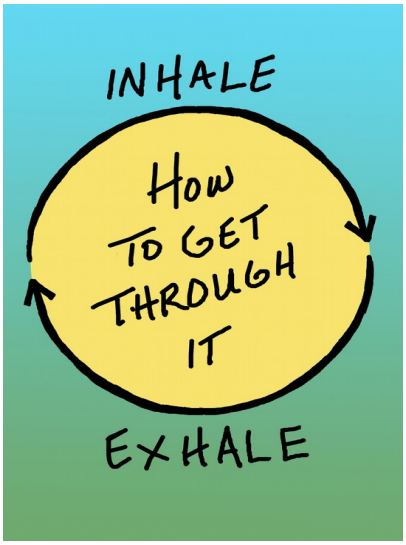
Learning to Breathe Deeply

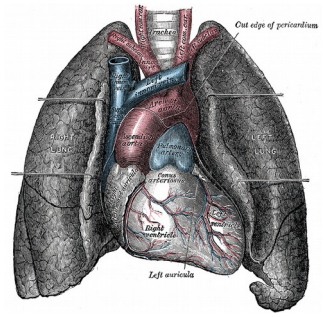
A deep breath serves many purposes.

- **It brings more oxygen into our lungs.** This in turn brings more oxygen to our blood and to all the tissues of our body. In the cells of our body, oxygen is used to extract energy from the foods we ingest.
- **Deep breathing lowers the acidity in our blood.** Decreased breathing causes increased blood carbon dioxide and decreases pH (increased acidity). When we breathe more deeply, we reduce carbon dioxide in the body, this rapidly changes the pH throughout the body. Removing carbon dioxide helps to increase pH (more alkaline) and reduces acidosis.
- **Deep breathing, especially belly breathing activates the vagus nerve.** Signals from this nerve travel to the brain and the brain responds by initiating relaxation throughout the body.
- **Breathing deeply activates respiratory muscles which increases their strength.** Ultimately, learning to breathe deeply will reduce our breaths per minute yet increase the amount of oxygen in our body while at the same time we expend less energy.
- **Breathing deeply relaxes our muscles.** By breathing with our lower respiratory muscles we reduce neck and back tension.
- **Deep breathing can lower our heart rate.** It can also lower our blood pressure.
- **A deep belly breath increases circulation in the lower abdomen.** It can also relax and improve intestinal motility.



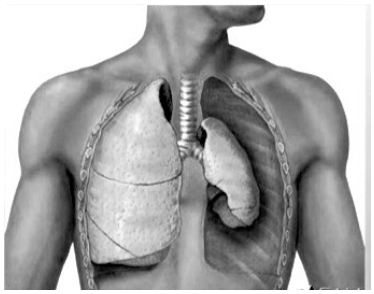
Breathing is an automatic process that occurs whether we think about it at all. However, deep breathing takes attention and practice. The techniques are easy to learn and immediate results can be achieved although it will take repetition for deep breathing to become a part of our daily life.

Basic Anatomy of Our Lungs



Our lungs are located in the two cavities created by our rib cage and on either side of the heart. The lungs are separated into segments called lobes, with three lobes on the right side and two lobes on the left side. The lobes further divide into lobules. The middle border of the right lung is almost vertical while the left lung has a cardiac notch that accommodates the shape of the heart.

Our lungs have a tremendous reserve volume compared to what we need at rest. The average lung capacity of an adult male is 6 liters of air, but typically only a small portion of the lung is expanded for blood and oxygen exchange. When we exercise we increase our need for oxygen which causes a greater portion of the lung to be used.

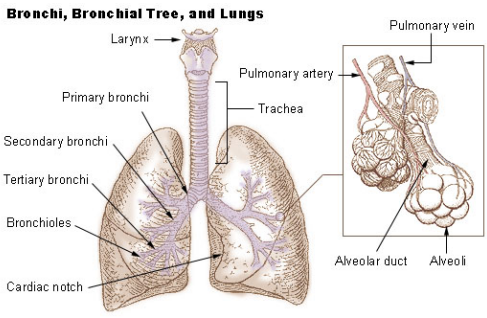


Inflated versus Uninflated Lung Size

When we begin a breath it first passes into our body through our nasal passages. Breathing in right now you will feel the coolness of the air temperature compared to your body temperature as the air begins to enter your nose. The air is filtered by tiny hairs and swirled by small bones that cause the air to brush against the mucous membranes of the sinus.

We can feel the coolness of the air as it flows to the back of the throat and into the trachea, the tube that will take the air to the lungs. During this passage the air is slightly warmed and further filtered as it comes in contact with small hairs, called cilia, lining the throat.

The trachea divides into two large tubes called bronchi that enter the root of the lung at about the collar bone level. You can feel a coolness at this area as the air concentrates upon entering this passage. The bronchi divide further within the lung reaching downward like the roots of a tree and eventually become smaller tubes called bronchioles.



Eventually the bronchioles lead to alveolar sacs. The alveolar sacs are made of tiny grape like clusters of alveoli. The average diameter of an adults alveoli is about 200 to 300 microns when un-inflated. The alveoli contain collagen and elastic fibers which allow them to stretch as they fill with air during an inhale and then recoil back to normal size during an exhale. Alveoli are tightly wrapped with a fine mesh of capillaries covering about 70% of its area. The interaction between the blood cells in the capillaries and the alveoli is where the gas exchange of our respiration takes place.

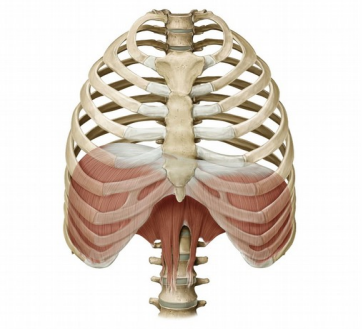
Even though alveoli are very small they are very tightly packed inside the lungs. Each lung contains about 300 million alveoli. This allows for an incredible amount of surface area that comes in contact with inhaled air. Together, the lungs contain approximately 2,400 kilometres (1,500 mi) of airways and 300 to 500 million alveoli. If the surface area of the lungs was flattened out it would be the size of a tennis court.

The Action of Respiration

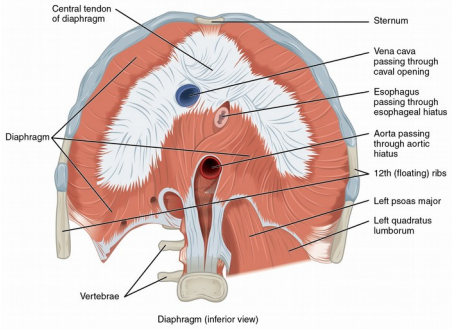
The alveoli of the lungs act much like balloons in that there is some effort involved to inflate them, but when the inflating pressure is released, the recoil of the elastic walls provides the pressure necessary to deflate them. The lungs are suspended in the thoracic (rib cage) cavity which is normally at a slight negative pressure. When the diaphragm muscle contracts and moves downward, that pressure becomes more negative and the lungs expand more completely into the cavity. Air from the atmosphere moves into the resulting partial vacuum and inflates the alveoli.

Once the alveoli are fully inflated, exhalation can be accomplished by merely relaxing the diaphragm, since the wall tension in all the tiny alveoli will act to force the air out of them. By using abdominal muscles, we can force the diaphragm upward, and exhale more forcefully, adding to the recoil of the elastic alveoli.

Diaphragm Muscle



Although there are other respiratory muscles, the largest is the diaphragm. The ***diaphragm*** muscle is located between the lungs and internal organs.

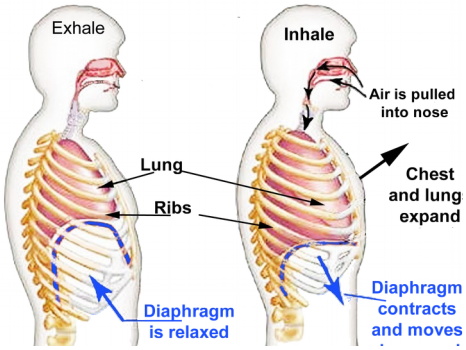


The diaphragm is a dome-shaped structure of muscle and fibrous tissue that separates the thoracic cavity (rib cage area) from the abdomen. The dome curves upwards towards the lungs so when it contracts it pulls downward toward the navel. The upper surface of the dome forms the floor of the lung cavity, and the lower surface the roof of the abdominal cavity.

As a dome, the diaphragm has muscle fibers emerging from many surrounding structures. At the front, fibers insert into the bottom of the breast bone (xiphoid process) and along the rib margins. Laterally, muscle fibers insert into ribs 6-12. In the back, muscle fibers insert into the vertebra at T12 and two sections descend and insert into the first and second lumbar vertebrae.

The diaphragm is not solid, allowing the blood supply structures of the aorta and vena cava to pass through as well as the esophagus to pass through to the stomach. Otherwise though the diaphragm muscle creates a tight seal to the lung cavity, allowing its contraction to pull air into the lungs.

The Belly Breath

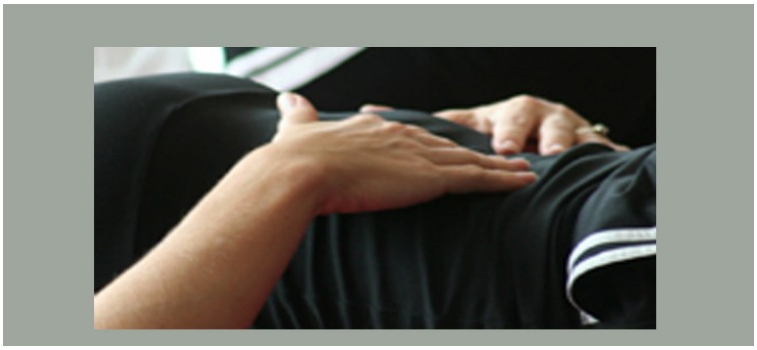


As we inhale, the diaphragm contracts and moves down away from the lungs, thus enlarging the volume of the lung cavity. This creates a reduction in the lung cavity pressure which creates suction that draws air into the lungs. The diaphragm is able to move about 4 or more inches in the direction of the navel. This causes the abdominal area to move outward as we 'belly breathe'.

When the diaphragm relaxes, air is exhaled by elastic recoil of the lung and the tissues lining the thoracic cavity. We can also assist in exhale (called forced exhalation) which involves the internal intercostal muscles as well as abdominal muscles.

Diaphragm Breath Practice

Most of the time we are barely aware of our breathing and most of us will breathe shallowly, using just the upper respiratory muscles near our neck. The following practice will help us find our diaphragm breath.



The best breathing practice occurs when we are relaxed with no distractions.

- Sit or recline comfortably. Loosen tight clothing around your waist line.
- Place one hand on your stomach between your navel and rib cage and the other hand on your chest near your collar bones.
- Exhale completely.
- Slowly inhale and note which hand moves the most.
- Exhale completely.
- Begin your next inhale focusing on expanding your abdominal area.
- As you exhale, prolong the action as if breathing out through a straw. If you begin to feel uncomfortable, return to your normal breathing.
- With the next ten breaths, slowly focus on inhaling into the belly for as long as possible, feeling the abdominal area stretch and your clothes tighten.
- After 10 breaths, return to your normal breathing.

Pranayama

Pranayama can be described as a rhythmic control of the breath. It is considered the fourth stage of yoga and the 'hub around which the wheel of yoga revolves'.[1] Pranayama is the science of breath control. The word Prana translates to life force, the energy that permeates the universe. Combined with the word ayama which means expansion and we have the concept of a discipline to expand the life force. The practice of pranayama can help develop a steady mind, strong will power and sound judgment.

Beginning Pranayama Training

Pranayama consists of exercises designed to allow control of the breath. With these practices a deep breath can be developed, stress can be reduced, respiratory muscles can be strengthened and the body can be better oxygenated.

A beginner to breathing practices should be encouraged to isolate the practice away from other yoga poses. Although some basic breathing practices and deep breaths should be encouraged in yoga, the concentration necessary to perform yoga poses well does not allow for concentration on advanced breathing exercises. Thus it is best to spend time just focusing on certain breathing techniques if the goal is to enhance a deep breath.

Pranayama's Effect on Respiration

Pranayama has various effects on the entire respiratory system. It involves voluntary deep breathing which utilizes all respiratory muscles and expands the lungs to their fullest capacity. The pranayama breath has the following characteristics:

1. A larger volume of air is taken in when inhaling and involves the lower lobes of the lungs.
2. Movement of the diaphragm muscle expands the base of the lungs allowing for more circulation into the capillaries surrounding the alveoli.
3. A massage to abdominal organs created by the movement of the diaphragm which can expand a possible 10 cm into the abdominal space.
4. Activation of the vagas nerve through contraction of the diaphragm muscle.

Several other effect of pranayama have been reported various studies and include:

- ***Decrease of Blood Pressure Following Alternate Nostril Breathing.***
  - Slow diaphragmatic breathing increases carbon dioxide levels which shifts the body's acid-base balance to a slight state of acidosis. Acidosis relaxes vascular tone, increases coronary and cerebral circulation, cleanses acidic metabolites and increases oxygen transfer from blood to tissues. This results in a general decrease of systolic blood pressure and a slight increase in heart rate. (Study: Mallika Rao of Hampshire College. Writing: Richard Miller “The Psychophysiology of Respiration: Eastern and Western Perspectives”, The Journal of International Association of Yoga Therapists, 1991)
- ***Optimal Breathing Rate Determined***
  - A study found the optimal healthy breath rate was six breaths per minute compared to the average resting breath rate of 12 – 14 breaths per minute. Those who slow their breathing have higher levels of oxygen and perform better on exercise tests. (The Lancet, May 2, 1998)

1 Light on Pranayama, glossary p. 277

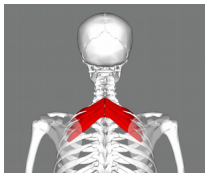
Pranayama Techniques

Creating the Right Posture

As with everything else in yoga, the correct posture is necessary for pranayama. As a beginning measure, it is best to use a posture lying on the back with the neck, rib cage, lower back, pelvis, arms and legs in an optimal and neutral position. The head and shoulders may be elevated on cushions if this is more comfortable.

Once pranayama can be done easily in a lying position, a seated position can be used, but care must be taken to create an aligned posture and maintain an uplifted rib cage and elongated spine. The position of the head may be tipped forward to reduce neck strain. A chair or bench may be used to reduce discomfort and the leg position is variable. It is important that the body feel no strain or discomfort while practicing pranayama. Those who wish to sit on the floor may use a wall to help support the body. The wall position must allow the shoulder and base of the pelvis to touch at all times.

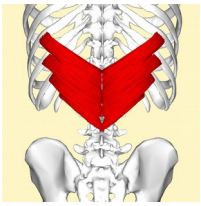
The 4 Part Breath



Serratus Posterior Superior (upper rib cage)

The diaphragm breath is a good beginning pranayama practice and the next step is learning to increase the lung capacity through the 4 part breath.

In this breathing technique we learn to use all of the respiratory muscles which include the diaphragm, serratus posterior superior and inferior, the intercostal muscles and the scalenes.



Serratus Posterior Inferior (bottom of rib cage)

The Basics of a 4 Part Breath

- Start in a comfortable position.
- Exhale completely.
- Begin your next breath by expanding your belly.
- Exhale slowly.
- With the next breath, tighten your abdomen and breathe into your lower back and shoulder blade area.
- Exhale slowly.
- With the next breath tighten your abdomen and breathe into your rib cage.
- Exhale slowly.
- With the next breath tighten your abdomen and breathe into your collar bone area.
- Exhale slowly.
- With the next breath, begin expanding your abdomen and as that fills, continue your breath into the back of your chest, continue into the sides of your chest, continue into your collar bone until you can breathe no further.
- Exhale very slowly.

Increasing Lung Capacity

In order to further our abilities in deep breathing we should seek to increase our lung capacity. Most of our day we spend breathing very shallowly and most of us do not participate in any activities that require our lungs to increase their capacity. Yet training the lungs can enhance our overall health and vitality. The following exercises can assist in training the lungs to inflate further.

Breathe deeply. You can increase the amount of air your lungs can absorb in a short amount of time by breathing steadily and deeply.

- Exhale completely and slowly. Practice it a few times before you start. Don't let any air linger in your lungs. This allows you to inhale more air on the next breath.
- Relax your abdominal muscles as you inhale. Your belly will expand as your diaphragm descends, making more room around your lungs, and allowing them to fill with air.
- Widen your arms, holding them farther away from your body, to help open up your chest.
- Focus on feeling your clothes tighten around your body as you inhale.

Inhale against resistance. Place a pillow on your abdomen between your ribs and your navel. Hold your arms against the pillow and inhale, working to expand your belly outward into the pillow. You can also do this resting your abdomen against the floor. Just like in resistance training for other muscles, you can strengthen your diaphragm muscle. Do this for several breaths and then relax. Muscle strength is not immediate, so practice this every day.

Blowing up balloons is a good method for increasing lung capacity. While you're walking, at home doing chores, or have a spare second, practice blowing up a balloon and letting it deflate. Do this over and over again; you should notice your lungs' ability to pump more air, stronger and longer.

Breathe in more than your brain thinks you can.
We are reluctant to stretch our body's limits. Yet, the body is capable of great ability once we relax and remain calm.

- For eight counts, breathe until your lungs are totally full. After each count you should be able to breathe in more.
- For the next eight to sixteen counts, take small sips of air. Feel your belly expanding. You shouldn't feel your shoulders moving.
- Hold your breath for a few seconds and release forcefully.
- After you feel "empty," make a "tssssss" sound for as long as possible. (This is called tizzling, and it mimics the resistance of playing a wind instrument.)
- Practice this periodically. Repetition of this action will train your brain to stretch the body's limits and your breathing capacity will increase.

Reclined Arch 	Place the bolster on a mat lengthwise. Sit off the end of the bolster leaning back onto the bolster length. Lift your hips and slowly slide back along the bolster. Your head can be supported by the bolster or if you prefer, allowed to hang off the end. While in this position, breathe deeply expanding your abdomen and rib cage.