

Take A Deep Breath...

Breathing is one of the most complex and broadly studied functions in the entire human body. The concept of breathing is greatly misunderstood by people, because it is incorrectly believed to be a basic function that works properly in everyone. In recent years there have been many advances in the study of function that works properly in everyone. In recent years there have been many advances in the study of breathing and all of the related chemistry due to research on breathing related illnesses and conditions. These breathing abnormalities include such things as hyperventilation and overbreathing. Because of medical advancements concerning breathing, people have begun to commit themselves to obtaining the most efficient breathing habits through either the Western or Eastern trains of thought. This widespread awareness has led to a considerable decrease in the number of unhealthy breathers and increase in the number of longer, healthier lives.

The Chemistry of Breathing

Scientists have improved their knowledge of breathing drastically in the past few years through studies on the pH levels in the human body. Figure 1 identifies the location of the medulla oblongata, which is a group of nerves in the back of the brain that work together to regulate breathing and make it mostly a voluntary action. These nerves help sense and monitor the pH levels of the blood and act as sort of a regulator to a person by forcing the lungs to contract, push out carbon dioxide (CO_2), and inhale oxygen when the pH fluctuates considerable amounts higher or lower than normal. When the pH levels in the blood become lower than average, the medulla is triggered into action and takes involuntary actions such as deeper and more rapid breaths. The body then stabilizes itself by taking out excess Hydrogen (H) and excess carbon dioxide. On the other hand, when the pH levels increase, the medulla slows down its functions causing the body to take very light, easy breaths. An example of how the body reacts to high pH levels is hyperventilation. Hyperventilation, which is a condition where a person breathes at a very fast, spastic rate, causes the pH levels to become so high the medulla quits working for a period. This lapse, sometimes called apnea, causes a very drastic decrease in pH because there is no breathing of any kind, allowing the hydrogen and carbon dioxide levels to become more balanced with oxygen levels.

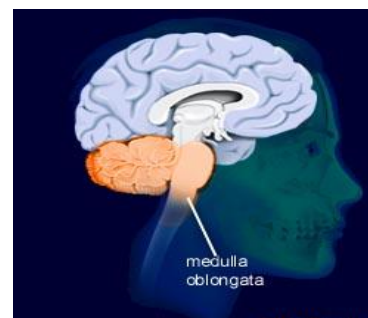


Figure 1
Location of the medulla oblongata
in the human brain

Figure 2 shows the formula for the compounds involved in breathing and thus how pH levels can be determined. When the carbon dioxide and water vapor (H₂O) come together in the body to form H₂CO₃, it travels through the alveoli (small parts in the lungs) and loses one of the hydrogen parts to become H⁺ CO₃⁻. The one part hydrogen determines the pH levels because high pH means that there is a low amount of hydrogen molecules while a low pH indicates an excess amount of hydrogen traveling through the blood stream.



Figure 2
The chemical formula used to indicate pH levels in humans

Even though many people may not be aware of everything taking place in their body during every breath, people have been manipulating their breathing habits to maximize performance in many circumstances. One of the most common examples of this self-induced manipulation is by swimmers. Before the start of races many swimmers will bring themselves to a state of hyperventilation, which causes the carbon dioxide in their body to become scarce, the hydrogen levels to increase rapidly, and their overall pH levels to become very high. This hyperventilation helps the swimmer lower his or her urge to go to the surface to breathe because the medulla is not working normally and the number of breaths needed to maintain consciousness is very low. Though this method has been known to improve a swimmer's performance, physicians do not recommend self-induced hyperventilation because it can easily lead to unconsciousness and drowning under the water ("Breathing Coordination").

What is Overbreathing?

In the same way, many people are unaware of the necessity for good breathing habits on a daily basis. In recent years, scientists have discovered the dangers of overbreathing. Overbreathing is a condition in which a person trains his or her medulla to expect an excessive number of breaths by breathing abnormally fast for an extended period of time. This condition has been found to affect about twenty-five percent of the population but unfortunately most people are completely unaware of the situation. Most people affected by overbreathing developed the condition the early years of life and over time, lost the ability to detect the changing pH levels in their body.

Effects of Overbreathing

With the discovery of overbreathing, scientists have been able to uncover some of the ways it disrupts bodily functions in humans. Entire systems of the body such as the vascular, digestive, and nervous systems may be thrown off. Overbreathing can alter blood flow in the vascular system and lead to ailments such as migraines, irregular heartbeat, stroke, and heart attack. The digestive system can be disturbed leading to complications such as nausea, cramping, and irritable bowel syndrome. Also, the nervous system, which controls a wide variety of functions in the body, can become unstable and symptoms such as headaches, fatigues, and seizures may be noticed. Overbreathing can have an impact on people is through

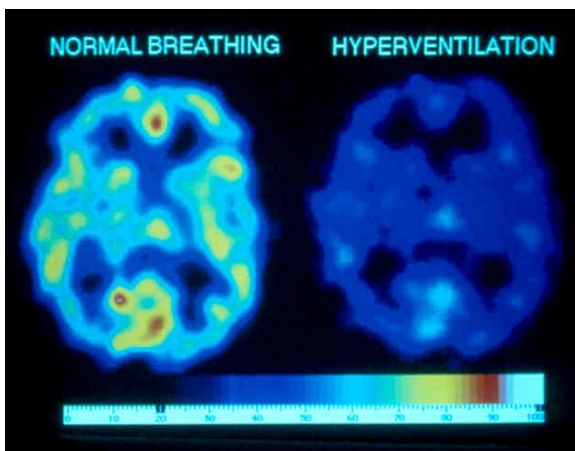


Figure 3

Compares the oxygen levels of a normal brain (left) and one that has experienced hyperventilation for one minute (right)

other areas besides the three main systems, these areas include the respiratory system, musculoskeletal system, and interpersonal skills.

Hyperventilation and overbreathing also have direct effects on the brain and its basic functions. Through many years of research, scientists have come to realize that in order for a person to function at highest levels, the brain needs a sufficient

supply of oxygen. Figure 3 clearly shows this conclusion by comparing an image of a brain during normal breathing and an image of a brain after

hyperventilation. This figure shows that during normal breathing, the brain has a sufficient supply of oxygen (red indicates high oxygen levels) while hyperventilating takes away the majority of the oxygen in the brain (dark blue indicates a lack of oxygen). The two scans are of the same brain and were taken just one minute apart. In that one minute, the subject lost more than forty percent of the oxygen in their brain through hyperventilation (“Overbreathing”). Because of findings such as these, it is very easy to see how prolonged hyperventilation and overbreathing directly alter a person’s ability to think clearly and do basic functions.

Developing A Good Breath

Fortunately, people suffering from overbreathing can train their bodies to breathe normally if they do a few exercises that deliberately target the medulla and its response to pH changes. The simplest way to prevent overbreathing is to make a conscious effort to breathe slower and more uniformly. This method will not lead to immediate results but will eventually rid the body of excess Hydrogen molecules and begin to train the medulla to expect more normal pH levels. For people experiencing highly developed forms of overbreathing, devices such as the a four to six week period of use to cure most symptoms of overbreathing. This time period is not very long considering the fact that people who use this will have many years of healthy, balanced breathing. The two methods mentioned are said to embody both the Eastern and Western trains of thought. Trying to slow down breathing without any aid goes along the lines of Buddhism and its related beliefs. Buddhism teaches its followers to find inner peace and eventually become one with both oneself and the surroundings which is similar to trying to cure a problem without aid. On the other hand, the use of devices such as the CapnoTrainer incorporates Western beliefs about the necessity of technology in everyday life.

Scientists have made many advancements in their knowledge of breathing through the discovery of things such as breathing's effects on pH levels and the concept of overbreathing. Through the works of many individuals, people now know that good breathing habits must be developed because unhealthy breathing is very common. A person's medulla, which keeps the pH levels balanced, can be disrupted if there have been many years of wrong breathing. This is harmful because a person could become accustomed to abnormal oxygen to carbon dioxide ratios and develop a breathing disorder such as overbreathing. Overbreathing can become detrimental to a person's health by interfering with the normal functions of the vascular, digestive, and nervous systems. These health problems can be cure and prevented if a person commits him or herself to developing correct breathing techniques. Devices such as the CapnoTrainer have become very popular in helping people who overbreathe by blocking the later symptoms and stages of overbreathing. The fact that many breakthroughs such as the CapnoTrainer have come in recent years is very promising to both the scientific community and the common people because we can all look forward to new discoveries about breathing and advice on how to develop the best breathing technique.

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