FINALS ASSIGNMENT #1
PHYSIOLOGICAL & BIOLOGICAL PSYCHOLOGY

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SUBJ CODE: PY48

UNIT 4 TOPIC:

A. Blood, Heart, and Circulation
B. Cardiac output, Blood Flow & Blood Pressure
C. The Immune System

SPECIFIC GUIDE QUESTIONS:

A. Cardiovascular System: Blood

1. Describe the nature of blood as a part of the cardiovascular system and to explain its functions.
   - The blood, heart and blood vessels make up the circulatory system.
   - The heart is a muscular pump.
   - Blood is pumped around the body in one direction
   - There are valves in the heart and in veins to help control the direction that blood flows.

   - Cardiovascular system – The cardiovascular system consists of the heart, blood vessels, and blood. Its primary function is to transport nutrients and oxygen-rich blood to all parts of the body and to carry deoxygenated blood back to the lungs.

   - Abnormalities or injuries to any or all parts of the cardiovascular system can result in serious health complications. Common conditions that can affect the cardiovascular system include coronary artery disease, heart attack, high blood pressure, and stroke.
2. Describe the composition of blood
   - Composition of the Blood
   - -Blood is the body's only fluid tissue (a connective tissue)
   - -2 major components
   - Liquid = plasma (55%)
   - Formed elements (45%)

   - -Erythrocytes, or red blood cells (RBCs)
   - -Leukocytes, or white blood cells (WBCs)
   - -Platelets – fragments of megakaryocytes in marrow
3. Describe erythrocytes (red blood cells) in terms of origin, structure, and function.

- Erythrocytes are cellular components of blood that give blood its distinctive color and transport oxygen from the lungs to the tissues. The adult human red blood cell is tiny, spherical, and biconcave; in profile, it resembles a dumbbell. As it passes through incredibly small blood veins, the cell becomes flexible and takes on a bell form. It has a lipid and protein-based membrane, no nucleus, and includes hemoglobin, a red iron-rich protein that binds oxygen.

Term of Origin

- Red blood cells are formed in the red bone marrow of bones. Stem cells in the red bone marrow are called hemocytoblasts. They give rise to all of the formed elements in blood. If a stem cell commits to becoming a cell called a proerythroblast, it will develop into a new red blood cell.

Structure

- Biconcave shape
- Do not contain organelles (including nucleus)
- Contain only hemoglobin

Function

- The function of the Erythrocytes carry oxygen from our lungs to the rest of our bodies. Then they make the return trip, taking carbon dioxide back to our lungs to be exhaled.

4. Outline the process of erythropoiesis and to describe the structure and function of hemoglobin
   - Erythropoiesis is the process whereby a fraction of primitive multipotent HSCs becomes committed to the red-cell lineage. Erythropoiesis involves highly specialized functional differentiation and gene expression. The main role of RBCs is to carry O2 in the blood by the hemoglobin molecule. Therefore, erythropoiesis needs to be tightly regulated to maintain homeostasis and to meet changes in O2 supply and demand.

Structure

- Biconcave shape Do not contain organelles (including nucleus) Contain only hemoglobin

Function of Hemoglobin

- -Hemoglobin is essential for transferring oxygen in your blood from the lungs to the tissues. Myoglobin, in muscle cells, accepts, stores, transports and releases oxygen.

5. Describe the origin of platelets and to explain how they function.
   - Platelets are produced in the bone marrow, the same as the red cells and most of the white blood cells. Platelets are produced from very large bone marrow cells called megakaryocytes.

- Function of Platelets
- 1. Platelets help the stopage of bleeding.

- 2. Platelets repair the blood vessels.
- 3. Platelets retraction the healed part.
- 4. Platelets active factor prothrombin.
- 5. Contraction of injured blood vessels so minimize blood loss.
- 6. It's helps transport and storage function.
- 7. Role in defense mechanism.

6. Explain the mechanism of hemostasis
   - The mechanism of hemostasis can divide into four stages. 1) Constriction of the blood vessel. 2) Formation of a temporary "platelet plug." 3) Activation of the coagulation cascade. 4) Formation of "fibrin plug" or the final clot.
7. Distinguish between the five types of leukocytes (white blood cells).

Type of white blood cell	Function
neutrophil	helps stop microorganisms in infections by eating them and destroying them with enzymes
lymphocyte	–uses antibodies to stop bacteria or viruses from entering the body (B-cell lymphocyte) –kills off the body's cells if they've been compromised by a virus or cancer cells (T-cell lymphocyte)
monocyte	becomes a macrophage in the body's tissues, eating microorganisms and getting rid of dead cells while increasing immune system strength
eosinophil	helps control inflammation, especially active during parasite infections and allergic reactions, stops substances or other foreign materials from harming the body
basophil	produces enzymes during asthma attacks and allergic reactions

8. List the major components of blood plasma and to describe the functions of the albumins, globulins, and electrolytes.
   - Plasma
   - Plasma constitutes 55% of total blood volume. Composed of 90% water, salts, lipids and hormones, it is especially rich in proteins (including its main protein albumin), immunoglobulins, clotting factors and fibrinogen.

   - Plasma performs several functions: transporting blood cells and nutrients; regulating the body's water and mineral salts; irrigating tissues; providing a defence against infections; and coagulating blood.

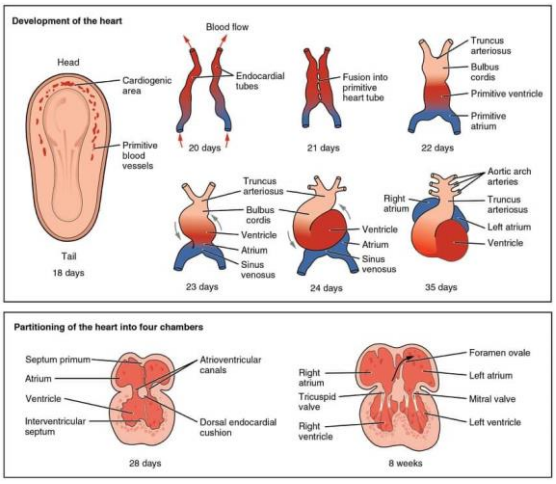
   - Albumin – The albumin helps maintain the colloid osmotic pressure of the blood. It is the smallest in size among the plasma proteins but makes up the

largest percentage. The colloid osmotic pressure of the blood is important in maintaining a balance between the water inside the blood and that in the tissue fluid, around the cells. When the plasma proteins are deficient, the water in the plasma seeps out into the space around the blood vessels and may result in interstitial edema, a feature of liver disorders, kidney disease and malnutrition, for instance. Albumin also helps transport many substances such as drugs, hormones, and fatty acids.

- Globulins – The Globulins are of three types, alpha, beta, and gamma, from smallest to largest. Gamma-globulins are called antibodies. The alpha globulins include the high-density lipoproteins (HDL) which are important in carrying fats to the cells for building various substances as well as for energy metabolism. HDL is best known for its role in preventing plaque formation by keeping cholesterol in transport within the blood. Low-density lipoproteins (LDL) are beta globulins which transport fat to the cells for steroid and cell membrane synthesis. It also promotes cholesterol plaque formation which is a risk factor for arterial and heart disease.
- Electrolytes – Sodium is the most abundant ion carried in plasma and contributes most of the plasma osmolarity.

B. Cardiovascular System: The Heart

1. What is the relationship between the heart and lungs?
    - The heart and lungs collaborate to ensure that the body receives the oxygen-rich blood it requires to function properly. The Pulmonary Loop The right side of the heart transports oxygen-depleted blood from the body to the lungs for cleaning and re-oxygenation. The Systemic Loop After the blood has been re-oxygenated, the left side of the heart circulates it throughout the body, ensuring that every part receives the oxygen it requires.
2. Trace the development of the embryonic heart from day 18 through day 25.



3. Describe the workings of each of the heart valves

   The four valves of the heart are:

   - **Aortic valve.** They open to allow blood to flow from the left ventricle of your heart to the aorta. The aorta is your body's largest blood vessel. It transports oxygenated blood from the heart to the rest of the body. The aortic valve prevents aortic backflow into the left ventricle.
   - **Mitral valve.** They allow blood from the lungs to flow into the left atrium. Furthermore, they prevent backflow from the left ventricle to the left atrium.
   - **Pulmonary valve (or pulmonic valve).** They allow blood to be transported from the right ventricle to the pulmonary artery. This artery transports blood to the lungs, where it picks up oxygen. The pulmonary valve prevents blood from returning to the right ventricle from the pulmonary artery.
   - **Tricuspid valve.** They allow blood to flow from the right atrium to the right ventricle. They also prevent blood from flowing backward from the right ventricle to the right atrium

4. Distinguish between the pulmonary and systemic circuits of blood flow.
   - Pulmonary circulation refers to the circulation of blood in which deoxygenated blood is pumped from the heart to the lungs and oxygenated blood is returned to back to the heart. Pulmonary circulation only occurs between the heart and the lungs.

   - Systemic circulation refers to the circulation of blood in which oxygenated blood is pumped from the heart to the body and deoxygenated blood is returned back to the heart. Systemic circulation occurs between the heart and the entire body.

5. Describe the flow of blood through the heart
   - The vena cava transports deoxygenated blood from various organs to the right atrium. Blood flows from the right atrium to the right ventricle. The tricuspid valve, located between the right atrium and the right ventricle, prevents blood backflow.
   - From the right ventricle. The pulmonary artery carries blood to the lungs. Inside the lungs, carbon dioxide is removed from the blood and oxygen is introduced.
   - It comes from the lungs. The pulmonary vein transports blood to the left atrium. Blood flows from the left atrium to the left ventricle. Blood is pumped into the aorta from the left ventricle and distributed to various organs.

6. Explain how the fetal circulation differs from the circulation of a newborn
   - Fetal circulation differs significantly from adult circulation. The placenta provides oxygenated blood and nutrients to the fetus via this intricate system. It is made up of placental blood vessels and the umbilical cord, which has two umbilical arteries and one umbilical vein. The ductus arteriosus bypasses the

lungs, while the ductus venosus bypasses the liver, and blood can travel from the right atrium to the left atrium via the foramen ovale. The normal fetal heart rate is 110 to 160 beats per minute. Fetuses have decreased ventricular filling and contractility when compared to adults. Fetal circulation undergoes a rapid transition after birth to accommodate extra-uterine life. Human understanding of fetal circulation originated with fetal sheep, but ultrasound and magnetic resonance imaging (MRI) during the fetal period now provide detailed information. There are distinct differences in the fetal circulation that, if not properly formed, can lead to childhood or adult diseases.

7. Describe the conduction system of the heart
    - The network of nodes, cells, and signals that controls your heartbeat is known as the heart conduction system. Electrical signals travel through your heart every time it beats. These signals cause various parts of your heart to contract and expand.
8. Describe the innervation of the heart
    - The innervation of the heart refers to the network of nerves that control the heart's function. Sympathetic and parasympathetic fibers from the autonomic branch of the peripheral nervous system innervate the heart.

    - The cardiac plexus is the network of nerves that supplies the heart. It receives input from both the right and left vagus nerves, as well as the sympathetic trunk. These are in charge of influencing heart rate, cardiac output, and heart contraction forces.
9. Describe the cardiac cycle
    - The cardiac cycle is the sequence of events that occurs when the hearts beats. As the heart beats, it's circulate blood through pulmonary and systematic circuits of the body. There are two phases of the cardiac cycle: The diastole phase and the systole phase. In the diastole phase, heart ventricles relax and the heart fills with blood. In the systole phase, the ventricles contract and pump blood out the heart to arteries. One cardiac cycle is completed when the heart chambers fill with blood and blood is pumped out of the heart

C. Cardiovascular System: Vessels and Blood Circulation

1. Describe the functions of the cardiovascular system in general terms
    - The cardiovascular system is made up of the heart, blood vessels, and blood itself. Its primary function is to carry nutrients and oxygen-rich blood to all parts of the body while returning deoxygenated blood to the lungs. Any or all parts of the cardiovascular system can be abnormal or injured, resulting in serious health complications. Coronary artery disease, heart attack, high blood pressure, and stroke are all common conditions that can affect the cardiovascular system. The cardiovascular system, including its components and functions, is the subject of this article. We also discuss some common cardiovascular diseases and their treatments.

2. To compare arteries, capillaries, and veins as to function
    - Artery versus Vein Arteries transport blood away from the heart, while veins transport blood towards the heart. Aside from pulmonary blood vessels, arteries transport oxygenated blood while veins transport deoxygenated blood. Arteries have thick muscle-filled walls. Veins have thinner walls than arteries and use valves to keep blood flowing.

    - Artery vs. Vein Veins are closer to the skin's surface, whereas arteries are deep within your muscles. A vein's walls are thinner than those of an artery. Veins transport blood from your organs to your heart. Arteries transport blood away from the heart.
    - Capillary vs. Vein Vein walls are thicker than capillary walls. Capillaries lack valves while veins use them to transport blood to the heart. Through their thin walls, capillaries transport blood and nutrients between veins and arteries.

    - Capillary versus Artery Capillaries are tiny blood vessels that run throughout your body. Arteries are thick, muscular blood vessels that run deep within your muscles.

    - Capillary versus Vein Both veins and capillaries can be seen through your skin at times, but veins are larger and thicker than capillaries. Capillaries can transport both oxygenated and deoxygenated blood, whereas most veins only carry deoxygenated blood.

    - Arteries: These powerful, muscular blood vessels transport oxygen-rich blood from your heart to the rest of your body. They can withstand a lot of force and pressure from your blood flow, but they can't carry a lot of blood. Only about 10% to 15% of your body's blood is in your arteries at any given time.

    - Capillaries have thin walls that allow oxygen, nutrients, carbon dioxide, and waste products to pass through and to tissue cells.

    - Veins transport blood to the right side of the heart.
    - The pulmonary arteries transport blood to the lungs, where it receives oxygen.
    - The pulmonary veins transport oxygen-rich blood to the left side of the heart.
3. What are the four vessels that supply blood to the brain?
    The four vessels that supply blood to the brain
    - The internal carotid arteries.
    - The anterior cerebral artery.
    - The anterior communicating artery.
    - The middle cerebral artery.

4. Identify the principal systemic veins.
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5. Define blood pressure and to explain how it is measured and controlled

    Definition of blood pressure

    - Blood pressure, force originating in the pumping action of the heart, exerted by the blood against the walls of the blood vessels; the stretching of the vessels in response to this force and their subsequent contraction are important in maintaining blood flow through the vascular system.

    Measured and controlled

    - For a manual blood pressure measurement, the care provider places a stethoscope over the major artery in the upper arm (brachial artery) to listen to blood flow. The cuff is inflated with a small hand pump.
      As the cuff inflates, it squeezes the arm. Blood flow through the artery stops for a moment.

    Lose extra pounds and watch your waistline. Blood pressure often increases as weight increases.

    - Exercise regularly.
    - Eat a healthy diet.
    - Reduce sodium in your diet.
    - Limit the amount of alcohol you drink.
    - Quit smoking.
    - Cut back on caffeine.
    - Reduce your stress.
6. Explain how blood flow is regulated by neural and renal mechanisms, and how changes in blood pressure alter the heart rate and peripheral resistance
    - Neurotransmitter release stimulates receptors on smooth muscle, endothelium, or astrocytes, causing constriction or dilation and thus regulating local blood flow in conjunction with neuronal demand [22,98,134].
    - -Increasing or decreasing arteriolar resistance is the primary means of controlling renal blood flow. Adrenaline and angiotensin are two key hormones that increase arteriolar resistance and, as a result, decrease renal blood flow.
    - The heart rate and blood pressure do not always rise at the same rate. Your blood pressure does not rise at the same rate as your heart rate. Even if your heart is beating faster, healthy blood vessels dilate (grow in size) to allow more blood to flow through more easily. When you exercise, your heart rate increases, allowing more blood to reach your muscles. It is possible that your heart rate can safely double while your blood pressure only rises slightly.
    - We increased the pressure by reducing the amount of space through which the water could flow. The same principle applies to blood and vessels in the body. This is known as ‘total peripheral resistance’ in the cardiovascular world

(TPR). When the area available for blood to flow through is reduced, pressure rises. If pressure remains extremely high for an extended period of time, the risk of a vessel bursting increases significantly; in the case of the aorta, this would result in near-instant death due to massive immediate blood loss.

7. Define hypertension and state some of the possible and known causes for this condition
   - High blood pressure, also known as hypertension, is elevated blood pressure above normal. Depending on your activities, your blood pressure fluctuates throughout the day. Having blood pressure readings that are consistently higher than normal may lead to a diagnosis of high blood pressure, also known as hypertension.
   - Many people are unaware they have high blood pressure because there are no warning signs or symptoms. Only by measuring your blood pressure can you determine if you have high blood pressure.

   - High blood pressure usually comes on gradually. It can occur as a result of poor lifestyle choices, such as a lack of regular physical activity. Diabetes and obesity, for example, can both increase the risk of developing high blood pressure. Pregnancy can also cause high blood pressure.
   - High blood pressure can harm your health in a variety of ways. It can seriously harm vital organs such as the heart, brain, kidneys, and eyes.

   - The good news is that you can usually control your blood pressure and reduce your risk of serious health problems.