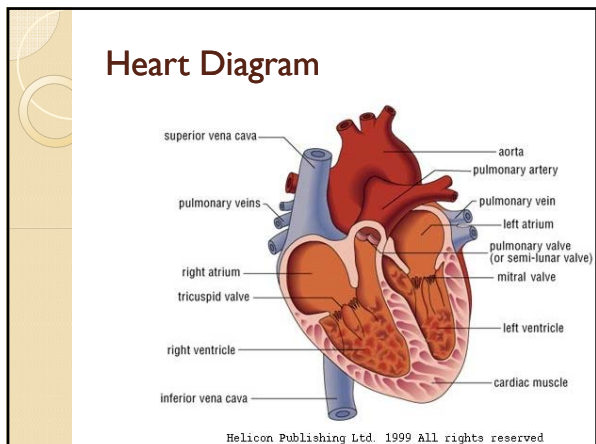
 **Circulation**
Heart , blood, Immunity, and
Vessels

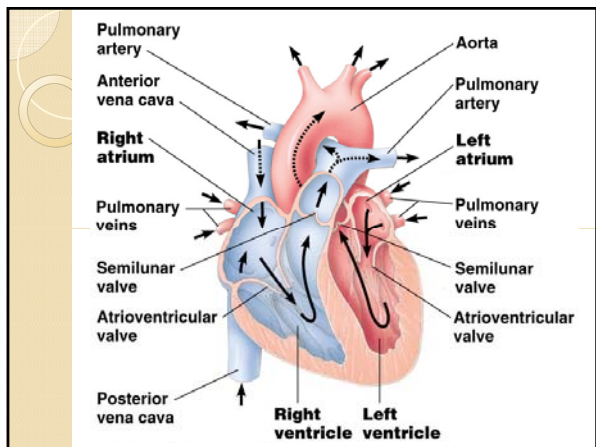
 **Internal Transport**

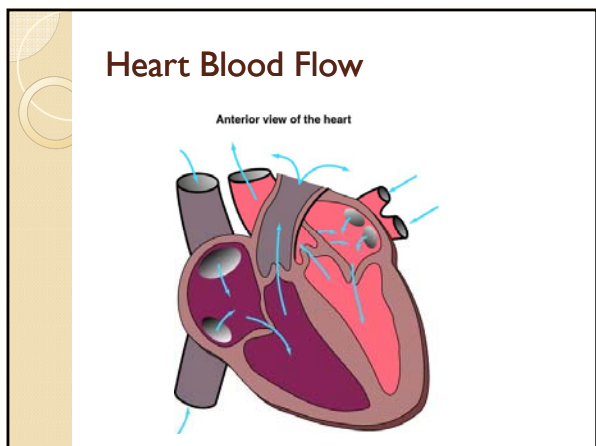
- Open vs Closed Circulatory Systems
- Trend has been to more chambers in the heart as complexity has increased.

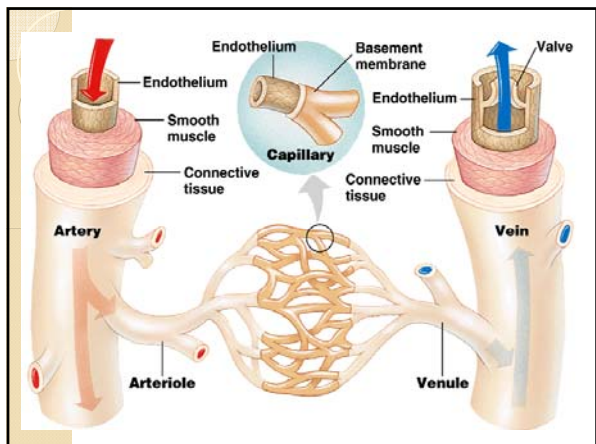
 **Mammalian Cardiovascular System**

- Heart
 - Cardiac muscle
 - Have intercalated discs- anchoring and communication
 - Thin walled atria
 - Thick walled Ventricles
 - Valves prevent backwards flow of blood
 - Follow blood flow through heart.









Heart Beating

- Passive filling followed by active pumping
- Diastole – when heart is not contracting with lasts less than one second.
- Systole – Begins when atria contract, followed by the ventricles contracting.
- AV valves open when blood fills them
- 75 ml per beat or 5.25 liters per minute.
- http://endeavor.med.nyu.edu/courses/physiology/courseware/ekg_pt1/EKGseq.html

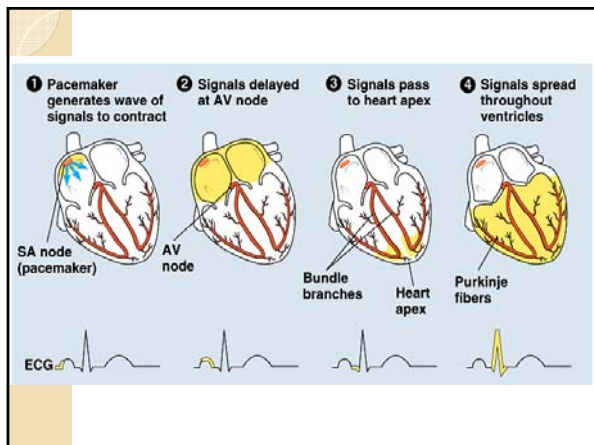
Cardiac Cycle

The diagram shows the heart during two phases of the cardiac cycle. In Diastole, the ventricles are relaxed and filling with blood. In Systole, the ventricles contract and eject blood. The diagram labels the major vessels: Aorta, Superior Vena Cava, Pulmonary Artery, Pulmonary Veins, Left Atrium, Right Atrium, Left Ventricle, Right Ventricle, and Inferior Vena Cava.

- What is the pressures of the Left atria, Left Ventricle and Aorta during the Cardiac Cycle

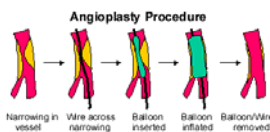
Pacemaker

- In wall of right atrium (SA or Sinoatrial node).
- AV node contracts later after a delay.
- Bundle of his is the link between the two.
- An artificial version is inserted when the natural one doesn't work. Pacemaker.



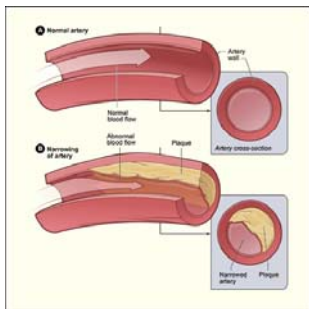
Heart Attack (Cardiac Thrombosis)

- Lack of blood flow to the heart muscle.
- Cardiac muscle cells don't regenerate. They leave non-contracting scar tissue.
- Bypass, Angioplasty, laser surgeries all open clogged arteries.

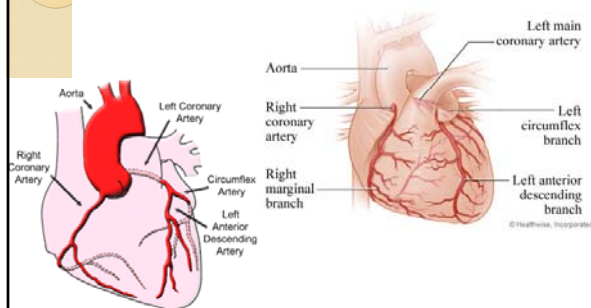


Causes of Atherosclerosis and Cardiac Thrombosis

- Atherosclerosis
 - Elevated levels of cholesterol and triglyceride in the blood
 - High blood pressure
 - Cigarette smoke
 - Male
 - Diabetes
 - Overweight
 - Stress



Coronary Arteries



Heart Attack



Blood Pressure

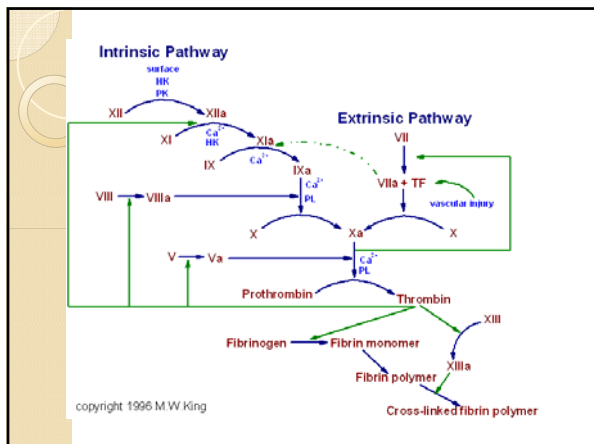
- Systolic 120
- Diastolic 80
- Pressure 120/80
 - Normal
 - Measured with a sphygmomanometer
 - Korotkoff sounds
 - Low blood pressure is below 100
 - High is 140/90

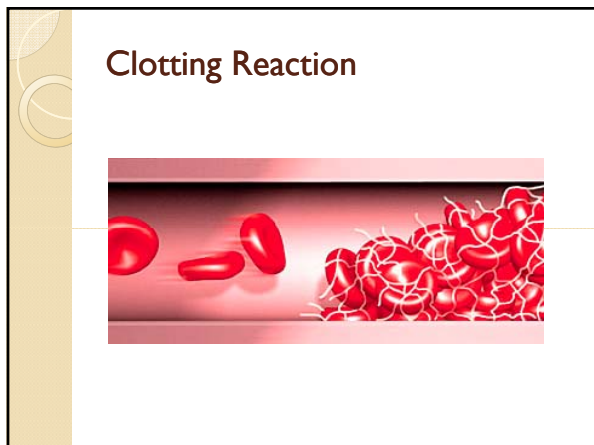
Blood

<ul style="list-style-type: none">• Plasma• 4-6 Liters• 45% is cells• 55% is plasma<ul style="list-style-type: none">◦ 90% water◦ 10% dissolved stuff• platelets	<ul style="list-style-type: none">• Blood Transports<ul style="list-style-type: none">◦ Nutrients◦ Oxygen◦ Carbon Dioxide◦ Hormones◦ Antibodies◦ Urea◦ Heat
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Blood clotting

- Platelets play a role in clotting
- Prothrombin → Thrombin
- Thrombin converts Fibrinogen to Fibrin



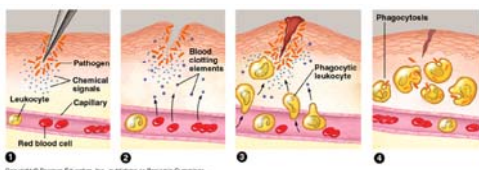


- ### Blood
- RBC's
 - Erythrocytes
 - 25 trillion present in the average person.
 - 3-4 months before being removed by liver.
 - 250 million hemoglobin molecules per cell.

Blood

- WBC's
 - Leukocytes
 - Basophils – release chemicals to fight infection
 - Neutrophils and Monocytes- phagocytic
 - Eosinophils- phagocytic cells search out protozoans and help in allergic reactions
 - Lymphocytes- Make antibodies

Chemical signals

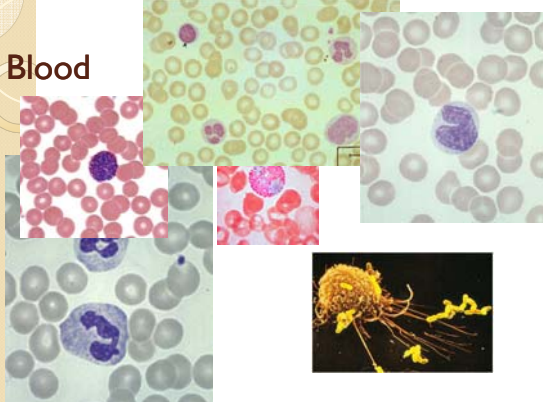


The diagram illustrates the process of chemotaxis and phagocytosis in four stages:

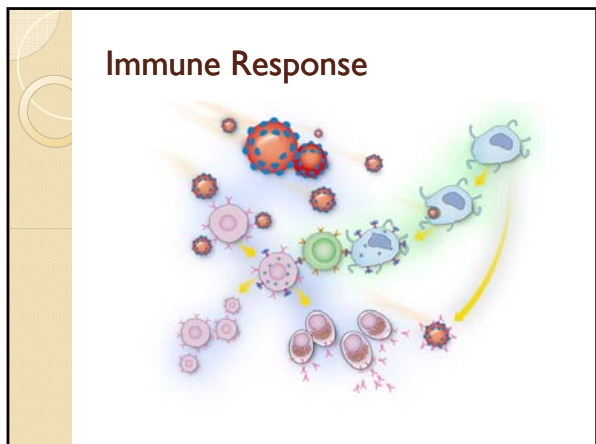
- 1**: A pathogen enters the skin, releasing chemical signals. A leukocyte is shown near a capillary, and a red blood cell is also present.
- 2**: Blood clotting elements are shown, and the leukocyte begins to move towards the chemical signals.
- 3**: The leukocyte has moved to the site of the pathogen and is beginning to engulf it.
- 4**: The leukocyte has completely engulfed the pathogen, a process labeled as phagocytosis.

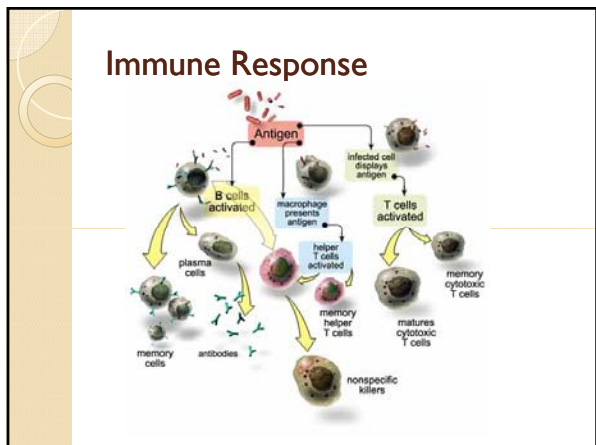
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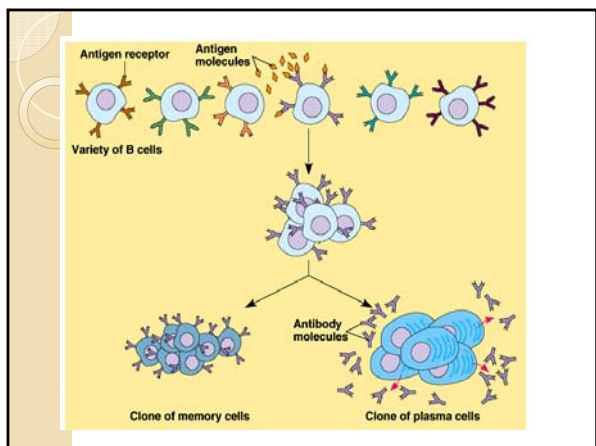
Blood

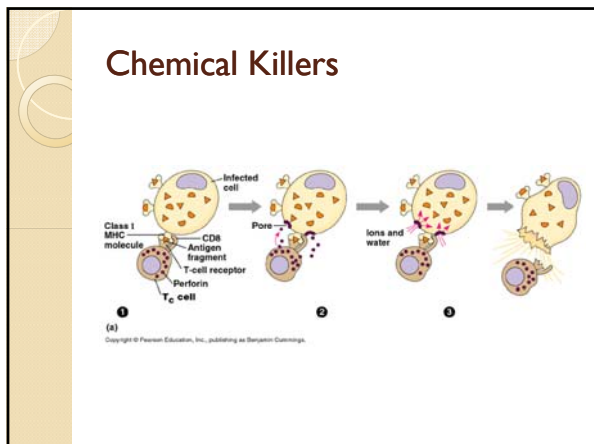


This section contains several microscopic images of blood cells. The top left shows a cluster of red blood cells and a few white blood cells. The top right shows a large white blood cell with a multi-lobed nucleus. The bottom left shows a white blood cell with a large, kidney-shaped nucleus. The bottom right shows a yellow, star-shaped structure, likely a platelet or a small organism.



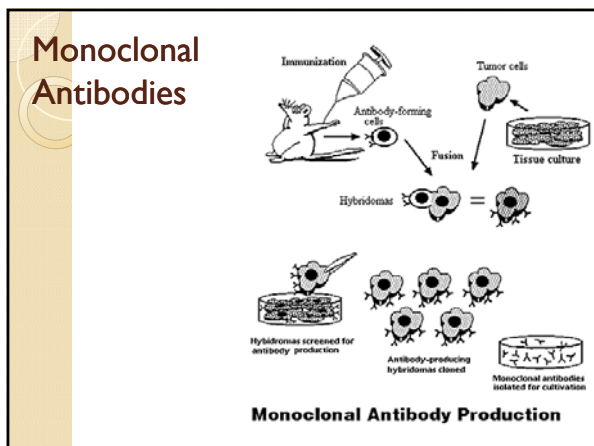


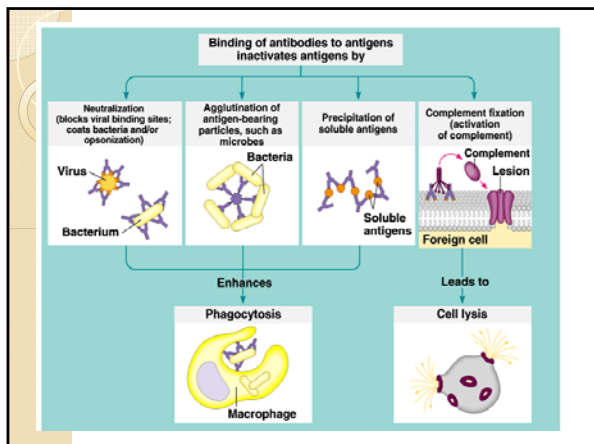


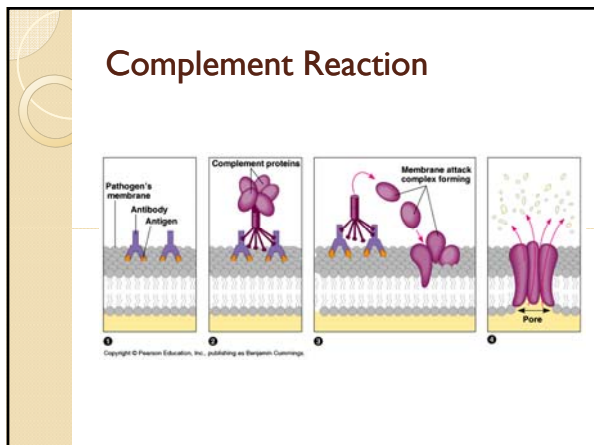


Antibody

Table 43.1 The Five Classes of Immunoglobulins	
 IgM (pentamer)	IgMs are the first circulating antibodies to appear in response to an initial exposure to an antigen; their concentration in the blood then declines rapidly. Thus the presence of IgM usually indicates a current infection. IgM consists of five Y-shaped monomers arranged in a pentagonal structure. The numerous antigen-binding sites make it very effective in agglutinating antigens and in reactions involving complement. IgM is too large to cross the placenta and does not confer maternal immunity.
 IgG (monomer)	IgG is the most abundant of the circulating antibodies. It readily crosses the walls of blood vessels and enters tissue fluids. IgG also crosses the placenta and confers passive immunity on the fetus. IgG protects against bacteria, viruses, and toxins in the blood and lymph, and triggers action of the complement system.
 IgA (dimer)	IgA is produced by cells in mucous membranes. The main function of IgA is to prevent the attachment of viruses and bacteria to epithelial surfaces. IgA is also found in many body secretions, such as saliva, perspiration, and tears. Its presence in the first milk produced helps protect the infant from gastrointestinal infections.
 IgD (monomer)	IgD antibodies do not activate the complement system and cannot cross the placenta. They are mostly found on the surfaces of B cells, probably functioning as antigen receptors that help initiate the differentiation of B cells into plasma cells and memory B cells.
 IgE (monomer)	IgE molecules are slightly larger than IgG and represent only a small fraction of the antibodies in the blood. The tails attach to mast cells and basophils and, when triggered by an antigen, cause the cells to release histamine and other chemicals that cause an allergic reaction.

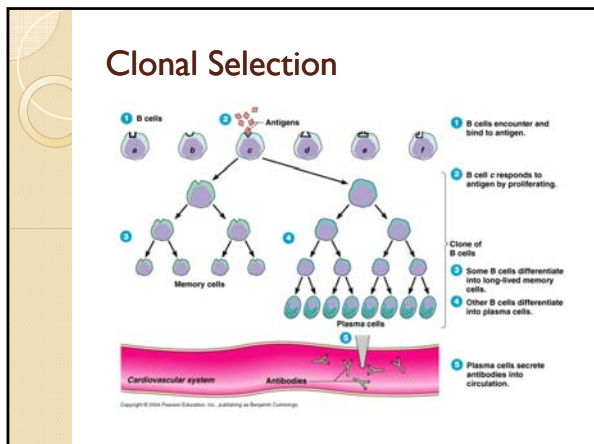


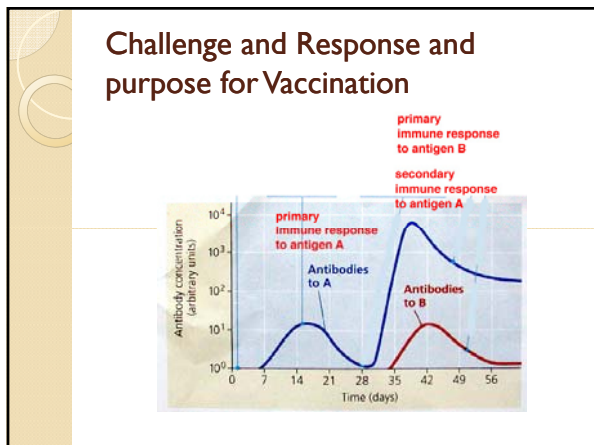




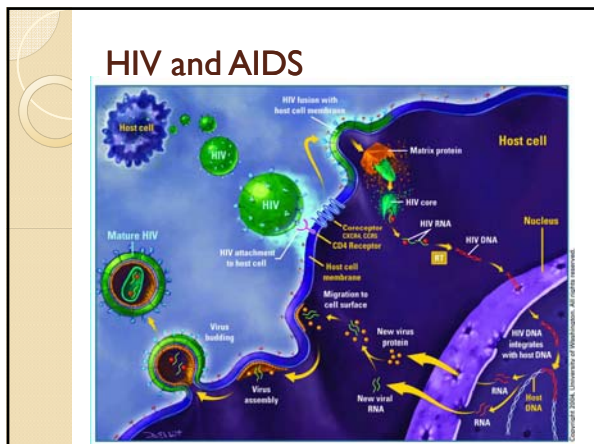
Active vs. Passive Immunity

- Active
 - In response of the body to an infection
- Passive
 - Transfer of antibodies by breast milk (colostrum), placenta, and direct injection of antibodies.





- ### Risk/Benefits for Vaccination
- Risks
 - MMR:Autism
 - Mercury in vaccines
 - Overload of immune system
 - Mental retardation
 - Benefits
 - Elimination of disease
 - Prevention of pandemics
 - Decreased healthcare costs



HIV and the Immune System

- Any cell that has CD4 receptor will be attacked
 - T-helper cells attacked
- Why antibiotics only work on Bacteria
 - They only inhibit metabolic processes
 - Viruses just harness the existing cell's systems to replicate.

Skin and Mucous Membranes

- Skin**
 - Physical barrier
 - Normal bacterial inhabitants can inhibit pathogenic bacteria
- Mucous Membranes**
 - Coatings that trap microorganisms
 - Cilia can move to be coughed up etc..

