B.PHARM. Ist SEMESTER
SUBJECT: HAP
SUBJECT CODE: AS 2503

SECTION A (Question No. 1 is Compulsory)

(24 Marks)

I. 1. Generation of ATP 2. Break down of glucose

II. 1. Embryonic connective tissues

2. Mature connective tissues

a. Loose connective tissues

b. Dense connective tissues

c. Cartilage

d. Bone

e. Liquid connective tissues

III. 1. Planar joints 2. Pivot joint 3. Hinge 4. Condyloid 4. Saddle 5. Ball and socket

IV. It is a passive process in which substance move freely through the lipid bilayer of the plasma membranes of the cell without the help of transport proteins.

V. The blood antigens are A, B, AB or none

VI. Thrombocytopenia is the condition due to decrease production or levels of platelets.

VII. Leucopenia is a condition characterized by decrease in total number of leucocyte count below the normal level.

VIII. 1. Filtration of lymph. 2. Production of lymphocytes

IX. SV = End Diastolic Volume - End Systolic Volume (The amount of blood ejected by the left ventricle with each heartbeat).

X. Phase I – Diastole Ventricular Filling II. Systole Isovolumetric contraction II. Systole Outflow IV. Diastole Isovolumetric relaxation

XI. Lymphedema

XII. SA: Sinoatrial node and AV: The atrioventricular node.

SECTION B

Note: Attempt any four questions. Each question carries equal marks. **(56 Marks)**

1. Write a note on

a. Platelets plug formation:

Platelets

Produced and released from the bone marrow, pass through the spleen before reaching the blood stream, where they survive 3-5 days. Normal platelet count 100,000 – 400,000 platelets/mm3 (~ 250,000/mm3). Platelets adhere to the injured site of the blood vessel few seconds after injury. Exposed collagen in the vessel wall attracts platelets to adhere to it and trigger the release of endogenous platelet adenosine diphosphate (ADP) which increases the stickiness of platelets.

Platelet aggregation in the presence of ADP with one another to form fragile and reversible primary haemostatic plug. After aggregation, platelets start release the following substances:

1. 5-HT, a potent vascoconstrictor
2. Platelet phospholipid or platelet factor 3 (PF3), which is essential for the process of blood.
3. Coagulation proteins, e.g. platelet β-thromboglobulin (β -TG) and platelet factor 4 (PF4, heparin neutralizing factor).
4. Thromboxane A2 (TXA2), a prostaglandin formed from arachidonic acid. It is a potent vasoconstrictor and aggregation agent. Aspirin ingestion inhibits TXA2 formation (Aspirin used in coronary heart disease). For stronger clot formation, other clotting factors are needed, e.g. thrombin.

b. **Joint disorders:** The disorders related to dysfunction and inflammatory conditions related to joints. The two major type of joint disorders are:

Arthritis:

The word “arthritis” is derived from two Greek words: arthron, meaning a joint, and –itis, meaning inflammation. Inflammation typically involves redness, heat, swelling and tenderness. Thus the joint becomes red, hot, swollen and tender.

Types of arthritis:

• Peripheral arthritis
• Axial arthritis (also called spondylitis or spondyloarthropathy)
• Ankylosing spondylitis

A related term, used less often by doctors now, is rheumatism, which refers to any persistent condition of pain and stiffness related to joints, tendons, ligaments, or bursas. The symptoms of arthritis differ somewhat among the different types of arthritis, but they all involve joint pain and stiffness. Osteoarthritis tends to affect the big weight-bearing joints (hips and knees), as well as

the finger joints (usually the knuckle closest to the end of the finger), while rheumatoid arthritis usually affects the small joints most, such as the middle joints of the fingers, the wrists, the jaw joint, the toes and the ankles. Ankylosing spondylitis often is first noticed as frequent pain and stiffness in the lower back, while psoriatic arthritis can begin in any joint in the body, usually in people who also have psoriasis.

Gout: Gout is considered the most common type of inflammatory arthritis and is typically associated with a reduction in quality of life for those who suffer from it. High levels of serum uric acid, termed hyperuricemia, are a necessary prerequisite for the development of gout. As uric acid levels in the blood serum rise and the saturation threshold is exceeded within bodily fluids, monosodium urate crystals precipitate out of solution and become deposited in and around joints, especially peripherally located synovial joints. Urate crystals are sharp, needle-like structures that become lodged within joint capsules, cartilage, ligaments and tendons. The most commonly affected area is the first metatarsophalangeal joint, often referred to as the first knuckle of the big toe.

Symptoms

Clinical symptoms of gout include severe pain (often described as “excruciating”), acute inflammation, redness, fever as high as 102 °F with or without chills, long-term joint damage with successive bouts, and deposits of the urate crystals (called tophi) on or under the surface of the skin, most notably within or on the ears. Due to the inflammation and pain, affected joints typically lose significant range of motion and stability. Weight-bearing becomes difficult or impossible. Light pressure, such as the weight of a single bed sheet, can be too painful to bear for some sufferers during acute episodes. Modifications in physical activity, posture, sleeping and footwear are often needed during acute gout attacks.

2. ANS :

Blood Coagulation

- A series of biochemical reaction which leads to activation of the thrombin enzyme
- Thrombin will change soluble plasma protein (fibrinogen) to insoluble protein (fibrin)
- Prothrombin (inactive thrombin) is activated by intrinsic and extrinsic pathways
- Activation is a cascade reaction involve 12 clotting factors, circulating in precursor forms

Intrinsic pathway:

 The trigger is the activation of factor XII by contact with foreign surface, collagen of injured blood vessels and glass

 Activated factor XIIa will activate factor XI, activated factor XIa will activate factor IX, activated factor IXa will act in the presence of factor VIII, Ca2+ and phospholipid to activate factor X

 Following this step, the pathway is common for both

Extrinsic pathway:

 Triggered by material from damaged tissues (tissue thromboplastin) in the presence of factor VII, Ca2+ will activate factor X

Common pathway: Activated factor X with factor V, PF3 and Ca2+ forms thrombokinase complex and convert prothrombin to thrombin (proteolytic enzyme). Thrombin splits two short peptide chains (fibrinopeptide A & B) from fibrinogen to form fragile aggregate of fibrin. This fragile fibrin forms a network with factor XIII and Ca2+ to form strong fibrin.

Note: Flow diagram of both the pathway to be given.

3. **ANS**

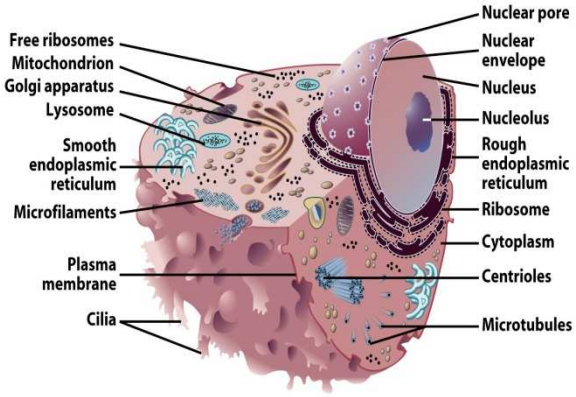


Diagram of cell

Function of various cell organelles:

Cell membrane: The cell membrane holds and protects the cell. It controls what substances come into and out of the cell like an entrance you have to pass to get into the shopping mall. It is called as "Gate of the Cell.

The cytoplasm: is the watery, gel-like material in which cell parts move and cell activities take place like the hallways of the mall where people move. "Area of Movement" .

Mitochondria: produces most of the energy for the cell, like an electrical system of the shopping mall, which supplies electrical energy."Powerhouse of the Cell" .

Vacuoles: store food, water, and chemicals, like water tank and pipes of the mall, which store water. "Storage Tanks"

Nucleus: Regulates and controls cell activities, acting like the "brain" of the cell, like the mall office, which regulates and controls activities of the shopping mall. "Control Center".

The nuclear membrane: it protects the nucleus and also allow substances to pass in and out of the nucleus, as the cell membrane does the same for the cell like the main office like the walls of the mall and its entrance, which protect the office and let workers in and out."Gate of the Nucleus".

The chromosomes: **in chromosomes – DNA is organized with proteins to form chromatin** contain the genetic information for the function to be executed by the cell. "Director of the Cell".

Ribosomes: Assemble amino acid into polypeptide chains a. Associated with the ER b. Composed of RNA and proteins.

Golgi apparatus: are membranous sacs associated with ER. a. Processing and transport of proteins, lipids. b. Synthesis and transport of polysaccharides.

Lysosomes: are Golgi-derived vesicles containing digestive enzymes and are involved in break down macromolecules and destroy cells or foreign matter that the cell has engulfed by phagocytosis

Endoplasmic reticulum: consists of folded membranes attached to the nucleus**. Rough ER** is site of protein synthesis and protein secretion. Membranes that create a network of channels throughout the cytoplasm -attachment of ribosomes to the membrane gives a rough appearance. Synthesis of proteins to be secreted, sent to lysosomes or plasma membrane **Smooth ER** is relatively few ribosomes attached-functions:-synthesis of membrane lipids, calcium storage detoxification of foreign substances.

Cytoskeleton:

Function: -Network of protein fibers found in all eukaryotic cells.

-Supports the shape of the cell.

-Keeps organelles in fixed locations.

-Helps move materials within the cell.

Cytoskeleton fibers include

-Actin filaments – responsible for cellular contractions, crawling, “pinching”

-Microtubules – provide organization to the cell and move materials within the cell

-Intermediate filaments – provide structural stability

Cilia: Hair like progression used for movement of cells.

4. **ANS:**

Formation of lymph: The system consists of a network of one The smallest vessels, called lymphatic capillaries, represent the beginning of the lymphatic drainage system. They originate in close proximity to blood capillaries as closed or dead-end tubes in the interstitial spaces (unlike vessels belonging to the cardiovascular system, which have a closed circuit). The walls of lymphatic capillaries are composed of only a single layer of flattened endothelial cells, which play an important role in a process called lymph formation. Lymph formation describes the absorption of interstitial fluid and other substances from the tissues into the lymphatic capillaries. Once the interstitial fluid enters the lymphatic system, it is called lymph, which is similar to blood plasma but contains more white blood cells. (The term lymph originates from the Latin word *lympha*, meaning "clear water.") Lymph fluid is transported from the lymphatic capillaries to the lymph nodes by larger lymph vessels, called lymph collectors. Lymph nodes serve as filter stations for harmful materials, such as cancer cells and pathogens, and play an important role in the body's immune function through the production of antibodies.

Composition of Lymph: the compostion of lymph is similar to plasma except that it contain less proteins and mostly WBC than the other formed elements of the blood.

Circulation of Lymph: The diameter of lymph collectors varies between 0.1 to 0.6 millimeters; its walls are structured similar to that of veins. Collectors contain valves, which as in venous vessels allow the flow of fluid in one direction only (proximal). The interval between the valves is irregular and varies between 6 and 20 millimeters; in larger collectors, also called lymphatic trunks, the interval can be up to 10 centimeters. The segment of a collector located between a

proximal and distal pair of valves is called lymph angion. Smooth muscles in the wall of lymph angions provide an autonomie contraction frequency of about 10 to 12 contractions per minute at rest. In healthy lymph collectors, the proximal valve is open during thé contraction of the angion while the distal valve is closed; in the relaxation phase, the opposite is the case. This permits directional flow of lymph fluid from distal to proximal angions.

Lymphatic circulation takes place in following way:

- From blood to interstitial fluid (lymph) through capillaries
- Returns to venous blood through lymphatic vessels

Lymphatic vessels are divided in to main two vessels:

1) Superficial lymphatics - located in:
    - skin
    - mucus membranes
    - serous membranes lining body

2) Deep lymphatics- Are larger vessels that accompany deep arteries and veins
    - Superficial and Deep Lymphatics joints to form large lymphatic trunks: Trunks empty into 2 major collecting vessels: 1. thoracic duct 2. right lymphatic duct
    - The Inferior Thoracic Duct collects lymph from: 1. left bronchiomediastinal trunk
    - 2. left subclavian trunk
    - 3. left jugular trunk

And all Empties into left subclavian vein

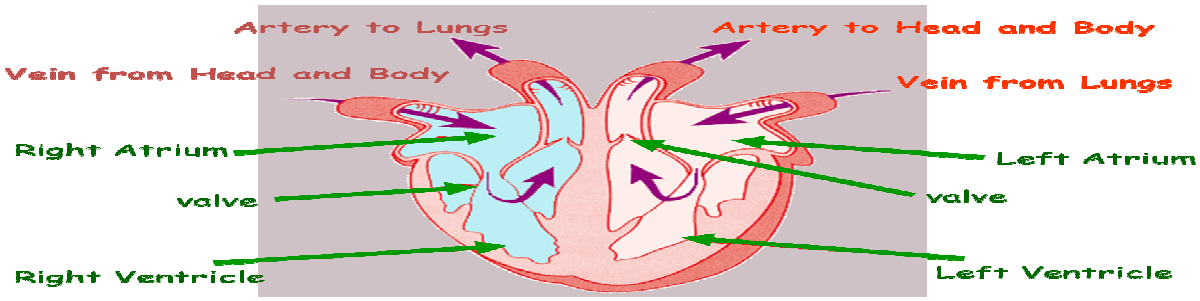
The Right Lymphatic Duct collects lymph from:

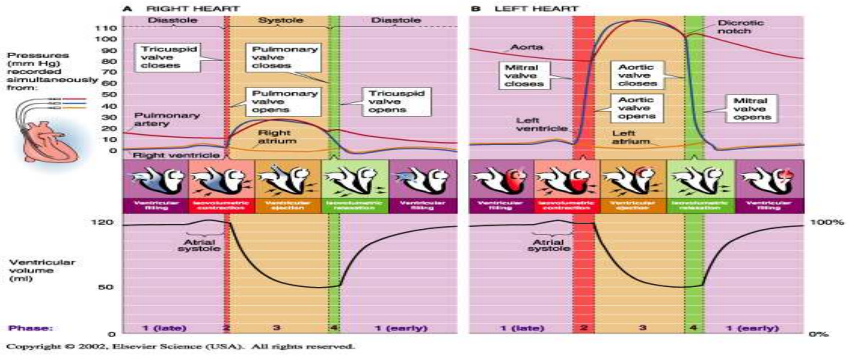
- right jugular trunk
- right subclavian trunk
- right bronchiomediastinal trunk

and all Empties into right subclavian vein

(Diagrams of the lymphatic vessels distribution to be given)

5. ANS





The cardiac cycle can be divided into four phases as follows:

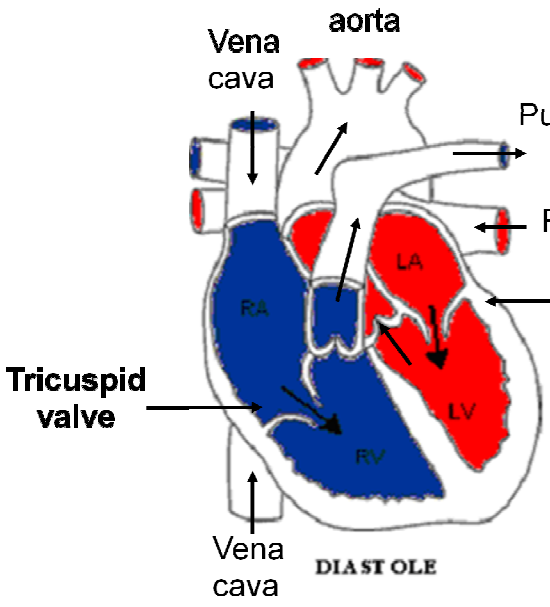
Phase I ***Diastole Ventricular Filling***

Phase 2 – Systole Isovolumetric contraction

Phase 3 – Systole Outflow phase

Phase 4 – Diastole Isovolumetric relaxation

INFLOW PHASE



-Rapid ventricular filling
-Slow ventricular filling
(diastasis)

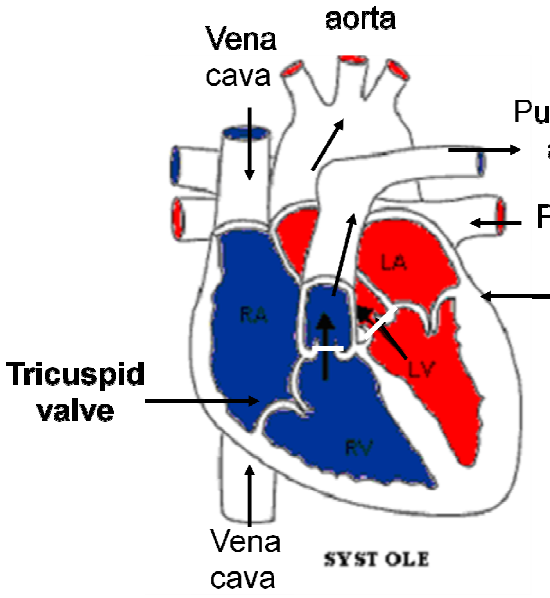
- P wave occurs in mid diastole

-Atrial contraction –
("atrial kick") - 10% rest
40% exercise (SV)
(right first, left second)

-Atrio-ventricular valves open
(Tricuspid and Mitral)
-Semilunar valves closed
(Aortic and pulmonary) .

-Volume of blood in ventricles
after Phase 1 is called
End Diastolic Volume (EDV) ~ 120 ml

Termination of Phase I – AV valves close



First heart sound **S1 "Lub"**
(M1 and T1 split)

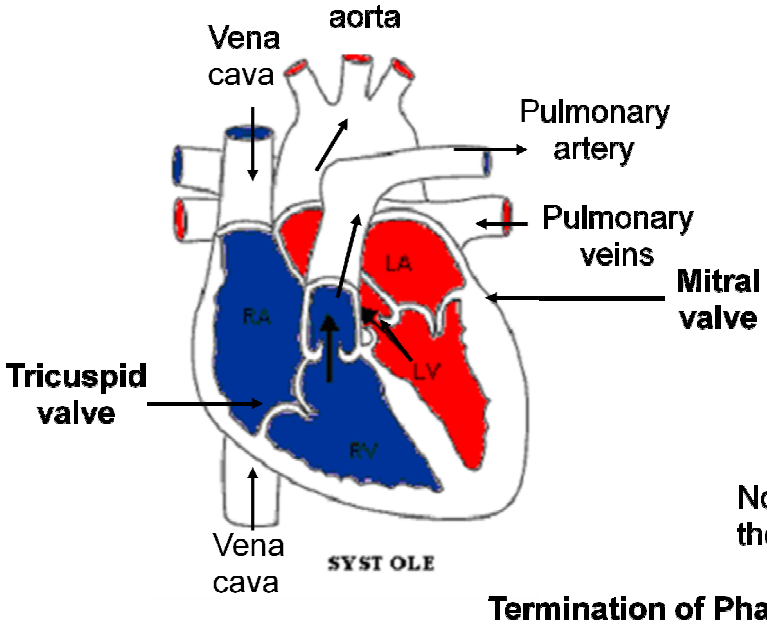
All heart valves closed

Occurs after QRS complex

Ventricles contract

HUGE pressure increase
in ventricles (all valves closed)

Semilunar valve opening terminates
Phase 2.



Rapid ventricular ejection
Slow ventricular ejection

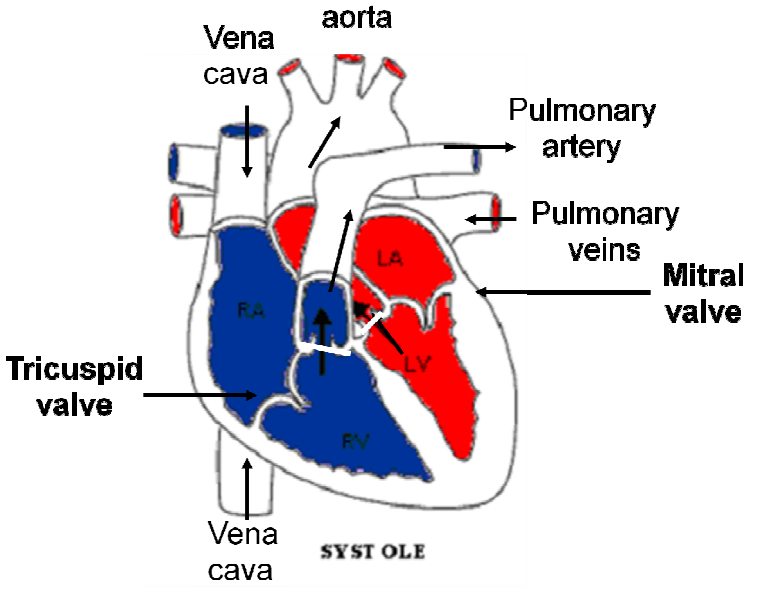
About 70 ml of blood is ejected **(Stroke Volume)** into aorta, leaving 50 ml behind **(End SystolicVolume).**

SV = EDV - ESV

Cardiac Output = SV x HR

No sounds during ejection. If so, these are typically murmurs.

Termination of Phase 3 – Semilunar valves close
(Second heart sound **S2 – "dub"**)



Relaxation of the ventricles

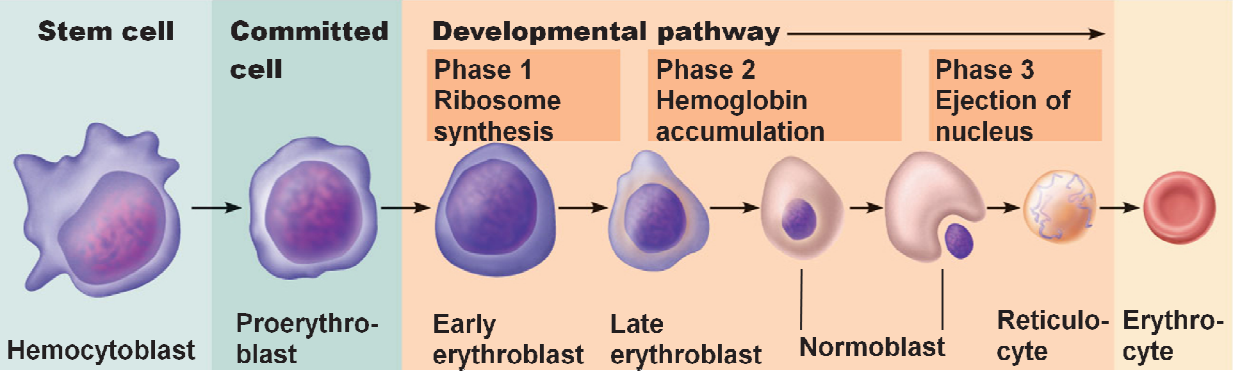
Ventricular pressure drop

Termination of Phase 4 - Atrioventricular valves open

6. ANS:

- Erythropoiesis: red blood cell production
  - A hemocytoblast is transformed into a proerythroblast
  - Proerythroblasts develop into early erythroblasts
    - Phases in development

- Ribosome synthesis
- Hemoglobin accumulation
- Ejection of the nucleus and formation of reticulocytes
  - Reticulocytes then become mature erythrocytes



Structrure and function of Erythrocyte (RBC)→7.5µm in diameter

- Anucleate- so can't reproduce; however, repro in red bone marrow
- Hematopoiesis- production of RBC
- Function- transport respiratory gases
- Hemoglobin- quaternary structure, 2 α chains and 2 β chains
- Lack mitochondria. Why?
- 1 RBC contains 280 million hemoglobin molecules
- Men- 5 million cells/mm^3
- Women- 4.5 million cells/mm^3
- Life span 100-120 days and then destroyed in spleen (RBC graveyard)