

DYNAMICS AND CONTROL OF RESPIRATION

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Contents

1. Introduction
 2. Dynamics of Respiration
 3. Control of Respiration
- Glossary
Bibliography
Biographical Sketches

Summary

Ventilation of the lungs occurs as a result of rhythmic contractions of respiratory muscles, which cause an increase of volume of the chest and lungs. The respiratory muscles need to overcome the combined resistance of the respiratory organs, and the interactions of these two forces determine the *dynamics of respiration*.

Breathing frequency and depth are regulated by many chemical and neural mechanisms. Sensory cells of the respiratory system receive information about lung inflation and effort of the respiratory muscles, as well as changes in the characteristics of arterial blood, sending signals to the respiratory center. Rhythmic discharges are then passed to the spinal cord motoneurons, innervating respiratory muscles, to provide a continuous gas exchange in the lungs.

1. Introduction

Respiration is a cyclic process of gas exchange between atmospheric air and alveoli of lungs. Its primary function is to maintain stable levels of partial pressures of oxygen and carbon dioxide in the alveolar gas, facilitating the exchange of oxygen and carbon dioxide in the blood (see the more detailed description in *Respiratory Structures and Gas Exchange*).

Lung ventilation occurs as a result of rhythmic contractions of respiratory muscles, which cause an increase of volume of chest wall and lungs. Breathing rhythm, frequency and depth and, hence, volume of ventilation are regulated by many chemical and neural mechanisms. *The Brainstem Respiratory Complex* is the main rhythm-generating mechanisms of automatic breathing.

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Biographical Sketches

Dr. Gennadi Isaev, MD, PhD, was born in 1935. In 1960, he graduated from Sverdlovsk Medical School and got his M.D. degree. Since 1986, he has been working as a head of the Laboratory of Respiratory Physiology at Pavlov Institute of Physiology of the Russian Academy of Sciences in St. Petersburg. G.G. Isaev is a well-known scientist in the field of both physiology and pathophysiology of respiration. He is a member of the Editorial Board of the Journal "Human Physiology", author of the book "Regulation of Breathing During Muscular Exercise". He is also one of the Editors-in-Chief of the Russian Handbook of Physiology (Respiratory Physiology). At present, his scientific activity is focused on study of respiratory regulation under conditions of modeling obstruction of the respiratory airway, as well as on analysis of fatigue of respiratory muscles. In 1998, he worked in Charing Cross Hospital, London, as an Invited Professor. His studies "Areas of the brain concerned with ventilatory load compensation in awake man" are supported by the Wellcome Trust.

Yrjö Salorinne, MD, PhD, is presently chief physician at the Department of Clinical Physiology and Nuclear Medicine at Helsinki University Hospital and associate professor of clinical physiology in the medical faculty of the University of Helsinki, Finland. His scientific work is mainly on respiratory physiology and lung diseases, and he is a co-author of many textbooks and reviews. He has been active in medical organizations and a co-editor of the Journal of Clinical Physiology.

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