

INFLAMMATION and BREATHING

Did you know that learning to breathe well offers you a natural pathway to reduce chronic inflammation?

Inflammation often begins as a natural response to stressors on the body as a defence mechanism.

Stressors may be:

- biological such as an infection
- neurological such as anxiety
- physiological such as from pain and injury or from over-extending the body
- toxins such as poisons either natural (eg a bee sting) or man-made (eg a pesticide)

Inflammation is classified as either **acute** or **chronic**. Acute inflammation is the immediate response of the body to recognize and remove harmful and foreign stimuli beginning the healing process. The body increases movement of plasma proteins and white blood cells (a type of leukocyte called granulocytes) from the blood into injured tissues to help healing and repair of an injured site or to help removal of pathogens or toxins at an entry point. It is intended to be a swift and short acting immune mechanism.

Inflammation becomes **chronic** when the body continues to send inflammatory cells to a site when there is no actual external danger. It can also occur even when there has been no acute inflammatory reaction. ¹

In other words your own cells can attack your own body!

Chronic inflammation is also known as slow or long term inflammation because it can last anywhere from a few months to a number of years.

If it lasts for more than a few months it can lead to various autoimmune diseases such as rheumatoid arthritis, thyroid diseases, lupus, periodontal (gum) disease, arteriosclerosis and the atopic diseases such as hayfever, allergies and eczema and asthma. ²



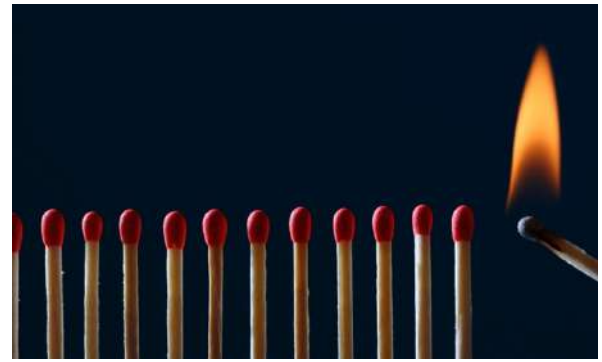
Common signs and symptoms of Chronic Inflammation ¹ are:

- Body pain, arthralgia, myalgia
- Chronic fatigue and insomnia
- Depression, anxiety and mood disorders
- Gastrointestinal complications like constipation, diarrhea, and acid reflux
- Weight gain or weight loss
- Frequent infections
- Irritable Bowel Syndrome

How does Breathing Relate to Chronic Inflammation?

Stress disrupts the body's maintenance of a healthy state by constantly adjusting its biochemical and physiological pathways. The healthy stable state is also known as homeostasis. ³

When stress is prolonged or severe the disruptions can set off a chain of reactions in the body. Chronic inflammation is often one of the ways the body responds to stress. ^{1&3} Overproduction of cortisol the primary stress hormone, is another response.



If we have a way to reduce inflammation by preventing, halting or reversing these responses naturally, then it makes sense to do so. Breathing well is one such natural pathway to achieve this.

Learning to breathe well activates the **vagus nerve**, which is the main component of the parasympathetic (rest and digest) nervous system.

What is the Vagus Nerve and what is the Inflammation connection?

The body has 12 cranial nerves which come in pairs and link the brain with the body. Some have sensory (sight, sound, taste, feel, smell) functions and other motor (movement) functions.

The **vagus nerve** (aka the 10th Cranial nerve, CNX) controls aspects of both sensory and motor functions, and provides a clever feedback loop system for the body.

Most cranial nerves feed information from the brain to the body (along efferent nerves), however the vagus nerve is made up mostly of afferent nerve fibres which send impulses from all the major organs of the body **to** the brain. It **also** has some efferent (brain to body) fibres which innervate the heart enabling a two way flow of data. ⁴

When it comes to the respiratory system, the vagus nerve is the major sensory feedback channel from the lungs and airways to the brain. According to a 2015 article by Chang et al., the vagus nerve “controls pulmonary function and (it) regulates respiration, including normal breathing and respiratory defence mechanisms.” ⁵

Much to the surprise of his colleagues, a study carried out on rats in 1998 by neurosurgeon, Kevin Tracey, proved that stimulation of the vagus nerve can help to reduce inflammation. ⁶



When activated, the vagus nerve releases acetylcholine (Ach), a neurotransmitter found in all motor neurons, which helps to calm the nervous system, slowing the heart rate, dilating blood vessels and stimulating smooth muscles to relax. ⁷ It does this by blocking the release of many of the inflammatory cytokines being produced as a stress response to triggers.

A number of studies have since backed up Tracey’s work.

Car and Udem stated in a 2003 article, that bronchopulmonary vagus nerve activation can lead to changes in breathing pattern, changes in messages flowing along the autonomic pathways to the airways such as sensations causing the urge to cough or dyspnoea (difficulty breathing or shortness of breath) for example. ⁸

More recently scientists working with ARDS (Acute Respiratory Distress Syndrome) which was one of the more severe COVID-19 outcomes, concluded that sensory feedback and respiration processes may be significantly impaired by inflammatory conditions (for example when a cytokine storm occurs or ‘over-production’ of cytokines), and that stimulation of the vagus nerve “activates the parasympathetic

anti-inflammatory pathways, brings into equilibrium the sympatho-vagal balance, and improves respiratory and cardiac ailments.”

They go on to suggest that vagal nerve stimulation (VNS) could therefore be effective in treating ARDS occurring from various viruses like COVID-19 concluding that: “vagal nerve activation will help to control lung inflammation. Furthermore, since the sympathetic-vagal imbalance worsens ARDS symptoms, we expect that VNS balancing function will improve treatment of a wider spectrum of respiratory diseases.”⁹

Whilst these studies were done using electronic stimulation of the vagus nerve, there is a **natural pathway** to positively influence the vagus nerve and autonomic nervous system. **This is where the breathing connection is so important** - learning to breathe well activates the vagus nerve not only as a result of the biomechanical diaphragm stimulation but also because of learning to increase carbon dioxide (CO₂) tolerance.¹⁰ (See article on Hyperventilation) Healthy levels of arterial CO₂ as a result of healthy breathing, directly influences the sensitivity of the vagus nerve’s nuclei.¹¹ This is what slows the pulse and improves the blood filling of the heart, slowing the heart during exhalation.

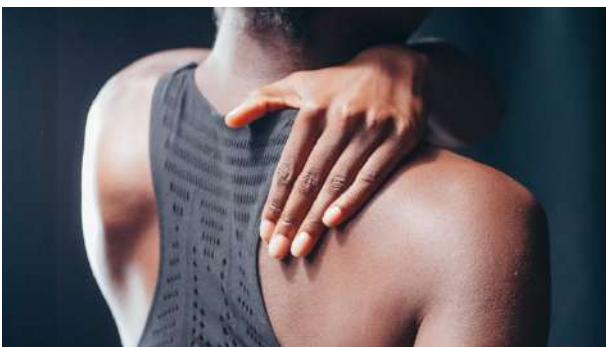


The good news is that the more the vagus system is activated the greater the resilience it develops to stressors over time – the effects of vagus nerve stimulation don’t stop once immediate activation ceases.

To recap:

- 1 There is increasing evidence to show that chronic stress suppresses the immune system and can cause chronic inflammation leading to both physical and mental health disorders including heart disease, digestive disorders, brain (such as epilepsy) and even forms of cancer.
- 2 Breathing well can help to reduce chronic inflammation through calming the nervous system and restoring and maintaining homeostasis.
- 3 Stimulation of the vagus nerve activates the parasympathetic nervous system (PNS) – your ‘rest and digest’ system so healthy breathing means being in PNS mode more of the time.

Many people are unaware of how well they breathe throughout the day unless it is noticeably loud or fast or erratic. It is worth getting checked with a breathing assessment to learn what the healthy parameters of breathing are and how you are doing.



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