**IQRA NATIONAL UNIVERSITY**

**DEPARTMENT OF ALLIED HEALTH SCIENCES**

**Final-Term Examination (Summer)**

**DPT 2nd semester**

**Course Title: Physiology Instructor: Dr Sara Naeem**

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**Time: 4hrs Max Marks:50**

**Q1. Explain the functions of blood in the human body.**

**Ans:** In human body blood plays an important role. Blood is a specialized body fluid. It has four major components.

* Plasma
* Red blood cells
* White blood cells
* Platelets

**Functions:**

* Transports oxygen and nutrients to the lungs and tissues
* Forming blood clots to prevent excess blood loss
* It carry cells and antibodies that fight infection
* It brings waste products to the kidneys and liver, which filter and clean the blood
* It also regulates body temperature.

The blood that runs through the veins, arteries, and capillaries is known as whole blood, a mixture of about 55 percent plasma and 45 percent blood cells. About 7 to 8 percent of your total body weight is blood. An average-sized man has about 12 pints of blood in his body, and an average-sized woman has about nine pints.

**Q2. What is hypoxia? What are the types of hypoxia? Explain.**

**Ans:** The term hypoxia is a condition where the tissues are not oxygenated adequately, usually due to an insufficient concentration of oxygen in the blood.

**Types of hypoxia:**

* Hypoxia can be classified as local if it is affecting a specific area of the body and generalized if it involves the whole body. When there is a complete deprivation of oxygen supply in the body the term anoxia is used.

Four types of hypoxia:

* **Hypoxic hypoxia or generalized hypoxia**
* **Anemic hypoxia**
* **Histotoxic hypoxia**
* **Stagnant hypoxia**

**Hypoxic hypoxia or generalized hypoxia;**

* Hypoxia resulting from an inadequate saturation of blood oxygen due to a reduced supply of oxygen in the air, decreased lung ventilation or respiratory disease.
* This type of hypoxia, the partial pressure of oxygen in the arterial blood (paO2) is lower than normal. Some of the causes of hypoxic hypoxia include:
* A high altitude, where the concentration of atmospheric oxygen is decreased.
* Deep sea diving if there is an inadequate supply of oxygen in the breathing gas or if a rusting cylinder has extracted oxygen, for example.
* The inhalation of nitrous oxide or laughing gas on a repeated basis for recreational purposes can decrease oxygen availability while increasing carbon dioxide levels.
* Sleep apnea or obstructive sleep apnea can interrupt airflow to the lungs.
* Certain diseases such as bronchial asthma, respiratory arrest, chronic obstructive pulmonary disease causing inadequate ventilation of the lungs.

**Anemic hypoxia**

* When the capacity of the blood to carry oxygen is reduced and inadequate levels of oxygen are therefore circulated around the body.
* Examples of causes include anemia and a decreased amount of oxygenated hemoglobin
* Carbon monoxide poisoning where the receptors that usually carry oxygen are blocked by the carbon monoxide and the use of certain medications which can alter the receptors present on red blood cells and affect their ability to carry oxygen.

**Histotoxic hypoxia**

* This refers to when oxygen is delivered to the tissues but they fail to utilize it effectively because the cells are damaged and cannot extract and absorb oxygen from circulating blood.
* This may occur with the overuse of alcohol or drugs and is also seen in cyanide poisoning. Cyanide disrupts cytochrome oxidase, an important enzyme in cell respiration.

**Stagnant hypoxia**

* This arises from a decrease in blood flow preventing adequate blood supply to tissues.
* Heart Attack, heart failure, or cardiac arrest, for example, can slow the circulation of blood meaning inadequate oxygen is delivered to important tissues and organs.

**Q3. Explain**

**Ans:**

**Nervous Regulation of Respiration:**

Involuntary respiration is controlled by the respiratory centers of the upper brainstem (sometimes termed the lower brain, along with the cerebellum). This region of the brain controls many involuntary and metabolic functions besides the respiratory system, including certain aspects of cardiovascular function and involuntary muscle movements (in the cerebellum). The respiratory centers contain chemoreceptors that detect pH levels in the blood and send signals to the respiratory centers of the brain to adjust the ventilation rate to change acidity by increasing or decreasing the removal of carbon dioxide (since carbon dioxide is linked to higher levels of hydrogen ions in blood). There are also peripheral chemoreceptors in other blood vessels that perform this function as well, which include the aortic and carotid bodies.

These three types of nerves continue the signal of the ascending respiratory pathway from the spinal cord to stimulate the muscles that perform the movements needed for respiration

1. The phrenic nerves: The nerves that stimulate the activity of the diaphragm.
2. The vagus nerve: Innervates the diaphragm as well as movements in the larynx and pharynx.
3. The posterior thoracic nerves: These nerves stimulate the intercostal muscles located around the pleura

**Chemical Control of Respiration:**

The chemical regulation of respiration concerns the hydrogen ion content of the respiratory neurons which in turn is dependent upon the carbon dioxide tension of the blood and the rate of flow of blood through the medulla Variations in blood oxygen tension under normal conditions are not thought to be concerned with direct regulating effects on the respiratory neurons. In severe anorexia, however, the respiratory neurons are probably directly depressed as a result of anoxia.

Peripheral chemoreceptors

Carotid and aortic bodies Discovered by Heymans C and Neil E in 1930. Carotid body near the carotid bifurcation on each side, and usually two or more aortic bodies near the arch of the aorta. These chemoreceptors increase their firing rate in response to increased arterial pCO2, decreased arterial PO2, or decreased arterial ph. Carotid and aortic body (glomus) contains islands of two types of cells, type I and type II cells, surrounded by fenestrated sinusoidal capillaries

**Central chemoreceptor:**

Also known as medullary chemoreceptorLocated on the ventral surface of medulla near VRG.Stimulated by the H+ concentration of CSF and brain interstitial fluid.Magnitude of stimulation is directly proportional to H+ concentration, which increases linearly with arterial pCO2.Gets inhibited by anesthesia, cyanide and sleep.

**Q4. What are the functions of thyroid gland.**

**Ans: Functions of thyroid gland:**

1. Basal Metabolic Rate
2. Gluconeogenesis
3. Glycogenolysis
4. Protein synthesis
5. Lipogenesis
6. Thermogenesis

Nervous System:

• Promotes growth and development of the brain (fetal life & for the first few years)

• Essential for normal myelination & development of the nervous system in infant

• Increased response of the brain to catecholamine’s & increases activation of RAS.

* This is achieved in a number of ways, such as increasing the size and number of mitochondria within cells, increasing Na-K pump activity and increasing the presence of β-adrenergic receptors in tissues such as cardiac muscle.

**Q5. Explain erythropoiesis in detail.**

**Ans:** Erythropoiesis from Greek 'erythro' meaning "red" and 'poiesis' meaning "to make" it is the process which produces red blood cells called erythrocytes, which is the development from erythropoietic stem cell to mature red blood cell.

**Or**

* The formation of red blood cells in blood-forming tissue. In the early development of a fetus, erythropoiesis takes place in the yolk sac, spleen, and liver. After birth, all erythropoiesis occurs in the bone marrow

**Areas for RBCs Production:**

Primitive RBCs are produced in the yolk sac Liver is the main organ in the middle trimester Some are also formed in spleen and lymph nodes Last month of gestation, bone marrow is chief organ for RBCs

**Genesis of Blood Cells:**

Pluripotential hematopoietic stem cells form different circulating blood cells Some cells are retained in the bone marrow to maintain a supply of these Intermediate stage cells also known as committed stem cells

**Stages of Differentiation of RBCs:**

* Proerythroblast
* Basophil erythroblast
* Polychromatophil erythroblast
* Orthochromatic erythroblast
* Reticulocyte
* Erythrocytes

**Erythropoietin:**

* Principle stimulus for RBC production A hormone, MW of about 34000 In its absence hypoxia has very little effect to stimulate RBCs production Relieves hypoxia by enhancing RBCs. Stimulates production of proerythroblasts from HPSC.
* Rapid production of cells within 24 hours, yet no new RBC until about 5 days
* Iron and other nutrients causes RBCs production up to 10 times, it is a powerful mechanism Vitamin B12 and folic acid is required for the maturation of RBCs Essential in synthesis of DNA by formation of thymidine triphosphate Failure , in case, leads of nuclear maturation and cell division Maturation failure