FINALS ASSIGNMENT #2
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

GUIDE QUESTIONS:

Discuss the following

1. Cardiac Output
   a. Regulation of Cardiac Rate
      - The two branches of the autonomic (involuntary) nervous system control heart rate. The sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS) are two types of nervous systems (PNS). To increase heart rate, the sympathetic nervous system (SNS) releases hormones (catecholamines epinephrine and norepinephrine). To slow the heart rate, the parasympathetic nervous system (PNS) releases the hormone acetylcholine. Stress, caffeine, and excitement can all temporarily increase your heart rate, whereas meditating or taking slow, deep breaths can help to slow it down.
   b. Regulation of Stroke Volume
      - The volume of blood pumped from the left ventricle per beat is referred to as stroke volume (SV). Stroke volume is calculated by subtracting the volume of blood in the ventricle at the end of a beat (called end-systolic volume) from the volume of blood just prior to the beat using echocardiogram measurements of ventricle volumes (called end-diastolic volume). The term stroke volume can refer to either of the heart's two ventricles, but it usually refers to the left ventricle. In a healthy 70-kg man, the stroke volumes for each ventricle are roughly equal, both being around 70 ml.

        Stroke volume is an important determinant of cardiac output, which is calculated as the product of stroke volume and heart rate, and it is also used to calculate ejection fraction, which is calculated as stroke volume divided by end-diastolic volume. Stroke volume correlates with cardiac function because it decreases in certain conditions and disease states.
   c. Venous Return
      - Venous return is the flow of blood from the periphery back to the right atrium, and it is equal to cardiac output except for brief periods. Because clinicians and researchers have long observed that factors affecting primarily the venous side of the circulation

can have a significant impact on cardiac output, mechanisms governing blood flow to the heart have been thoroughly studied. However, full comprehension of the venous side has been difficult due to the complexity of some of its characteristics.

2. Blood Volume
   a. Exchange of Fluid Between Capillaries and Tissues
      - Fluids, gases, nutrients, and wastes are exchanged between the blood and body tissues via diffusion through capillaries. Small pores in the capillary walls allow certain substances to pass into and out of the blood vessel. The blood pressure within the capillary vessel (hydrostatic pressure) and the osmotic pressure of the blood within the vessel control fluid exchange. High concentrations of salts and plasma proteins in the blood produce osmotic pressure. Capillary walls allow water and small solutes to pass through but not proteins.
   b. Regulation of Blood Volume by the Kidneys
      - The kidneys control extracellular fluid volume (ECFV) homeostasis by controlling sodium and water balance. Simply put, increasing sodium and water consumption raises ECFV, which raises blood volume. This causes atrial stretch and increases cardiac output, raising systemic blood pressure.
3. Vascular Resistance to Blood Flow
   a. Physical Laws Describing Blood Flow
      - The blood flows depending on where it comes from, and the first is in the lung, then the artery where the oxygen-rich blood passes and distributes to the body organs, then the veins where oxygen-depleted blood flows and returns to the heart and goes back to the lungs, and the blood flow cycle continues.
   b. Extrinsic Regulation of Blood Flow
      - Neuronal, humoral, reflex, and chemical regulatory mechanisms are examples of extrinsic cardiovascular system controls. These extrinsic controls maintain cardiac output, blood flow distribution, and arterial blood pressure by regulating heart rate, myocardial contractility, and vascular smooth muscle. Complex interactions between these control mechanisms are required for the integration and regulation of cardiovascular functioning.
   c. Paracrine Regulation of Blood Flow
      - Blood flow is regulated by paracrine mediators released by blood elements and endothelial cells. Platelets release thromboxane A2, thrombin, and serotonin, which cause vascular smooth muscle contraction in the absence of intact endothelium.
   d. Intrinsic Regulation of Blood Flow
      - Tissues and organs in the body can intrinsically regulate their own blood supply to varying degrees in order to meet their metabolic and functional needs. This is referred to as blood flow localization or intrinsic regulation. Local blood flow regulation is controlled by a variety of mechanisms.
4. Blood Flow to the Heart and Skeletal Muscles
   a. Aerobic Requirements of the Heart
      - Walking at a fast pace, running, swimming, cycling, playing tennis, and jumping rope Doctors recommend at least 150 minutes of moderate activity per week, which includes heart-pumping aerobic exercise.
   b. Regulation of Coronary Blood Flow

  - Blood flow is primarily regulated by local intrinsic regulation, most likely through the production of vasodilating metabolites in response to minor degrees of ischaemia. In most cases, local regulation appears to take precedence over remote regulation. The distribution of blood flow to the myocardium is depth dependent as well as regionally variable.

c. Regulation of Blood Flow Through Skeletal Muscles
  - The regulation of blood flow to skeletal muscle is inextricably linked to the metabolic demand for oxygen, with a change in oxygen requirement causing a proportional change in blood flow. The precise regulation of blood flow serves to reduce heart work while ensuring adequate oxygen supply to the working muscle.

d. Circulatory Changes During Exercise
  - As pulmonary and systemic vascular resistance to blood flow is reduced, the large changes in cardiac output and increases in blood pressure during exercise are maintained within relatively smaller limits. During exercise, redistribution of blood flow to working muscles also contributes significantly to the efficient delivery of oxygen to sites of greatest need.

5. Blood Flow to the Brain and Skin

a. Cerebral Circulation
  - The movement of blood through a network of cerebral arteries and veins that supply the brain is referred to as cerebral circulation. In an adult human, cerebral blood flow is typically 750 milliliters per minute, or about 15% of cardiac output. Arteries supply the brain with oxygenated blood, glucose, and other nutrients. Veins transport “used or spent” blood back to the heart, where carbon dioxide, lactic acid, and other metabolic products are removed.

b. Cutaneous Blood Flow
  - The amount of heat lost to the environment is determined by cutaneous blood flow. Sympathetic efferent pathways to skin vessels are activated when skin or core temperatures fall. These pathways begin in the rostral MnPO. Warm skin or core activates a descending GABAergic pathway, which is relayed indirectly to inhibit medullary raphé premotor neurons.

6. Blood Pressure

a. Baroreceptor Reflex
  - The baroreflex, also known as the baroreceptor reflex, is a homeostatic mechanism that helps to keep blood pressure at nearly constant levels. The baroreflex creates a rapid negative feedback loop in which increased blood pressure causes a decrease in heart rate.

b. Atrial Stretch Reflexes
  - The Bainbridge reflex, also known as the atrial reflex, is a rise in heart rate caused by a rise in central venous pressure. Stretch receptors located at the venoatrial junctions in both atria detect increased blood volume.