

Lungs as the Source of Oxygen and Oxygen as the Only Source of Energy for Vital Activity

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Lungs are the reservoir of oxygen and, consequently, the source of life. The vital capacity of lungs is about 4800 ml of air containing 960 ml of oxygen. Oxygen incessantly transfers to the blood, where it reacts with hemoglobin. Up to now even an ultimately simplified mechanism of this process presented a large problem, was an enigma many eminent physiologists were fighting with. According to our studies each alveolus in the lungs is the most complex apparatus for saturating the blood with oxygen. It consists of veins from 20 to 50 microns in diameter and even more, which surround each alveolus by a closed ring. By our data the blood of these veins flows in a special volume of the alveolus through the holes in the veins. This volume constitutes a space between the outer coating of the alveolus and its internal thinnest coating. The width of this space is from 2 to 4 microns. The blood in this layer is saturated with oxygen from the air through a thinnest (0.60 microns) internal coating of the alveolus, which is located between the blood layer in this space and the air inside the alveolus. Given the blood flow rate through the lungs 5.5 - 6 liters per minute the blood gets saturated from 40 to 90 % in about 3.5 seconds. The rate of saturation increases owing to a constant rotation of the blood in the space between the outer and inner coatings. We see this rotation quite distinctly with the help of our special contact microscope.

The experiments were carried out on rats under light anesthesia. We made an opening a little larger than a pin head in the side of an animal above the lung. A micro incision of the pleurisy was made through this opening. The objective (1.3 mm in size) of the contact microscope was introduced through this opening. A luxurious colored picture was seen – 8 - 12 alveoli with all their details. Therefore all our observations were carried out under strictly physiological conditions (see *Respiratory and Neurobiology*, 187, 26-30. 2013, and so on).

The respiration and energetics of homoeothermic animals and humans is based on oxidation of proteins, carbohydrates, and fats, which are fed by intestines, with oxygen. The role of oxygen in the energetics is clear. With the help of this energy in the tissue cells ATP molecules are synthesized, which upon splitting incessantly feed various vital processes at the sites of their location in an organism with energy and even can create its small reserves in the cells. The question arises how the lung respiration compensates oxygen deficit, which underlies many human illnesses, muscle activity of humans and animals, occurs in the underwater swimming, during the respiration inhibition for an hour and more in some floating mammals, during continuous life of a man and animals at high altitudes in the mountains, etc. In the modern science about respiration and life of humans and homoeothermic animals there are two axioms. Here are they:

1. In the organism of humans and of highest animals a sufficient amount of energy for maintaining and development of life can be obtained only with the help of oxidation with oxygen of the nutrition products, i.e. proteins, fats, and hydrocarbohydrates. This energy is concentrated in ATP and then is spent in the cells at the sites of its consumption in an organism.
2. In the process of oxidation reactions in the living organisms of humans and highest animals oxygen cannot be replaced by any substance or compound.

These two axioms exclude the possibility to consider any substances as the donors of energy but for oxygen. Oxygen is contained in sufficiently large amount only in the blood. Consequently, resuscitation of normal lung respiration after oxygen deficit may occur only

with the help of increasing the blood flow as the result of widening the vessels bringing in the blood and of increasing the blood pressure. On the other hand, a decrease in the amount of oxygen in the blood may result in a reflective activation of indirect circulation in the brain, heart, and other organs. Therefore, hypoxemia or anoxia can be compensated only by the circulation.

Of course, there is also glycolysis. This oxygen-free energy source is 16 times less in its power than the oxygen source and cannot replace it. After an abrupt arrest of circulation in the brain a man dies from the arrest of respiration in 4-5 minutes, in this case the reserve of sugar in an organism is not yet exhausted and the glycolysis is still possible. One cannot but emphasize a large discrepancy between the scientists about compensation of oxygen deficit in the brain and heart. From 1986 to 2012 an effect of preconditioning or resuscitation the brain and heart functions after a short-term cut off of circulation in these organs has been lively discussed. At least 2000 works was published making various fantastic assumptions about the mechanism of oxygen deficit compensation (Murry, 1986; Chicherin, 2003; Giddey, 2006; Obrenovich, 2008; Shlyakhto, 2012; Samoilov and Rybnikova, 2012; Lishmanov, 2015; and so on). But almost no authors of thousands analyzed in sufficient details the role of circulation in the preconditioning. The most fantastic and proved by nothing assumption concerned an "antihypoxic factor" resulting in the tissues during hypoxia, which somehow replaces the lack of oxygen.

Such is the far from irreproachable story of studying respiration with oxygen of humans and animals, which nowadays is clogged with a number of incorrect conclusions and false assumptions. It is incorporated into a great problem of adaptation of various organisms to oxygen deficit in the environment and in an organism and makes up the basis of the life in our planet.

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