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Respiratory System Physiology Study

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Annotation: In this article, the essence, stages and mechanism of breathing. Types of breathing, speed. Ventilation coefficient of the lungs. Gas exchange in the lungs. Transport of gases with blood. Oxygen capacity of blood. The control of the respiratory process and the influence of various factors on it are suppressed.

Keywords: Breath, external breath, internal breath, oxygen, carbon dioxide, lungs, nasal cavity, oral cavity, throat, larynx, larynx, bronchi, alveoli, external and internal dentate muscles, elasticity, negative pressure, inspiration, expiration, vital air capacity, total air capacity, dead space, ventilation coefficient, minute ventilation volume, gas exchange, gas transport.

Breathing is a physiological act that includes a number of biochemical processes that ensure the release of carbon dioxide gas and water as a result of the consumption of oxygen in the tissues.

Energy is needed for various physiological processes in the body. This energy is mainly produced as a result of oxidation-reduction processes in the body. Oxidation processes occur in the presence of oxygen.

Therefore, for the life-activity of all the cells in the body, the breathing process must take place all the time.

In highly developed organisms, the respiratory process consists of the following stages: External breath: air exchange between the external environment and the alveoli of the lungs; gas exchange between alveolar air and blood. Transport of gases by blood: transport of oxygen from lungs to tissues by blood; transport of carbon dioxide from the tissues to the lungs by blood. Internal respiration: exchange of gases between blood and tissues; cells consume oxygen and release carbon dioxide - cellular respiration. Therefore, the lungs participate only in external respiration, that is, gas exchange between the external environment and the blood.

The lungs are a well-developed pair of organs connected to the external environment through the nasal and oral cavities, throat, larynx, larynx, and bronchi. The bronchi branch and form bronchioles, which end with air bubbles - alveoli. In the wall of the alveoli, the capillaries collide and form a mesh.

The wall of alveoli and capillaries consists of a single layer of cells, which is a very good condition for the exchange of gases between them. In order for gases to be exchanged through the lungs, they must constantly expand and contract. But it does not have special muscles that can ensure its expansion and contraction. But since it is located in the closed cavity of the chest, it expands when the chest expands, and when it narrows, it narrows and contracts. Therefore, the lung follows the active movement of the chest and moves passively. Such a movement appears with the birth of an animal.

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Physiology of the first breath. When a baby animal is born, the umbilical cord is cut and immediately the contact between the baby and the mother ceases. As a result, carbon dioxide accumulates in the child's blood, its amount increases and stimulates the respiratory center. Impulses generated in the respiratory center due to excitation cause contraction of the external intercostal muscles in the chest. As a result, the chest expands, the heads of the ribs fall into the corresponding cavities of the vertebrae and do not come back out for life. A negative pressure is created inside the chest and it is less than the pressure of the external environment (atmosphere) by 6-15 mm Hg. As a result, oxygen from the external environment begins to enter the lungs, and the baby animal breathes for the first time.

Inhalation and exhalation mechanism. Breathing is called inspiration, exhalation is called exhalation. Breathing mechanism. Breathing occurs due to the expansion of the chest in width, length and height due to the contraction of the intercostal external dentate muscles. At this time, the sternum is pulled down, and the diaphragm is pulled towards the abdomen. As a result, the lungs expand from the side of the chest, the pressure inside it decreases and air is sucked into it. Air inhalation continues until the pressure inside the lungs equals the atmospheric pressure. The intercostal external dentate muscles involved in the expansion of the chest are called inspiratory muscles. When inhalation ends, exhalation begins.

Breathing mechanism. Exhalation occurs due to the contraction of the intercostal internal dentate muscles due to the narrowing of the chest in width, length and height. At this time, the sternum and diaphragm regain their previous position. As a result, following the path of the chest, the lungs are also narrowed and air is expelled from it. The internal intercostal tooth-like muscles involved in the narrowing of the chest are called expiratory muscles. Therefore, the processes of inhalation and exhalation continuously manage and ensure each other's activity.

There are 3 types of breathing: Chest-rib breathing. Abdominal-diaphragmatic breathing. Mixing, that is, chest-belly breathing. Chest-rib breathing is observed in dogs and women. Abdominal diaphragm breathing is observed in men. Mixed respiration is observed in farm animals.

Types of breathing can change during various physiological states and diseases of the body. For example, animals breathe in the thoracic-rib type during suffocation, and in the abdominal-diaphragm type in case of lung diseases.

The rate of respiration (frequency) is different in animals and birds.

Respiration rate depends on the following factors: Type of animal. To the jussa of animals. To the breed of animals. To the age of animals. To the sex of animals. To the productivity of animals. To the physiological condition of animals. To the speed (intensity) of metabolism. To the season of the year. It depends on the temperature of the external environment and others. For example, breathing rate is faster in small animals than in large animals, in young animals than in older animals, in animals with high productivity, breathing is faster than in animals with low productivity and vice versa.

Ventilation coefficient of the lungs. Not all inhaled air reaches the alveoli of the lungs. About 30% of it remains in the upper respiratory tract and does not participate in gas exchange in the lungs. This air is called "harmful" or "dead" space air.

This air is very important for the respiratory process and the body. Because it ensures that the inhaled air is heated, cleaned and saturated with water vapor in the upper respiratory tract. If such tasks were not performed in the upper respiratory tract, various diseases would have arisen in the respiratory system and in the body as a whole.

The ventilation coefficient of the lungs is the ratio of the part of the inhaled air reaching the alveoli of the lungs to the air in the alveoli. For example, if a horse takes 5 l of air every time, 30% or 1.5 l of this air is retained in the upper respiratory tract, and the remaining 3.5 l air reaches the alveoli of the lungs. If we assume that the amount of alveolar air in horses is 22 l, then the ventilation coefficient of

the lungs is 3.5:22=1.6. Therefore, every time the animal breathes, 1 part of the alveolar air is exchanged with inhaled air.

The volume of air taken into the lungs in one minute is called the minute ventilation volume of the lungs. To the volume of minute ventilation of the lungs: the speed of respiratory movements. Animal nutrition. Time of day. Season of the year. Physiological state of the body, speed of metabolism, etc. are affected. For example, lung ventilation increases 5 times when a horse trots, and 8 times when it walks gently. The minute ventilation volume of the lungs cannot fully express the state of lung ventilation.

Gas exchange in the lungs. There is continuous gas exchange between alveolar air in the alveoli of the lungs and blood in the capillaries of the alveolar walls. Gases move from a place of high partial pressure to a place of low partial pressure according to the phenomenon of diffusion. So, gases pass from alveolar air to blood and from blood to alveolar air in the lungs. The partial pressure of gases is the part of the total pressure of a mixture of gases corresponding to a certain percentage of gas in the mixture.

Transport of gases by blood. One of the most important functions of the blood in the body is the transport of gases, that is, the transport of O2 from the lungs to tissues and cells, and SO2 from the tissues and cells to the lungs.

Blood does not completely deliver SO2 in the lungs, and O2 in the tissues. Certain amounts of O2, SO2, and N2 are constantly circulating throughout the body in the blood.

The transport of gases by blood depends on their position in the blood.

Gases in the blood exist in 2 different states: Physically dissolved, in a free state. In a chemically bonded state. In the blood, 0.3% of O2 is dissolved, 99.7% is in the combined state, 2.7% of SO2 is dissolved, 97.3% is in the combined state, and the amount of N2 is equal to 1%, only in the dissolved state. Therefore, a part of blood gases is dissolved in plasma, and the main part is transported combined with hemoglobin (Nb) contained in erythrocytes.

According to Henry's law, the solubility of gases in liquids depends on their nature, partial pressure, and liquid temperature. The volume of a certain gas that can dissolve in 1 ml of liquid under standard conditions at a temperature of 0o and a pressure of 760 mm of mercury column is called the gas solubility coefficient.

The lower the temperature of the liquid and the higher the pressure of the gas, the more gas dissolves in that liquid and vice versa. When the body temperature is normal and the pressure is equal to 760 mm Hg, the solubility coefficient of gases in the blood plasma is as follows: Oxygen - 0.022. That of carbon dioxide is 0.511. Nitrogen - 0.011. Nitrogen solubility coefficient can fully express its amount in blood. The coefficient of dissolution of oxygen and carbon dioxide in the blood cannot fully represent the amount of these gases in the blood. If oxygen and carbon dioxide were only dissolved in the blood, according to their solubility coefficient, the amount of O2 in the blood would not exceed 0.3%, and that of SO2 would not exceed 2.7%.

But, in fact, arterial blood contains 20% oxygen, 30-40% carbon dioxide, venous blood contains 12% oxygen and 50-55% carbon dioxide. Therefore, this indicates that less of the O2 and SO2 in the blood is freely dissolved and more of it is chemically bound.

Oxygen capacity of blood. One of the remarkable properties of hemoglobin in the blood is that it easily binds oxygen in places of high partial pressure - in the lungs, and in places of low partial pressure - in the tissues, it easily separates it from itself. The oxygen capacity of the blood is the amount of oxygen needed to fully convert hemoglobin in 100 ml of blood into oxyhemoglobin. it is said. When 1 gram of hemoglobin becomes fully oxyhemoglobin, it binds 1.34 cm2 of oxygen. If we take into account that the blood of various farm animals contains an average of 13-15 grams of hemoglobin and multiply it by 1.34 cm2, the oxygen capacity of their blood is on average 17.32 - 20.0 cm2.

Knowing the oxygen capacity of the blood, it is possible to determine the amount of O2 in the blood freshly taken from the blood vessel and think about how saturated this blood is with O2. If the blood is not well saturated with oxygen, various changes occur in the body. For example: Hypoxemia is a decrease in the amount of oxygen in the blood. Hypoxia is a decrease in the amount of oxygen in the tissues. Anoxia is a complete lack of oxygen to the tissues. If urgent measures are not taken in such cases, the organism will die. Therefore, it is impossible to reduce the animal organism to such conditions.

Breath control. Respiratory processes in the body are controlled in 2 different ways: Through the nervous system. Humorally. The main center that controls the activity of the respiratory system is located in the medulla oblongata, which was identified and studied by the Russian physiologist N.D. Mislavsky in 1885.

The center in the medulla oblongata consists of a pair of symmetrical parts, each of which controls the respiratory movements of the corresponding side of the thorax. Therefore, whichever side of the respiratory center is damaged, breathing movements on that side of the chest stop. The secondary lower center that controls breathing is located in the cortex of the spinal cord and cerebral hemispheres.

The respiratory center is excited and responds to the influences coming from different parts of the body: from the lungs, the wall of blood vessels, the sinuses of the carotid arteries, the pleura and other organs through the corresponding fibers of sympathetic and parasympathetic nerves.

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