

Physiological Mechanism of External and Internal Respiration

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Abstract: This article provides a detailed analysis of the physiological mechanisms of external and internal respiration in the human body. The biomechanical basis of breathing, alveolar gas exchange, the role of hemoglobin in oxygen and carbon dioxide transport, cellular oxidative phosphorylation, ATP synthesis, and the neurohumoral regulation of the respiratory center are examined. The study also incorporates insights from both foreign and Uzbek scientists to support key theoretical conclusions.

Keywords: External respiration, internal respiration, alveolus, gas exchange, hemoglobin, oxidative phosphorylation, respiratory center, ATP, cellular metabolism.

Introduction: Respiration is a vital process that ensures the metabolic needs of the organism. It occurs on two levels: external and internal. External respiration involves the exchange of oxygen and carbon dioxide between pulmonary alveoli and capillary blood. Internal respiration refers to the delivery of oxygen from the blood to tissues and the production of energy in cells through oxidative phosphorylation. According to the American physiologist Arthur C. Guyton, respiration is an integrative system serving the metabolic requirements of the body. He emphasizes that the respiratory system works in close coordination with the cardiovascular system and other organ systems. Uzbek researchers have also explored the complex mechanisms of respiration, analyzing its variations under physiological and pathological conditions (Ahmedov X., 2010; Tursunov K., 2015).

I. Physiological Mechanism of External Respiration.

1. Biomechanics of Inhalation and Exhalation. External respiration is facilitated by changes in thoracic cavity volume. Inhalation (inspiration) and exhalation (expiration) are driven by the diaphragm and intercostal muscles. Inhalation-the diaphragm contracts and moves downward, while the external intercostal muscles contract, increasing thoracic volume. This lowers intrapulmonary pressure, allowing air to flow into the lungs. Exhalation -the diaphragm and intercostal muscles relax, reducing thoracic volume

and expelling air from the lungs. Russian physiologist Ivan Pavlov explained this process through reflex control mechanisms, noting that respiratory rhythm is regulated by the central nervous system and adapts to internal and external environmental changes.

The main task of primary school educational activities is to teach students to learn. Under the influence of education, serious changes occur in the mental development of children of primary school age. In other words, the psyche affects the production of neurotransmitters, and neurotransmitters control the life activities of the whole organism.

2. Alveolar Gas Exchange. The alveolar walls are extremely thin and closely surrounded by capillaries. Oxygen diffuses from the alveoli into the blood, while carbon dioxide diffuses in the opposite direction. Gas exchange efficiency depends on:

1. Partial pressure differences between alveoli and capillaries
2. The surface area of the alveoli
3. The balance between ventilation and perfusion (V/Q ratio)
4. Hemoglobin's oxygen-binding capacity

American physiologist John B. West demonstrated that the V/Q balance determines the efficiency of alveolar gas exchange. Hemoglobin binds oxygen and transports it to tissues.

II. Physiological Mechanism of Internal Respiration.

1. Gas Exchange in Tissues. Internal respiration involves the diffusion of oxygen from blood into cells. Oxygen reaches mitochondria and participates in oxidative phosphorylation. The German biochemist Hans Krebs discovered the Krebs cycle (citric acid cycle), the central stage of cellular respiration, in which substrate oxidation generates ATP, providing energy for cellular functions.

2. Cellular Oxidation and Energy Production. Within cells, oxidation occurs through the electron transport chain. British biochemist Peter Mitchell proposed the chemiosmotic theory, explaining that ATP synthesis is driven by the proton gradient. Internal respiration thus supplies energy required for all vital cellular activities. The educational process of medical students is accompanied by high intellectual and psycho-emotional stress, which increases the likelihood of developing psychological problems such as stress, anxiety, and depression.

In the educational process, a teacher's reflective skill has a significant impact on students' personal development. Reflective teachers understand their emotions and show empathy for them. In other words, the psyche affects the production of neurotransmitters, and neurotransmitters control the life activities of the whole organism. The main task of primary school educational activities is to teach students to learn. Under the influence of education, serious changes occur in the mental development of children of primary school age.

Anxiety about somatic disorders can lead to hypochondriacal feelings, which also contribute to malnutrition. Thus, a kind of vicious circle arises in the form of anorexic cycles, when chronic starvation causes changes in the internal organs, leading, in turn, to food restrictions. In some cases, patients begin to be actively examined by various specialists, exaggerating the severity of somatic disorders and avoiding consultation with a psychiatrist. Therefore, emphasis should be placed on the development of emotional stability of parents and the development of a single strategy of upbringing, which is dominated by methods of support and reward.

The family environment has the greatest psychogenic effect on children's psychology. Since there are Overall, adopting a biopsychosocial perspective enhances the understanding of how persistent somatic symptoms develop and are maintained, and informs more effective clinical strategies for diagnosis, treatment, and prevention.ften disagreements, constant quarrels, and abuse

between parents, children who lack maternal love and care experience psychological stress.

III. Regulation of Respiration.

The respiratory center, located in the medulla oblongata and pons, regulates breathing via reflex and humoral pathways:

Reflex control: Respiratory rhythm is coordinated by reflex activity of the diaphragm and thoracic muscles.

Humoral control: Blood levels of CO₂, O₂, and pH stimulate or inhibit the respiratory center.

Uzbek physiologist Xudoybergan Ahmedov studied vegetative control of respiration and its adaptation to environmental changes. Komiljon Tursunov examined the mechanisms of impaired gas exchange under pathological conditions, contributing to clinical physiology research.

CONCLUSION

External and internal respiration are closely interconnected and form a complex physiological system. External respiration ensures the entry of oxygen into the blood and the removal of carbon dioxide through alveolar ventilation and diffusion, while internal respiration generates energy at the cellular level through oxidative phosphorylation. In addition, hemoglobin's function in transporting oxygen and carbon dioxide, ATP synthesis in mitochondria, and overall cellular metabolism operate in a coordinated and integrated manner.

The neurohumoral regulation of the respiratory center, through reflex and humoral mechanisms, coordinates gas exchange in the lungs and tissues, and allows rapid adaptation to environmental conditions and physiological demands. This process helps to understand the causes of the disease more deeply. In other words, the psyche affects the production of neurotransmitters, and neurotransmitters control the life activities of the whole organism.

Modern physiology studies respiration at molecular, cellular, and systemic levels, aiming to elucidate its regulatory mechanisms, pathological alterations, and clinical significance. This knowledge contributes to the prevention and treatment of respiratory system disorders and supports the development of new diagnostic and therapeutic methods.

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