Michael's® NATUROPATHIC PROGRAMS
HealthCare Solutions

LUNG FACTORS™

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RESPIRATION

Every 24 hours about 500 cubic feet of air passes through the breathing tract of the average adult, who breathes in and out between 12 and 18 times a minute.[1] Surprisingly, only about 10% of the air in the lungs is actually changed with each cycle of inhaling and exhaling when a person at rest is breathing, but up to 80% can be exchanged during deep breathing or strenuous exercise.[2]

Cells continually use oxygen for the metabolic reactions that release energy from the nutrient molecules and release carbon dioxide at the same time.[3] The cardiovascular and respiratory system participate equally in respiration to provide oxygen and expel the waste gases. The respiratory system provides for gas exchange, intake of oxygen and elimination of carbon dioxide, whereas the cardiovascular system transports the gases in the blood between the lungs and the cells.[4]

The exchange of gases between the atmosphere, blood and cells is respiration.[5] Specifically, the process includes ventilation (inhale/exhale), the utilization of oxygen by the tissues, and the giving off of carbon dioxide. It is, of course, not possible to have normal respiration exchange of oxygen and carbon dioxide in the lungs unless the pulmonary tissue is adequately diffused with blood.[6] The three basic processes of respiration are pulmonary ventilation, external (pulmonary) respiration, and internal (tissue) respiration.[7]

THE LUNGS

Although perceived as anatomical, identical twins, the two cone-shaped lungs are actually very different. The bi-lobed left lung contains a concavity, the cardiac notch or depression, in which the heart lies.[8] The three-lobed, right lung is broader and somewhat shorter than the left to accommodate the liver below.[9]

The two lungs (*lunge* = light, since the lungs float) are spongy organs lying in the thoracic cavity.[10] They collectively include the lobes, lobules, bronchi, bronchioles, infundibula, and alveoli or air sacs.[11] The lungs actually contain 300 million alveoli and their respiratory surface is equivalent to about 756 square feet for the exchange of gases.[12]

More than just inflatable air bags, the lungs perform a complex interaction for the body's cardiovascular and respiratory systems. Simply put, the lungs bring in air to be absorbed by the bloodstream while removing the carbon dioxide during the same exchange.

GROSS ANATOMY

The lungs occupy the lateral cavities of the chest, separated from each other by the heart and mediastinal (medial) structures.[13] They connect with the pharynx through the trachea and larynx. Each base rests on the diaphragm and the tops rise slightly above the first rib.[14]

Each lung consists of an external serous coat, subserous areolar tissue and lung parenchyma.[15] Two layers of serous membrane, collectively called the pleural membrane, enclose and protect each lung. The mediastinal surface of each lung contains a region, the hilus, through which bronchi, pulmonary blood vessels, lymphatic vessels, and nerves enter and exit.[16] These structures are held together by the pleura and connective tissue and constitute the root of the lung.[17]

FUNCTIONING OF THE LUNGS

The exchange of respiratory gases between the lungs and blood takes place by diffusion across layers of alveolar and capillary walls.[18] Despite the several layers, the alveolar-capillary membrane is extremely thin, just a fraction of the diameter of a red blood cell, allowing for rapid diffusion of respiratory gases.[19] Each alveoli is surrounded by a network of capillaries necessary for the gas exchange to take place.[20]

There are two types of blood reporting to the lungs. Deoxygenated blood passes through the pulmonary trunk, which divides into a left pulmonary artery that enters the left lung and a right pulmonary artery that enters the right lung.[21] The venous return of the oxygenated blood is by way of the pulmonary veins, typically two in number on each side—the right and left superior and inferior pulmonary veins.[22] All four veins drain into the left atrium.

Oxygenated blood is delivered through bronchial arteries, which branch directly from the aorta.[23] At this time the removal of carbon dioxide takes place and the blood exits via pulmonary veins.

VENTILATION

The intake of air into the lungs occurs because the air pressure inside the lungs is less than the air pressure in the atmosphere.[24] This condition is achieved by increasing the volume (size) of the lungs.

For inspiration (inhale) to occur, the lungs must expand. This increases lung volume and thus decreases the pressure in the lungs below atmospheric pressure. The first step in expanding the lungs involves contraction of the principal inspiratory muscles—the diaphragm and external intercostals.[25]

The diaphragm, **the most important muscle of inspiration**, is dome-shaped skeletal muscle that forms the floor of the thoracic cavity.[26] The base of the lung rests on the surface of the diaphragm and moves with the muscle, down during inhaling and up during exhaling.[27] Contraction of the diaphragm causes it to flatten, lowering its dome. This increases the vertical dimension of the thoracic cavity and accounts for the movement of about 75% of the air that enters the lungs during inspiration.[28]

Breathing out is called expiration (exhale). It starts when the inspiratory muscles relax. Normal expiration during quiet breathing, unlike inspiration, is passive process since no muscular contractions are involved.[29] It depends on two factors: (1) the recoil of elastic fibers that were stretched during inspiration and, (2) the inward pull of surface tension due to the film of alveolar fluid.

Expiration becomes active during labored breathing and when air movement out of the lungs is impeded.[30] Although the basic rhythm of respiration is set and coordinated by the brain's respiratory center, the rhythm can be modified in response to metabolic demands by nerve impulses to the center.[31] During this time, muscles of expiration—abdominal and internal intercostals—contract.

MUSCLE MECHANICS

The respiratory muscles cause respiration by alternatively compressing and distending the lungs, which in turn cause the pressure in the alveoli to rise and fall.[32] These muscles are attached to the ribs and by their contraction and relaxation alter the size of the thoracic cavity during normal breathing.[33] Beginning with the downward contraction of the diaphragm to increase the length of the lungs during inhalation, it is then possible, but not necessary, for the different abdominal muscles to contract to force the upward momentum of the diaphragm for exhalation.[34]

The seemingly small external and internal intercostals are responsible for the leveraged movement of the ribs in relation to inspiration and expiration.[35] During expiration the ribs extend in a downward direction from the spinal column, but during inspiration, the ribs extend almost directly forward rather than downward.[36] Therefore, muscles that elevate the chest cage can be classified as muscles of inspiration, and muscles that depress the chest cage as muscles of expiration.[37]

Ordinarily, expiration is an entirely passive process; that is, when the diaphragm relaxes, the elastic structures of the lung, chest cage, and abdomen, as well as the tone of the abdominal muscles, forces the diaphragm upward.[38] But, about 70% of the expansion and contraction of the lungs is caused by the anteroposterior movement of the chest cage and only about 30% by movement of the diaphragm.[39]

In addition to the principal muscles of respiration, the diaphragm and intercostals, there are several other accessory muscle groups helping with the task when necessary. Muscles with tongue-twisting names like the sternocleidomastoids, scapular elevators, scaleni, and anterior and posterior serrati also play a part in the mechanics of respiration.[40]

These muscles contract and relax as a

result of nerve impulses transmitted to them from centers in the brain. The area from which nerve impulses are sent to respiratory muscles is located bilaterally in the reticular formation of the brain stem and is referred to as the respiratory center.[41] The phrenic nerve is responsible for stimulating the diaphragm, while the intercostal nerves are responsible for innervation of both the internal and external intercostals.[42]

As soon as you start exercising, your rate and depth of breathing increase. The main stimulus for these quick changes in respiratory effort is thought to be input from proprioceptors, which monitor movement of joints and muscles.[43] Nerve impulses from the proprioceptors stimulate the inspiratory area of the medulla to compensate for the additional output.

RESPIRATORY RESISTANCE

The normal flow of air through the lungs meet with little resistance. Any condition that obstructs the air passageways increases resistance, and more pressure to force air through is required.[44] During a forced expiration, as in coughing, straining, or playing a wind instrument, intrapleural pressure may increase form its normally subatmospheric (negative) value to a positive one.[45] This greatly increases airway resistance because it results in compression of the airways.[46]

Seldom thought of as organs of expression, the lungs are actually responsible for the force behind a few methods of exhibiting emotions. Laughing, yawning, sighing and sobbing all get their start in the respiratory system.[47] Known as modified respiratory movements, they also include specialized forced actions such as coughing, sneezing and hiccuping. In fact, laughing and crying are the same basic movements—sometimes indistinguishable—but the rhythm of the movements and the facial expressions usually differ.[48] The spasmodic contractions of coughing and sneezing win the expiration power play with speeds sometimes exceeding 60 m.p.h. and 100 m.p.h. respectively.[49]

RESPIRATION & HOMEOSTASIS

Your body's cells continuously use oxygen for the metabolic reactions that release energy from nutrient molecules and produce ATP, the substance that provides energy for cellular activity.[50] At the same time, these reactions release carbon dioxide which must be eliminated from the body, because in excess, it is toxic to cells. The two systems that work together to achieve this are the cardiovascular system and the respiratory system participating equally. Failure of either system has the same effect on the body: disruption of homeostasis and rapid death of cells from oxygen starvation and buildup of waste products.[51]

Homeostasis is defined as balance and harmony within the body. It is a condition created when each cell in the body functions in an internal environment that remains within certain physiological limits. This condition is not a static state; rather it is through continuous physiological adjustments that the body is able to retain this stability.

Homeostasis can be achieved when the body: 1) has the proper amounts of gases, nutrients, ions and water; 2) maintains the optimal internal temperature and; 3) has an optimal fluid volume for the health of cells.[52] When homeostasis is disturbed, illness may result.

NUTRITIONAL NEEDS

It is quite obvious that the lungs depend upon muscular action in order to function properly. The act of respiration also requires proper nerve transmissions. This is all in keeping with the body's internal feedback systems. The ultimate goal of the respiratory system is to maintain the proper levels of carbon dioxide and oxygen, and the system is highly responsive to changes in the blood levels of either.[50]

The nutrients that play a role in proper nerve and muscle function are:

CALCIUM serves as the principal component of skeletal tissue, imparting to it structural integrity essential for support.[51] It also functions to influence neuromuscular excitability, transmission of nerve impulses and various essential physiologic and biochemical processes.[52] Calcium is essential for the function of nerves and muscles.[53]

VITAMIN D intake effects the absorption efficiency for calcium in the intestine.[54] Unless vitamin D is present as an activating substance, increased calcium intake does not affect the tissues or blood calcium levels.[55]

MAGNESIUM is a naturally occurring mineral found in muscles, bones and soft tissue.[56] It is involved in many enzymatic reactions in intermediary metabolism, including the contractibility of cardiac muscles and is essential for calcium transport and utilization.[57] Magnesium is also associated with regulation of body temperature, neuromuscular contraction, and synthesis of protein.[58]

IRON is best known for being an active part of hemoglobin formation, but is also a constituent of the muscle protein myoglobin and of a variety of proteins (enzymes) that speed up chemical reactions in the body.[59] Iron, as a component of hemoglobin, is essential in the transportation of oxygen.[60] It is needed for tissue respiration and the development of blood cells.[61] Additionally, it is also present in enzymes that permit cellular respiration to occur.[62]

VITAMIN B-6 serves as a coenzyme in reactions necessary for the formation of the neurotransmitters and neurohormones.[63] It is necessary for normal neurologic function.[64]

HOW TO OBTAIN NUTRITIONAL SUPPORT

Even at rest, about 200 ml of oxygen are consumed from the blood each minute and during exercise, oxygen use can increase 30-fold.[67] The extensive communications and interactions necessary for one to respirate their cells, in essence to breathe, under all circumstances clearly demonstrates homeostasis. The basic rhythm of respiration and the various mechanisms involved, must all match the effort of metabolic demand for the body to remain in homeostatic balance. **MICHAEL'S® LUNG FACTORS™** is a targeted formula composed of vitamins and minerals, complemented with natural herbs, essential for lung function providing proper oxydation for all the body's needs and uses.

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Michael's®
NATUROPATHIC PROGRAMS

Lung Factors™

Supplement Facts
Serving Size: One (1) Tablet

Amount Per Serving		% Daily Value
Vitamin D (as Calciferol)	8 IU	2%
Vitamin B-6 (as Pyridoxine)	6 mg	300%
Calcium (as Calcium Amino Acid Chelate)	60 mg	6%
Iron (as Iron Amino Acid Chelate)	1 mg	6%
Magnesium (as Magnesium Amino Acid Chelate)	30 mg	8%
Mullein Leaf (Verbascum thapsus)	150 mg	*
Slippery Elm Bark (Ulmus fulva)	150 mg	*
Fenugreek Seed (Trigonella graecum)	100 mg	*
Wind Root (Asclepias tuberosa)	100 mg	*
Gotu Kola Herb (Centella asiatica)	50 mg	*
Horehound Herb (Marrubium vulgare)	50 mg	*

*Daily Value not established.

OTHER INGREDIENTS: Maltodextrin, Vegetable Stearine, Sodium Croscarmellose, Magnesium Stearate, Sillicon Dioxide.