



## Breathe In, Breathe Out — But Do It Right



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When someone says, "you're full of hot air"—you are!!! You take about 17,000 breaths per day and that brings in about 2,000 gallons of air every day!! And most of the time you are not even aware you are breathing. Your lungs are super-supporters of your life force!!

Breathing is a function of the Respiratory System designed to bring oxygen into the body during inhalation of air and get rid of carbon dioxide during exhalation. Components of the respiratory system include:

**The nose** – the entry to the respiratory system. It warms and moistens the inhaled air so it can move comfortably into the lungs. The hairs and "sweeper hairs" called cilia in the nose help filter out unwanted irritants like germs, allergens, and particulate pollution. The nasal passages are lined with a protective mucus barrier that helps prevent infection. The nose also is part of the olfactory system – our sense of smell. Humans have a few million smell receptor cells in the nose.

**The mouth** – its function is mostly digestive but it is also considered part of the respiratory system as it can bring air into the lungs. But unlike the nose, the mouth does not have a filtration system so it is not the ideal way to bring air into the body.

**The sinus cavities** (8 total, 2 of each: frontal, ethmoid, maxillary and sphenoid) help to lighten the weight of the skull. They secrete mucus that traps particulates and drains them into the throat (post nasal drip). The mucus secreted by the sinuses also protects against infection and humidifies the inhaled air.

**The pharynx** – also called the throat (sore throat = pharyngitis). This 4-inch muscular tube has a dual role. It moves air

from the nose and mouth down to the larynx and trachea on its way to the lungs. As part of the digestive system, it delivers food to the esophagus on its way to the stomach.

**The larynx** is a hollow tube connecting the throat to the trachea. It also allows for the passage of air to and from the lungs. Sounds are made by the vocal cords that are located here. The larynx is also referred to as the voicebox.

**Upper respiratory tract** is defined as: nose, mouth, sinuses, pharynx and larynx located in the face, head and neck. Upper respiratory tract infections (URIs) are mainly caused by viruses and affect sinuses and throat. Symptoms are commonly sneezing, headaches and sore throats. Sometimes there is coughing if there is a lot of post nasal drip.

**The trachea** is a hollow tube that travels in the neck from the mouth to the lungs. It lies in front of the esophagus (digestive pipe to the stomach). The trachea (sometimes called wind-pipe) allows the passage of air into and out of the bronchioles and bronchi.

**The bronchi and bronchioles** – airways that come off the trachea into a series of increasingly smaller tubes to carry the air from the upper respiratory tract into the tiny air sacs known as alveoli all throughout the lungs. The bronchial tubes are lined with mucus that traps inhaled particles, germs and allergens that come in with the air. They also contain very small sweeping hairs called cilia (as in the nose). These cilia move like waves carrying the mucus with its trapped particles upward into the throat and keeping it out of the lungs. In Med school, I learned that this was called the "muco-ciliary escalator". This escalator is damaged by smoking. Bronchitis is infection leading to swelling in these "larger airways".

**The lungs** – 2 large spongy organs, 1 on each side of the chest with 480 million alveoli (very small air sacs) that lie next to capillary blood vessels. This is where gas exchange takes place. On inhalation, the alveoli will contain oxygenated air and this is where the oxygen diffuses into the blood. The oxygen in the blood is delivered to all cells

so that they can make energy to function. Each cell delivers its waste product of energy production, carbon dioxide, back to the blood and the blood delivers it to the lungs. There it diffuses from the blood into the alveoli and out through the bronchioles, the bronchi, the trachea, the larynx, pharynx and is expelled out of the nose (or mouth). There is a lot of gas exchange going on as the surface area of the lungs is roughly the same size as a tennis court to supply us with enough of the breath of life!! Our lungs are also the biggest waste removal engine in the body. They remove 70% of our body's waste in the carbon dioxide we exhale!! And we exhale out ½ liter of water everyday from our lungs as well. This is water we need to replace in our hydration calculations. So, breathing is life – yes and it is an organ of elimination as well!!

The respiratory rate is the rate at which breathing (1 cycle of inhalation and exhalation) occurs. It is set and controlled by the respiratory center of the brain. The normal respiratory rate for a resting adult is between 12 – 20 respirations per minute. In the elderly, a rate of up to 28 respirations per minute can be normal. Children breathe much faster. Normal respiratory rates for them: ~44 per minute at birth to ~26 per minute at 2yo.

The breathing center in the brain is controlled by the autonomic nervous system so we don't have to give breathing any thought. But we can override this. We can control our breathing. Most people can hold their breath for 1 – 2 minutes. The world record holder for holding the breath in a free dive is currently 24 minutes and 37 seconds – astounding!! This is obviously a highly practiced skill. For the average person, there will be extensive brain damage within 3 minutes of oxygen deprivation and death between 5 and 15 minutes. But there is also value in exerting some control over our breathing – mostly learning to slow our breathing down. In our stressful, over-producing, over-working, over-worried, anxious lifestyle most of us are breathing faster and more shallow than what is ideal. We call this "breathing like life is an emergency". The diaphragm is the muscle at the bottom of the lungs that contracts helping

the lungs to expand fully. Unless one breathes deeply the diaphragm doesn't contract much. Using the diaphragm fully activates the vagus nerve which triggers the body's relaxation response (parasympathetic) and lowers the body's stress response (sympathetic nervous system). Deep breathing practices have been shown to be effective for decreasing anxiety, depression and stress; reducing blood pressure; and influencing the emotions we experience. It's simple and it's free!! Breathwork resources are widely available. Google: Buteyko method, Wim Hof method, Pranayama...

A big concern among various health care providers these days is mouth breathing. James Nestor, author of the book, "Breath: The New Science of a Lost Art" believes that our softer processed foods diet in the past few centuries has reduced our need to chew fibrous foods and led to less development of the jaw and facial bones during growth. He theorizes that "disuse atrophy" has led to smaller mouths, crowded teeth and narrower nasal passages. Combined with allergens and pollution causing high rates of nasal congestion, there is a lot of mouth breathing going on. Mouth breathing may occur during sleep or may occur daytime and nighttime and most people are unaware they are doing it and that it is unhealthy. According to Nestor, there are consequences to mouth breathing:

- Bypasses the filtration and humidification functions of the nose
- Leads to dry mouth, increasing the risk of bad breath and oral infections
- Causes over-breathing, reducing carbon dioxide and oxygen delivery to tissues
- Associated with snoring, sleep apnea, asthma, and ADHD-like symptoms in children
- Mouth breathing triggers a chronic stress response in the body, shifting us toward sympathetic (fight-or-flight) dominance.

Nestor's own experiment, plugging his and a colleague's nose and exclusively breathing through their mouths for 10 days, brought about these results in just 3 days:

- A snoring increase of 4,800%

- A skyrocketing of sleep apnea episodes
- An elevation in blood pressure
- A lowering of cognitive function and mood
- Constant fatigue, irritability, bad breath, and dry throat
- Genuine feelings of being ill

Mouth breathing in children can influence the development of their still growing facial structures forming a narrow face, crooked nose, droopier eyes, and a smaller airway. All these can increase the chances of future respiratory problems.

To return to nasal breathing, one has to resolve the root cause (is there obstruction from blocked airways due to enlarged adenoids or tonsils, nasal congestion, tongue tie, deviated nasal septum, already developing narrow jaw...). For many adults mouth breathing is the result of airway blockage from chronic allergens or pollutant particulate exposures. There are treatment options like:

- Mouth tape while sleeping (www.myotape.com or hypoallergenic surgical tape vertically placed across lips)
- Optimal sleeping position (head elevated on a pillow and lying on back)
- Orthodontics
- Septoplasty, adenoidectomy, tonsillectomy...
- Orofacial Myofunctional Therapy (OMT) a form of physical therapy for the muscles of the mouth and face

There is a lot of good information about the importance of proper breathing easily available. I highly recommend James Nestor's book as well. Remember respiration is a Vital Sign. You breathe 17,000 times a day. We should learn to do it right.

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