* Lecture 37

**Introduction to Circulation**
* **BY DR QAZI IMTIAZ RASOOL**
* OBJECTIVES
* Functions of the Heart
* Generating blood pressure
* Routing blood: separates pulmonary and systemic circulations
* Ensuring one-way blood flow: valves
* Regulating blood supply

 1.Changes in contraction rate and force match blood delivery to changing metabolic needs

* Circulatory System Function

Move circulatory fluid (blood) around body

* Gas Transport
* Nutrient Transport
* Excretory Product Transport
* Cell Signal Transport
* Distribute secretions of endocrine glands,
* Production/Synthesis
* Hydraulic Force
* Heat Conductance
* Immunity
* Overview of the Cardiovascular System
* Heart- circulates blood through vessels
* Vascular System **/**Blood vessels
* Arteries- away from heart
* Veins- towards heart
* Capillaries- location of internal respiration, are tiny, thin-walled blood vessels that connect arteries to veins and are located in all body tissues.

 - in diameter that blood cells pass through in a single file.

3. Blood- transport medium

* Path of Blood

**Pulmonary Circuit**

Blood flow between the lungs and heart

Supplied by the *Right* side of the heart

**Systemic Circuit**

Blood flow between the rest of the body and heart

Supplied by the *Left* side of the heart

* Venous return

is aided by both structural modifications and functional adaptations.

1. Structural

 -Large lumen

 -Valves - present mostly in extremities, none in ventral body cavity

2. Functional

 -Respiratory Pump

 -Muscular Pump

 -Smooth muscle layer under sympathetic control

* **Systemic Blood Pressure**
* Functional Anatomy of the Heart
Chambers
* 4 chambers
* 2 Atria
* 2 Ventricles
* 2 systems
* Pulmonary
* Systemic
* Functional Anatomy of the Heart
Cardiac Muscle
* Characteristics
* Striated
* Short branched cells
* Uninucleate
* Intercalated discs
* T-tubules larger and
over z-discs
* Functional Anatomy of the Heart
Valves
* Function is to prevent backflow
* Atrioventricular Valves
* Prevent backflow to the atria
* Prolapse is prevented by the chordae tendinae
* Tensioned by the papillary muscles
* Semilunar Valves
* Prevent backflow into ventricles
* The Conduction System of the Heart
* **Conduction pathways**
* Depolarization spreads throughout the heart very rapidly facilitating a coordinated contraction pattern
* Intercalated disks
* Form junctions between adjacent cardiac muscle fibers
* Contain a high concentration of *gap junctions* for rapid transmission of the action potential
* Myocardial Physiology
Contractile Cells
* Plateau phase prevents summation due to the elongated refractory period
* No summation capacity = no tetanus (Which would be fatal)
* Myocardial Physiology
Autorhythmic Cells (Pacemaker Cells)
* Altering Activity of Pacemaker Cells
* Sympathetic activity
* NE and E increase If channel activity
* Binds to β1 adrenergic receptors which activate cAMP and increase If channel open time
* Causes more rapid pacemaker potential and faster rate of action potentials
* Myocardial Physiology
Autorhythmic Cells (Pacemaker Cells)
* Altering Activity of Pacemaker Cells
* Parasympathetic activity
* ACh binds to muscarinic receptors
* Increases K+ permeability and decreases Ca2+ permeability = hyperpolarizing the membrane
* Longer time to threshold = slower rate of action potentials
* **Aging and the CVS**

Changes occur in the blood, heart, and BVs

* Blood changes – HCT; thrombi and emboli form more easily; blood pools in leg
* Heart changes – efficiency and elasticity; atherosclerosis of coronary vessels; scar tissue forms
* Blood vessel changes – loss of elasticity; calcium deposits damage vessel walls
* Gradual changes in heart function, minor under resting condition, more significant during exercise
* Hypertrophy of L ventricle
* Maximum heart rate decreases
* tendency for valves to function abnormally and arrhythmias to occur
* O2 consumption required to pump same amount of blood