

WHAT IS HAPPENING WHEN YOU BREATHE?

Your respiratory system is quite complex. It seemed tireless before in its perpetual motion: inhaling and exhaling, bringing new oxygen into the blood stream via the lungs and removing carbon dioxide from the body. The waste product of body metabolism is carbon dioxide. However, now that you have been diagnosed as a person with COPD (Chronic Obstructive Pulmonary Disease), don't feel that your respiratory system will no longer work for you. It is a remarkably adaptable system. If you make some alteration in your lifestyle and concentrate on caring for yourself, you will soon feel better both physically and mentally.

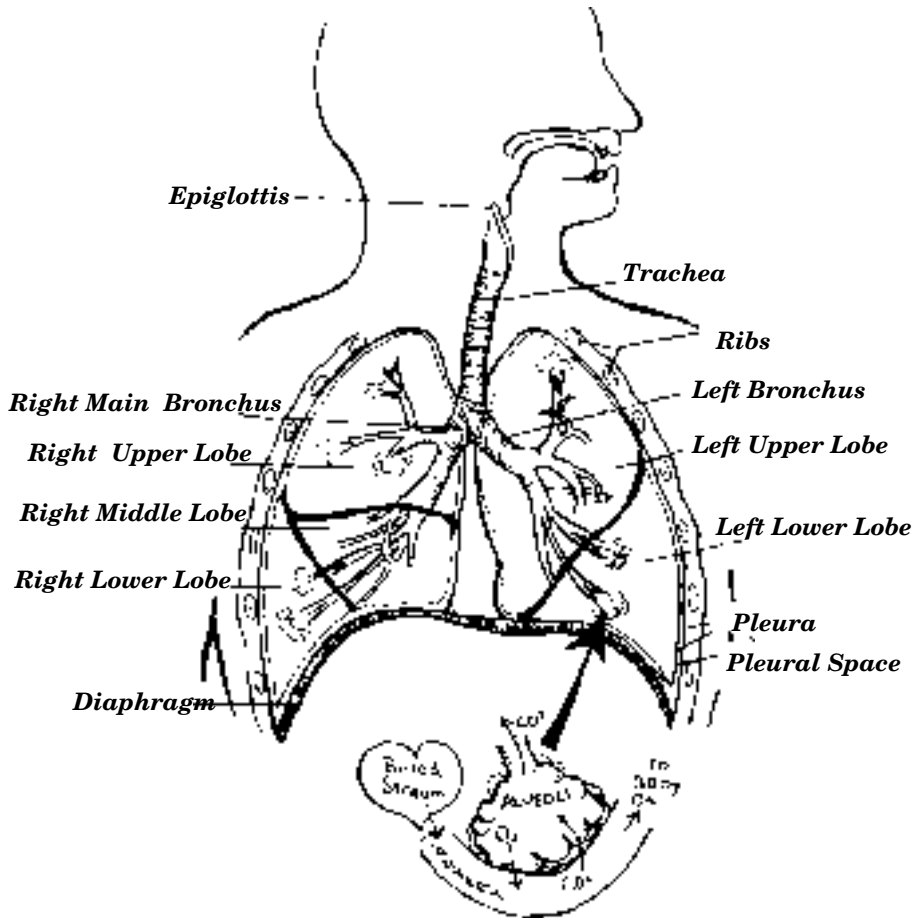
You may have taken breathing for granted before; but, now it is very important for you to learn the techniques of proper breathing. This is termed "abdominal diaphragmatic breathing." (Chapter 3) In order to successfully learn abdominal diaphragmatic breathing, it will be helpful if you understand something about the structure and function of the respiratory system, your breathing apparatus.

For ease of discussion, let us consider first the conductive system which brings air into and out of the lungs, then the respiratory system where the exchange of oxygen and carbon dioxide occurs (respiration).

Conductive System

As you inhale, air passes into the upper airways through the nasal cavities. These cavities are lined with a mucous membrane and tiny hair-like structures called cilia. The mucous membrane helps to warm and moisten the air

THE RESPIRATORY SYSTEM



you inhale and the mucus catches the inhaled dust. The cilia trap the larger particles of dust and together the mucus and the cilia clear the nasal cavity.

The air then passes through the *pharynx* (fahr´ -inks - cavity behind the nasal cavity and mouth) and through the *larynx* (lahr´ -inks - voice box). The inhaled air continues farther into the lower airways through the *trachea* (tray´ - Key-ah - windpipe) where it there divides into the left and right bronchi (main airways branching into the left and right lungs). These bronchi further divide twenty more times becoming smaller and smaller with each division. The trachea and the branching bronchial tubes also contain mucous membranes and cilia to aid in the removal of foreign particles including pollutants, like smoke, smog, etc.

The conductive system brings fresh oxygen to the lungs and removes the carbon dioxide the body needs to eliminate.

Respiratory System

Once inhaled, air passed through the bronchioles (the smallest bronchi). It enters the alveolar ducts and finally the air sacs (alveolar sacs). These air sacs are clustered in groups of 15 to 20. This is where respiration takes place. Oxygen from the inhaled air passes into the blood stream while carbon dioxide, the waste product of metabolism, is excreted from the blood into the lungs to be exhaled.

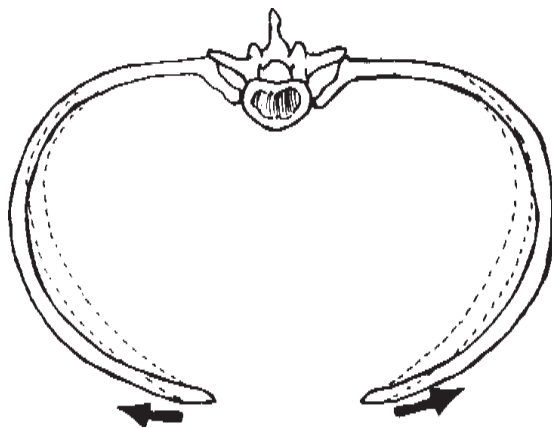
You might ask how this process of respiration takes place. As mentioned, air sacs exist in clusters of 15 to 20. Each sac and the capillaries have semi-permeable membranes through which certain molecules can pass back and forth, and yet remain a boundary against fluid formation in the air sacs. Oxygen molecules pass from the lungs through the membrane and into the blood; carbon dioxide molecules pass out of the blood through the membrane and into the lungs where it can be exhaled.

The lungs are truly amazing in their complexity and splendid in their functioning. There are approximately 300

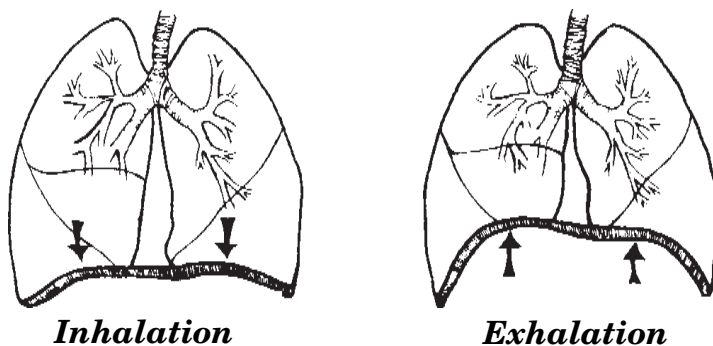
million alveoli. If these were spread out on a flat surface they would cover a space at least the size of a tennis court. Without the oxygen obtained through this system, the body could not continue to operate for more than a few minutes.

It will be necessary to understand the functioning of certain other body structures in order to understand how breathing “works.”

The thoracic cage encloses and protects the lungs and the heart. It is formed by the 12 thoracic vertebrae (part of the spinal column or backbone), the ribs and the sternum (breast bone). Each time you breathe in, the ribs swing outward in a bucket-handle movement. During this act of inhalation the thorax increases in size allowing the lungs to expand.



Various muscles are used in breathing. The diaphragm is the principal muscle of respiration. It is a large, flat, dome-shaped muscle which separates the chest cavity from the abdominal cavity. Normally, the center portion is domed upward. As inhalation begins, the diaphragm contracts (tightens) and descends, allowing room for the lungs to expand. When this muscle relaxes it ascends aiding in exhalation.



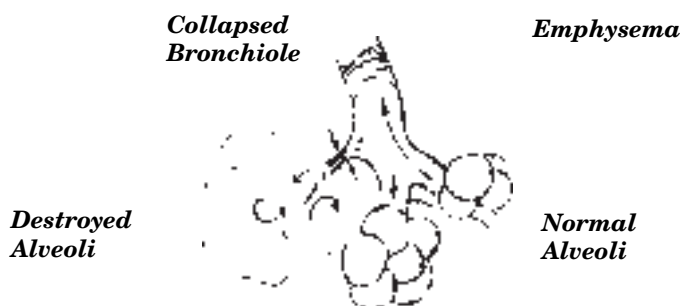
Inhalation: The diaphragm expands downward increasing the size of the chest cavity for the lungs to fill with air.
Exhalation: The diaphragm rises, expelling air from the lungs.

The accessory muscles of the shoulder and neck are used primarily when a person is working or exercising strenuously or when a person takes shallow breaths as some do who have COPD. If you find that shortness of breath is straining these accessory muscles, you will need to exercise these muscles in order to relax them so that you can breathe more easily. (Chapter 7)

This is a very brief summary of the respiratory system, but it may give you an idea of its complexity. Though there are many kinds of respiratory diseases, they often have aspects in common. The following diseases have been chosen to represent chronic obstructive lung disease (COPD) since the majority of persons with lung disease have one or another of these or a combination: emphysema, chronic bronchitis, asthma, and bronchiectasis.

Emphysema is a nonreversible disease which is characterized by the destruction of the wall of the alveoli (air sacs) and the destruction of the connective tissue which is responsible for much of the elastic recoil of the lungs (that property of the lungs which allows them to return to their

original size after inhalation). As the walls of the alveoli rupture and the connective tissue is destroyed, one air sac must do the work of two, four, or many more. Blebs and/or bullae, due to the destruction of air sacs, are formed. The more air sacs have been destroyed, the less elasticity the lungs will have. They may become floppy bags which no longer spring back to let the air out of your lungs. The smaller airways are also affected since they are partly held open by the elasticity of encircling fibers. As other tissues of the lungs lose their elasticity, so do these fibers surrounding the smaller airways thus causing them to collapse. This situation creates trapped air in the lungs and reduces the lungs' ability to exchange oxygen for carbon dioxide.



If you have emphysema, the situation worsens as you begin to breathe faster thinking you will get more air. This only traps more air which leads to more tightness in the chest, shortness of breath, and, over the years, causes lung enlargement. The more overinflated the lungs become, the faster the emphysema progresses. A barrel chest is characteristic of a severe emphysemic. The person's chest is expanded and the shoulder blades and the ribs are spread apart in what appears to be a state of permanent inhalation. The use of the shoulder and neck muscles for breathing is very obvious.

What can be done? In emphysema, not every area of the lung is necessarily affected. Even in completely healthy lungs, all areas are not being used unless called upon for

more air, such as in exercise. You can improve the flow of air into and out of the lungs; and, if your lungs are functioning to their capacity via proper breathing, it will help the entire body. The heart will work better, and in turn, it will distribute the blood more easily where it is needed.

Remember to begin pursed-lip breathing whenever you do anything that exerts energy and anytime you feel tightness in your chest or shortness of breath.

Chronic bronchitis, according to an internationally accepted definition, is a disease characterized by a cough producing sputum for at least three months during two consecutive years.

When a patient is asked, “How long have you had this productive cough?” the answer quite often is, “What cough?” So you see, what may be chronic bronchitis to a trained observer may be scarcely noticed by the sufferer.

Chronic Bronchitis



Swollen mucous membrane with excess mucus

The problem in chronic bronchitis is inflammation and swelling of the cells lining the inside of the bronchi. When these cells become irritated and inflamed, whether it be from smoking, infection, air pollution or allergy, they produce excess mucus. The swelling of these cells and the excess mucus narrow the airways causing more obstruction and often extremely labored breathing. Thus, as in emphysema, one may experience shortness of breath and tightness in the chest.

Smoking is probably the number one factor in the development of chronic bronchitis; but, repeated infections,

such as pneumonia or colds which settle in the chest and air pollution, can significantly contribute to bronchitis.

Certain allergies may cause swelling of the airways and a person can have a combination of chronic bronchitis with allergy often called asthmatic bronchitis.

It is extremely important that one should stop smoking, treat chest infections promptly, try to treat excessive allergies, and avoid air pollution. There are many ways to avoid pollution which will be covered in another chapter.

Bronchial irritations and infections can be treated with antibiotics, bronchodilators, postural drainage, etc. Although some persons recover more completely than others, probably due to the length of time and number of times of infection, many can reverse the inflammation and reduce the mucous production.

Asthma, which is an extremely misunderstood disease, is an acute onset of muscle spasms in the bronchial tubes. During an attack, the smooth muscles which line the bronchi and bronchioles contract (bronchospasm) causing the airways to become narrower.

A glandular component of asthma in which very thick, tenacious secretions are produced causes an additional problem. The mucus further narrows the inflamed, spastic airways causing more obstruction to breathing and causing the patient increased shortness of breath.



Asthma can be triggered in several ways. Responses to apparently unrelated factors, such as seasonal or non-seasonal allergens (substances capable of inducing a hyper-

sensitive response affecting the smooth muscle in the bronchial tubes), cold or hot air, high humidity, exercise, infection, emotional upset, aspirin, foods, fumes, smoke and odors can trigger an asthmatic attack. Asthmatic episodes may be continuous or may be of abrupt onset and termination, ranging from a modest degree of disability to life-threatening asphyxiation - status asthmaticus.

It is most important for an asthmatic to relax and try to prevent further attacks and to deal with attacks effectively. It has been reported that about 98% of asthma patients can be controlled with a good care plan and knowledge of early warning symptoms. A physician or respiratory therapist can help the patient monitor his/her asthma status with a peak flow meter. This meter measures airway patency and can effectively determine if the patient is headed for breathing trouble. It is absolutely essential to learn and consistently practice diaphragmatic breathing with pursed-lips during exhalation. When an attack occurs, the asthmatic is usually not expecting it and hasn't time to stop and think about how to breathe properly.

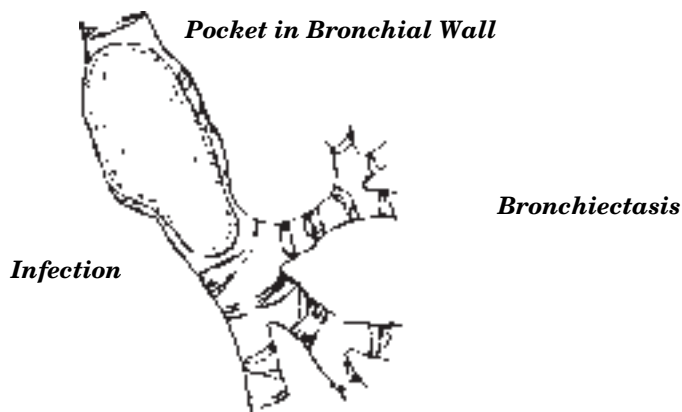
Anytime breathing becomes labored, diaphragmatic breathing with pursed-lips will help prevent additional air from becoming trapped in the lungs. To continue taking rapid, shallow breaths causes the lungs to become overinflated thus causing even more shortness of breath, tightness in the chest and extreme anxiety. This vicious cycle can be short-circuited with proper breathing (panic control, Appendix C) and proper use of an inhaler and/or appropriate medication and therapy.

Daily exercise routines have proven extremely helpful. These should become habitual for anyone with asthma.

The effectiveness of warm-up exercise for inducing dilation of the airways and improving circulation of blood in the capillaries surrounding the lungs for proper oxygen uptake has been well documented in asthmatic patients. A good warm-up for 5 to 10 minutes should include a cardiac activity such as easy running in place, muscular exercises such as push-ups and modified sit-ups, and the exercise routine in this manual to ensure proper breathing.

You should never abruptly stop a strenuous, physical exercise session. A cool-off period for 5 to 10 minutes of stretching and flexing should follow every physical workout.

In **bronchiectasis**, the bronchial walls have suffered varying degrees of destruction of the elastic and muscular structures. This results in permanent distortion of the airways and usually increased mucous production.



Bronchiectasis is caused by obstruction of the airways caused by other chronic obstructive lung diseases and acute respiratory infection. The infection causes increased mucous production. This causes an obstruction which then causes damage to the bronchial walls. Damaged portions of the bronchial walls are replaced by scar tissue causing the involved airways to become permanently distorted. The scarred areas are devoid of the cilia which trap impurities. These areas may generate copious amounts of mucus. There have been far fewer patients with bronchiectasis since the introduction of antibiotics to treat respiratory infections.

Some patients complain of relatively few symptoms except during a respiratory infection when coughing and mucous production have increased. The amount of mucus and the severity of the cough vary from patient to patient according to the amount of involvement. Hemoptysis (spitting of blood) does occur in many patients, evidently due to

the erosion of the bronchial arteries that accompany the involved bronchial tubes and when chronic infection is present. In the event of hemoptysis, postural drainage and chest percussion (usual therapy) should not be performed until your doctor has been notified. Antibiotics are usually prescribed.