# DIAPHRAGMATIC
# BREATHING

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# DIAPHRAGMATIC BREATHING

*THE MASTER KEY TO HEALING*

Good Psychology needs to be grounded in good Biology. Shallow chest breathing is the body's response to stress, and in turn, chest breathing keeps the body stuck in a kind of panic, which manifests as chronic anger, anxiety and/or depression. This vicious cycle needs to be broken. Restoring natural, healthy - diaphragmatic - breathing is the pre-requisite for successful therapy, including releasing stuck emotions, as well as enabling the brain to accept more resourceful and positive thinking patterns.

Psychology = from "psycho-" and "-ology".
**psycho** = Greek: psyche - breath, spirit, soul, mind
**ology** = the study of something

"You simply watch. Remember, simply watch. This is what **Buddha** has called **VIPASSANA** - the watching of the breath, **awareness of the breath** – or SATIPATTHANA - remembering, being alert of the life energy that moves in breath. Don't try to take deep breaths, don't try to inhale or exhale, don't do anything. You simply relax and let the breathing be natural - going on its own, coming on its own - and many things will become available to you." (Osho)

**PRANAYAMA** in Yoga is the art of **breathing control**: "When the breath wanders the mind also is unsteady. But when the breath is calmed the mind too will be still, and the yogi achieves long life. Therefore, one should learn to **control the breath**." (Hatha Yoga Pradipika)

## Why Control Breathing?

We need to pay special attention to the breath, **firstly** because the respiratory system is the only major system in the body, which is **usually involuntary**, but which **can also be voluntarily controlled**.

We need to pay special attention to the breath **secondly** because it is a very powerful and centrally important system. Somewhat like the flywheel in a car engine, the **breath regulates all the other autonomic systems**, including brain function.

As yogis have known for centuries, **controlling and changing the way we breathe**, can go a long way towards getting us unstuck from the physically and psychologically debilitating effects of **sympathetic over-activation**, that is: stress.

To **restore the balance in the ANS** (Autonomic Nervous System), we need to change the chronic habit of subtle or more obvious hyperventilation (rapid chest breathing) to **slow diaphragmatic (belly) breathing**, which is natural in normal, happy people, and all animals. If you don't believe me, take a look at a happy baby, or your dog.

## Oxygen and Carbon Dioxide

**Photosynthesis** is the chemical process in **green plants** that traps the sun's energy - photons - and uses them to manufacture convenient energy-storage molecules such as sugars and starch. The process **uses carbon dioxide (CO2)** and **releases oxygen (O2)** into the atmosphere as a by-product.

**Metabolism** is the neatly symmetrical chemical process in **animal cells**. It is the slow burning that releases the sun's energy trapped in the fuels manufactured by plants, for use by animals. Just like any other fire, or your car's engine, the process **requires oxygen, and releases carbon dioxide as a by-product**, which is then utilized by plants to perform photosynthesis... and this is the **cycle of life** on planet Earth.

**res·pi·ra·tion**

1. The act or process by which **every living organism** exchanges gases with its environment.
2. a. **In animals**: The act or process of inhaling and exhaling; breathing. Also called *ventilation*.

   b. The *oxidative process* occurring within living cells by which the chemical energy of organic molecules is released in a series of metabolic steps involving the consumption of oxygen and the liberation of carbon dioxide and water.

**All the energy** that drives life comes ultimately from **sunlight**, trapped by plants.

Adults take anywhere from **17,000 to 30,000** breaths a day, on average, most of the time without even realizing they're doing it. Breathing is so natural that we usually take it for granted; that is, until something happens that threatens our ability to breathe.

The **mitochondrion** is an organelle, or in other words a **tiny machine**, found in every one of our cells. They range from 0.5 to 10 micrometres (μm) in diameter. Mitochondria are the "cellular power plants" because they generate most of the cell's supply of adenosine triphosphate (ATP), the main source of **chemical energy**.

They use **glucose and oxygen** to produce energy (and release carbon dioxide and water in the process) for use in all metabolic processes.

## The Evolution of Unnatural Breathing in Humans

**Somatic Experiencing®** was developed by Dr. Peter Levine following his observation that animals in the wild do not get traumatized even though daily they are faced with life threatening situations. Dr. Levine observed the mechanisms by which animals are able to shake off the high levels of nervous system arousal and return to their daily lives. He then asked the question of why humans are so susceptible to the devastating effects of trauma.

What he realized is that as the **neo cortex** evolved, that part of the brain that makes us the most human, giving us the ability to think and ponder deep philosophical questions, our ability to override our instinctual responses also came online.

Now, in most cases this is a really good thing. We don't have to automatically lash out and kill someone just because they took our food. We can creatively think up better strategies to deal with threats.

But, as with most things in nature, being given a new and enhanced capability usually involves losing some part of an old one in its place. In this case the ability to override the instinctual responses of the nervous system left us with a **vulnerability to being traumatized**.

First, let's look at some of the underlying theory on which SE® is built. We start with the **Polyvagal Theory** of Dr. Stephen Porges at the University of Illinois.

Physiologists and medical schools are still teaching (not quite correctly) that the ANS exists in **two states** (or phases):

**Fight or flight (sympathetic),** and

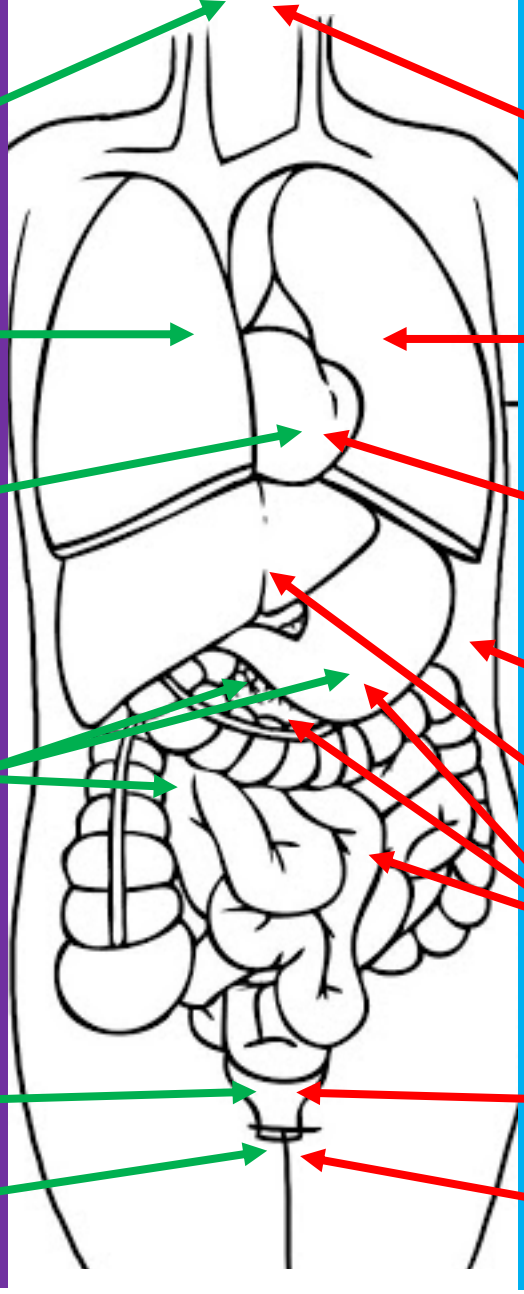
**Rest and recuperation (parasympathetic).**

Dr. Porges observed that we actually have **three states** in the ANS which form a hierarchy. He calls these states:

**'Social Engagement'** which is parasympathetic, **'Fight or Flight'** which is sympathetic, and

**'Freeze'** which is **parasympathetic and sympathetic activation simultaneously**.

| Parasympathetic Division | Sympathetic Division |
| --- | --- |
| Constricts pupil | Dilates pupil |
| Stimulates saliva production | Inhibits saliva production |
| Constricts bronchi | Dilates bronchi |
| Slows heart | Accelerates heart |
| Stimulates stomach, pancreas and intestines | Stimulates epinephrine and norepinephrine release |
| | Stimulates glucose release |
| | Inhibits stomach, pancreas and intestines |
| Stimulates urination | Inhibits urination |
| Promotes erection of genitals | Promotes ejaculation and vaginal contractions |



In the human nervous system, **we still have freeze / dissociation** as an algorithm that can be run to protect us. But, in humans it is a bit more complicated. In most cases we can at least **partially override freeze**. Most people have never fully fainted in fear. But most of us have temporarily been unable to move, or have spaced out, or went speechless in fear.

We have several synonyms for freeze, including **dissociation, immobility, spacing out**, deer in the headlights look. In the healthy nervous system, it still serves and protects us humans, but often, freeze is associated with the residual crippling effects of trauma. Here's what happens that causes humans to **get stuck in trauma**.

When we are faced with a life-threatening crisis our nervous system develops **a motor plan** for escaping it. Usually that motor plan begins to be executed, for example running, or lashing out. But, when that **plan is thwarted**, by being caught in a dead-end situation, we go into **freeze**. Please note that "life-threatening" doesn't only refer to our physical survival, but also to our **emotional survival**.

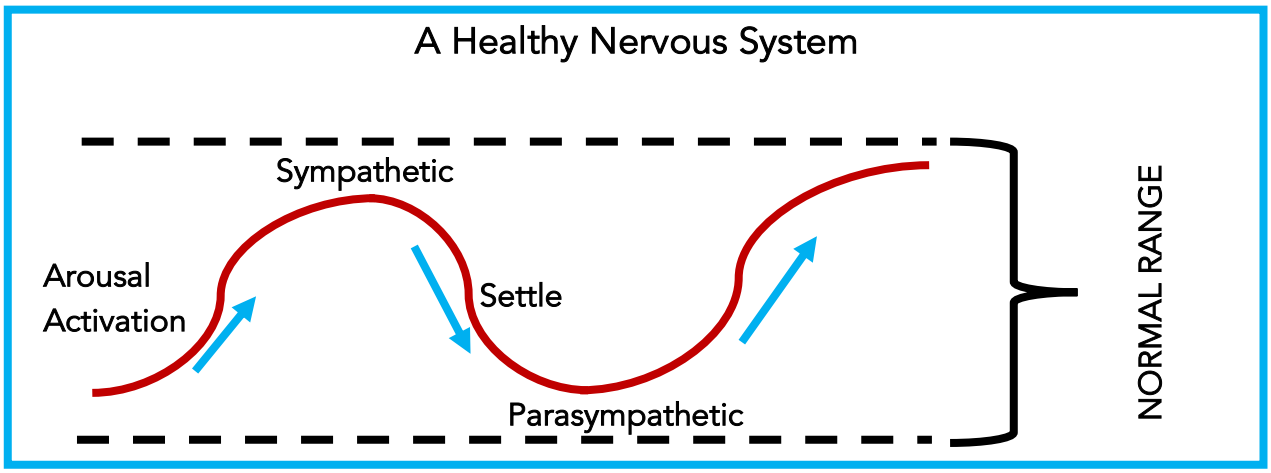
This means that humans are equally traumatized by **rejection, abandonment, betrayal, and humiliation**, that is, the experience of being **disconnected** from others, the world, and self.

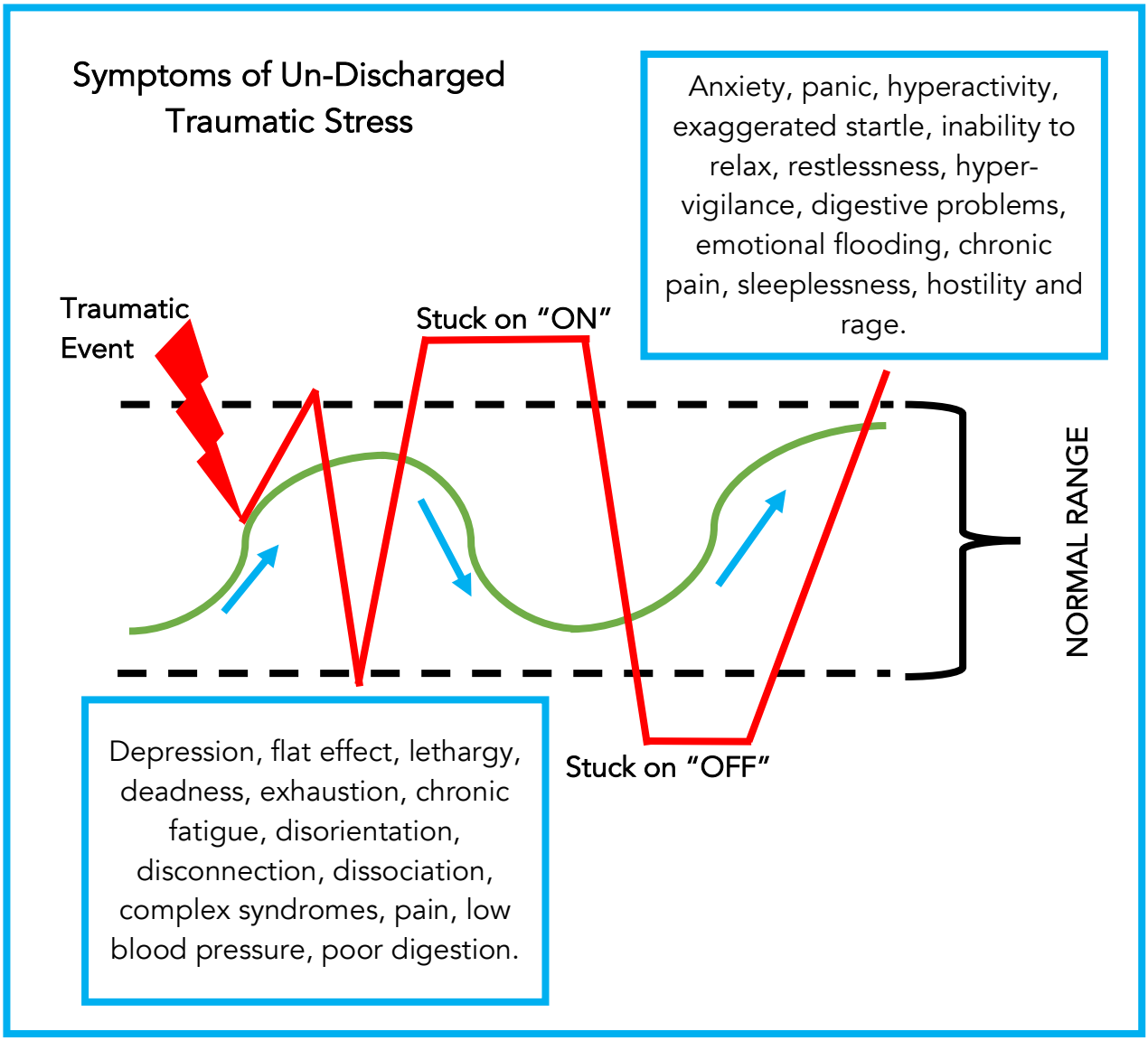
Even though we cannot escape, our protective motor plan **continues to go around in our brain.** In animals when they come out of freeze the **energy is drained off** by running to escape or by the rhythmic waves of muscle contractions. This **doesn't happen in humans** every time, or we override the trembling that would help accomplish this.

So, we are left **highly activated, with an incomplete motor plan** still going round and round in our brain. This motor plan wants to complete and so our unconscious mind may continually place us in situations similar to this one so that we can use the motor plan to complete the movement back to safety.

These incomplete motor plans continue to run long **after the original event**. They waste mental energy and they **continually activate the nervous system towards fight or flight** or even push it into freeze with the right kind of threat.

Many people are always hyper, or hyper-vigilant. They look like they have had too much coffee. Those are people who have gotten **stuck in the sympathetic system activation of fight or flight.**


A Healthy Nervous System
Sympathetic
Arousal
Activation
Settle
Parasympathetic
NORMAL RANGE


Symptoms of Un-Discharged
Traumatic Stress
Anxiety, panic, hyperactivity, exaggerated startle, inability to relax, restlessness, hyper-vigilance, digestive problems, emotional flooding, chronic pain, sleeplessness, hostility and rage.
Traumatic
Event
Stuck on "ON"
NORMAL RANGE
Depression, flat effect, lethargy, deadness, exhaustion, chronic fatigue, disorientation, disconnection, dissociation, complex syndromes, pain, low blood pressure, poor digestion.
Stuck on "OFF"

Being stuck is like when your **computer slows to a crawl** when some error causes a program to get stuck in a **continuous loop**, eating up CPU cycles. You sit there waiting and waiting for the task at hand to complete.

When the brain is stuck with **several of these protective motor plans running all the time** because they can't complete, our brains run slow and inefficiently, just as our computer does.

Being frozen in fight / flight **affects every single cell, organ, and system** of the body that is controlled by the ANS (Autonomic Nervous System).

## What Effect is Stress Having on your Long-Term Health?

**Brain**: Depression, Anxiety, Insomnia, Low Energy, Migraines

**Neck**: Hypothyroidism, Sore Throats, Mouth Ulcers

**Hair**: Hair Loss, Thinning

**Arteries**: High Blood Pressure, Cholesterol, Stroke

**Muscles & Joints**: Pain, Tension, Fibromyalgia, Fluid Retention

**Lungs**: Coughs, Colds, Asthma

**Heart**: Heart Disease, Irregular Heartbeat

**Liver & Pancreas**: Liver Disease, Diabetes

**Stomach**: Ulcers, Malnutrition, Anorexia, Constipation, IBS, IBD

**Sex Glands**: PMT, Irregular Periods, Low Libido, Prostatitis, Night Sweats

**Weight Gain**: Fat Around the Middle

**Skin**: Aging, Acne Rosacea, Eczema, Psoriasis, Allergies

But the most visible and dramatic sign of being frozen in fight / flight is **rapid, shallow chest breathing (hyperventilation)**, often accompanied by rapid heartbeat, cold, sweaty hands, and neck spasm.

Chronic hyperventilation can also be the result of **poor posture**, excessive **muscular tension, poor diet,** and the prevailing **image of the hard, flat belly** that we find in fashion and fitness magazines.

Aerobics instructors and personal trainers teach people to suck in their stomachs and to do strenuous **exercise using only chest breathing**.

By adolescence, most people breathe as if they are encased in a **tight corset**.

## The Vicious Hyperventilation Cycle

**Hyperventilation** means breathing **more air per minute** than the medical norm. The values for normal minute ventilation at rest for a 70-kg man range from 6-9 L/min.

Hyperventilation is simply over-breathing, and the constellation of symptoms produced is called the **Hyperventilation Syndrome**. These symptoms may be acute and sudden, the **Acute Hyperventilation Syndrome**, or they may be chronic and quite subtle, the so-called **Chronic Hyperventilation Syndrome**.

Typically, **Panic Attacks** (or **Anxiety Attacks**) are associated with the **Acute Hyperventilation Syndrome**, though subtle **Chronic Hyperventilation Syndrome** complaints may provide a **background of anxiety symptoms** that set the stage for developing Panic Attacks with even more hyperventilation problems being produced.

Patients with **Acute Hyperventilation Syndrome** (HVS) may present with great agitation and anxiety. The history is of sudden onset of dyspnoea (shortness of breath), chest pain, or neurological symptoms (dizziness, weakness, paraesthesia's, near syncope / fainting).

Patients with **Chronic Hyperventilation Syndrome** present with similar symptoms, including recurrent chest pain, dyspnoea, and neurological deficits, and usually have many similar presentations in the past.

## Frequency

### United States

As many as **10% of patients** in a general medical practice are reported to have Hyperventilation Syndrome. It is thought that up to **6% of the general population** exhibits aspects of Hyperventilation Syndrome.

### Sex

A **female** preponderance of Hyperventilation Syndrome exists; the female-to-male ratio may be as high as **7:1**.

### Age

The peak age of incidence is from 15-55 years, but cases have been reported in all age groups except infancy.

## Chronic Hyperventilation Syndrome

Hyperventilation is usually **not readily apparent**.

Neck and shoulders are tight and painful, chest wall tenderness, numbness, and tingling.

Characteristically, patients have multiple complaints without much supporting physical evidence of disease.

Hyperventilation can be maintained without any change in the absolute minute volume if the patient exhibits **frequent sighs** interspersed with normal respirations.

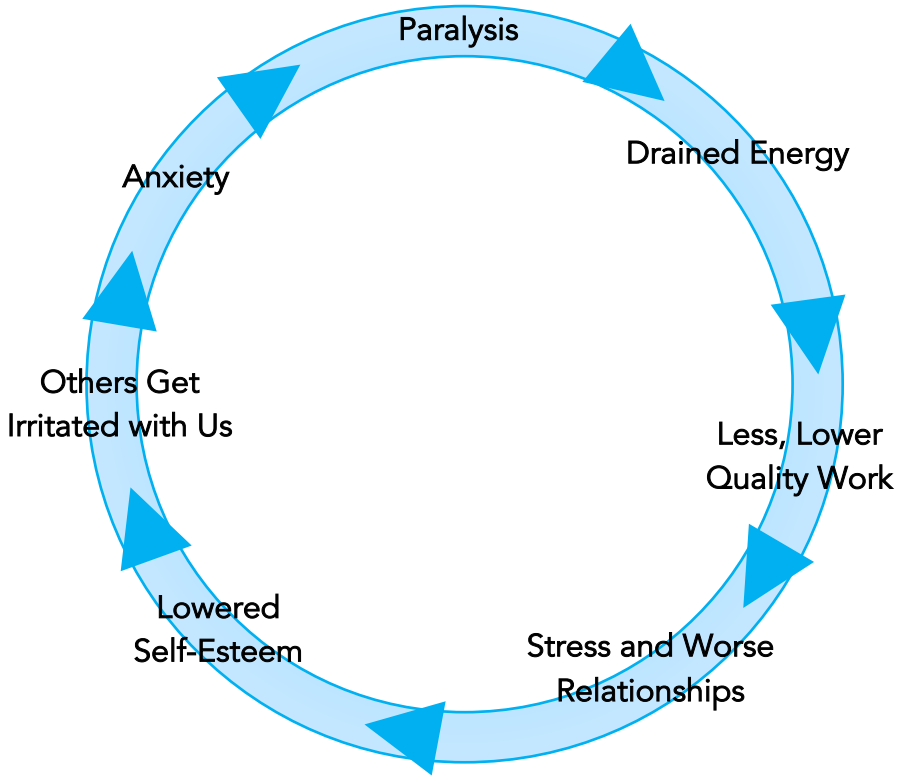
Because of the subtlety of hyperventilation, many patients with Chronic Hyperventilation Syndrome are admitted and undergo **extensive and expensive testing** in an attempt to discover organic causes of their complaints.

## What Is the Impact of Breathing on Our Perception of the Outer World?

**Normal perception requires a calm brain** so that our senses and nerve cells can freely transmit correct information for objective analysis. In other words, we need minimal abnormal interference from our nervous system (self-generated signals).

Hyperventilation, on the other hand, plays a key role in our immediate reaction to stress or in an emergency situation when our wellbeing or life is in danger. At such moments we do not need the objective world. We need to save/fight for our lives. Hence our minds are **focused on threats, enemies, stress sources or outside problems**.

Sometimes an obvious or visible threat is absent. Then the **excited brain can invent threats literally from nothing** due to spontaneous and asynchronous firing of cortical neurons. Hence, when we breathe more, we have a tendency to experience anxiety and search for threats, enemies, problems, etc. Indeed, a vicious cycle, which can cause **relationship problems**, and unnecessary **wounds to self-esteem**, even **perceived personality, moral, and spiritual** deficits.




What is wrong with me? Why am I this way? Maybe this is just who I am.

Changes to How You Experience Yourself

- Cognitive Changes
  - Don't remember as much
  - Don't think as quickly
- Physical Changes
  - Pain
  - Insomnia
  - Light and sound sensitivity
- Personality Changes
  - Short temper
  - Violent reactions
  - Wild mood swings

Who am I?

- Disorientation
- Embarrassment
- Frustration
- Confusion
- Low self-esteem

Traumatic Moral Injury

- Stress
- Despair
- Depression
- Anxiety
- Rage / Anger

## Oxygen-Carbon Dioxide Imbalance

The lungs have **two basic functions**. The first is to take in **Oxygen** (O2) containing air. The second is the removal from the body of **Carbon Dioxide**. The rate of CO2 removal is normally **exquisitely balanced** by lung breathing control mechanisms, depending on general activity levels, so that not too much, and not too little CO2 is eliminated.

Hyperventilation Syndrome occurs **when breathing is over-active**, and this over breathing **eliminates too much CO2, thus causing the CO2 level in the body to fall lower than it should (hypocapnia).** This has immediate consequences in terms of maintaining the all-important internal body **pH**, a measure of how acidic or alkaline the body environment is.

An excessively **low CO2** level causes **vasoconstriction**, i.e., spasm or constriction, of the arteries carrying blood to the **brain**. This causes a reduction of vital **oxygen delivery to the brain**.

This causes a reduction of the supply of **glucose**. The brain has essentially no reserve supplies of oxygen and glucose, therefore, any disruption of blood flow to the brain has almost immediate consequences.

Typical hyperventilation complaints are those of being light-headed, or feeling somewhat disoriented, or dizzy or feeling faint, and occasionally actual fainting may occur. These are direct manifestations of brain distress.

Most people believe that a deep or heavy breathing pattern provides more oxygen for brain cells. Many people "practice" hyperventilation 24/7. However, over-breathing reduces oxygenation of the brain, causing **cerebral hypoxia**.

Studies have shown that oxygen to the brain can be reduced up to 60% via chronic hyperventilation.

You can test these ideas in practice. If you take a hundred deep and fast breaths, you can easily faint or pass out due to ... **cerebral hypoxia** or reduced oxygenation of the brain. Why? O2 availability for the brain is reduced by about 40% as a result of 1 minute of over-breathing (hyperventilation).

And there may be additional **peripheral symptoms**, such as numbness or tingling about the face and around the mouth, or tingling in the fingers, and muscular spasm of the fingers. There may be a sense of pressure of tightness in the chest, leading to fears of a heart attack. And there may be a vague feeling of overall anxiety, weakness and fatigue.

Other symptoms of hyperventilation can range from dyspnoea (or shortness of breath) and angina pain (a sign of low heart oxygenation) to blocked nose, sleep apnoea, Irritable Bowel Syndrome, spastic colon, and constipation.

These symptoms are also caused by **coronary constriction** (heart), **ischemia** (localized anaemia), **buffer depletion** (bicarbonates), **bronchial constriction**, **gut constriction, calcium imbalance, magnesium deficiency, and muscle fatigue.**

Over-breathing reduces CO2 levels in the arterial blood. This causes **decreased oxygen delivery to cells (hypoxia).** Cell hypoxia can cause a **spasm in all muscles** of the body: airways, colon, arteries, arterioles, the heart and the diaphragm. As a result, the **diaphragm gets into a state of spasm**, making normal breathing difficult.

How reduced CO2 causes reduced O2 is explained by the **Bohr effect**.

What is the Bohr effect in simple terms? Oxygen is transported in blood by haemoglobin cells. How do these red blood cells know where to release more oxygen and where less? Or why do they unload more oxygen at all? Why is O2 released in tissues? The haemoglobin cells sense higher concentrations of CO2 in tissues and release oxygen in such places.

Hence, if CO2 concentration is low, O2 molecules are stuck with red blood cells. CO2 deficiency (hypocapnia) leads to hypoxia in the cells. The more we breathe at rest, the less the amount of available oxygen in the cells of vital organs, like the brain, heart, liver, kidneys, etc.

Haemoglobin cells in normal blood are about 98% saturated with O2. When we hyperventilate this percentage is about the same, but without CO2, this oxygen is tightly bound with red blood cells and cannot get into the tissues in required amounts.

The Bohr effect is crucial for our survival. During each moment of our lives, some organs and tissues work harder and produce more CO2. These additional CO2 concentrations are sensed by the haemoglobin cells and cause them to release more O2 in those places where it is most required.

This is a smart self-regulating mechanism for efficient cell oxygen supply. Without the Bohr effect, you could not walk or run for even 3-5 minutes.

In normal conditions, more O2 is released in those muscles, which generate more CO2. Hence, these muscles can continue to work with the same high rate.

In 1885, Miescher (Swiss physiologist) inspired by the insight of genius wrote: **"Over the O2 supply of the body, CO2 spreads its protecting wings".**

## Disturbed Breathing Mechanism

But the explanation of hyperventilation syndrome also lies partially in the **mechanics of breathing**. Normal tidal volumes range from 35-45% of vital capacity at rest. The elastic recoil of the chest wall resists hyperinflation of the lungs beyond that level, and inspiratory volumes beyond this level are perceived as effort or dyspnoea.

Patients with hyperventilation syndrome tend to breathe by using the **upper thorax rather than the diaphragm**, resulting in **chronically over-inflated lungs**. The sensation of dyspnoea creates anxiety, which encourages more deep breathing, and a vicious cycle is created.

Relying on thoracic breathing rather than diaphragmatic breathing, results in a hyperexpanded chest and **high residual lung volume**. Because of this, they are then **unable to take a normal tidal volume** with the next breath and consequently experience dyspnoea.

Proprioceptors in the lung and chest wall signal the brain with a **"suffocation alarm"** that triggers release of **excitatory neurotransmitters** that are responsible for many of the symptoms such as palpitations, tremor, anxiety, and diaphoresis (sweating).

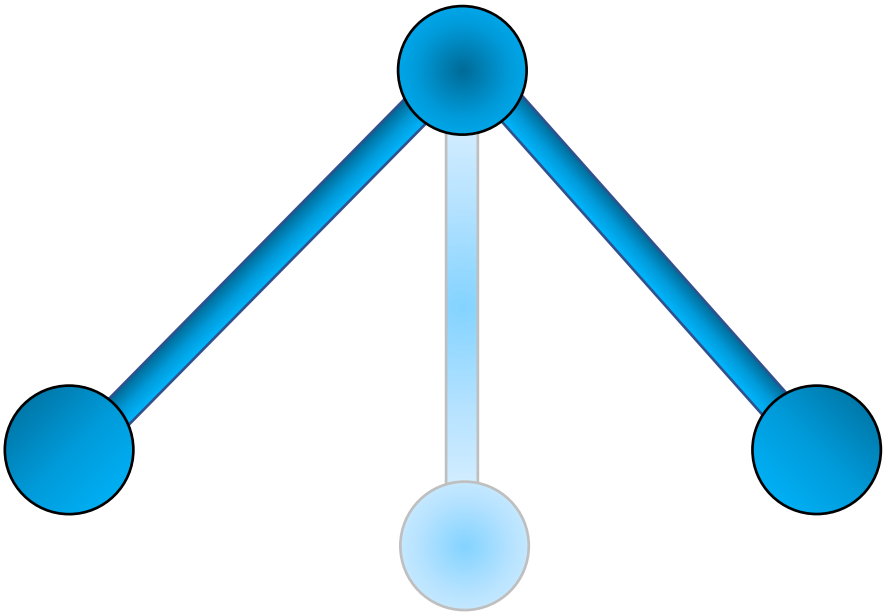
## Heartbeat-Breathing Disharmony

At this point, it is necessary to look more deeply into the relationship between **heartbeat rate** and **breathing**.

The autonomic nervous system consists principally of two antagonistic divisions:

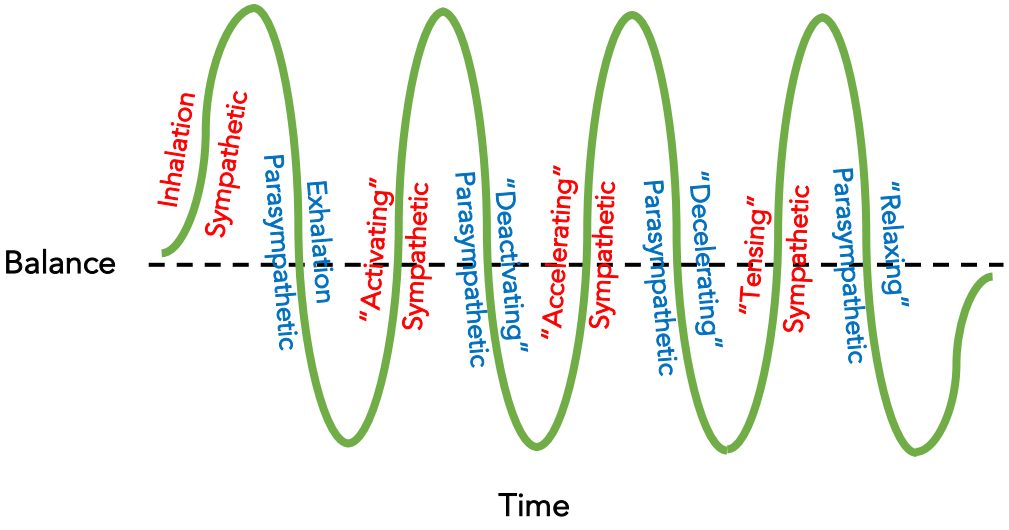
The **sympathetic division** – responsible for "activating" functions, and

The **parasympathetic division** – responsible for "deactivating".



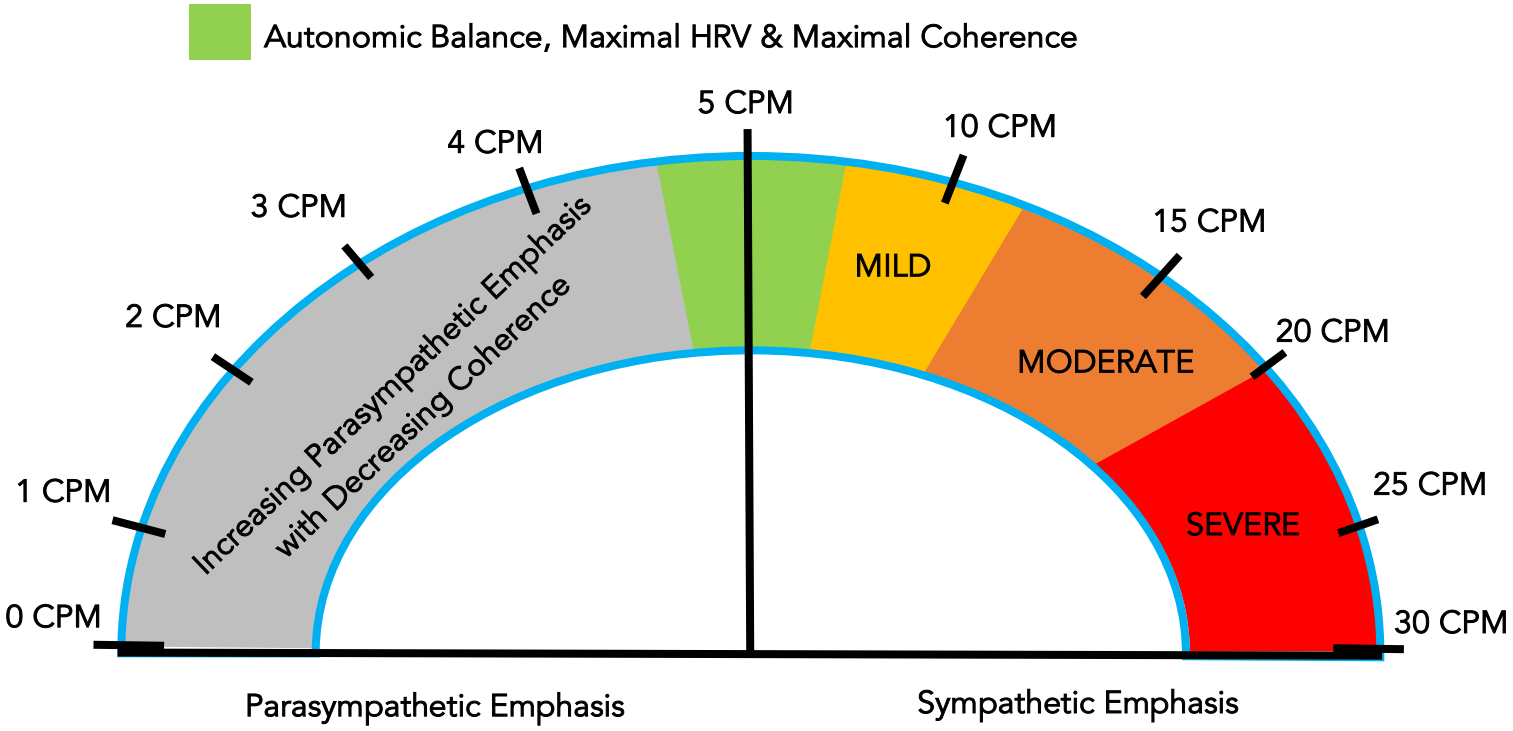
**Parasympathetic Phase**
Exhalation
Bronchi constrict
Carbon Dioxide – out of bloodstream
Heartbeat rate decreases
Arterial pressure decreases
Arterial blood flow decreases
Arterial relaxation / elastic contraction
Peripheral arterial pressure decreases
Venous blood flow decelerates
Venous reservoirs empty

**Sympathetic Phase**
Inhalation
Bronchi dilate
Oxygen – into bloodstream
Heartbeat rate increases
Arterial pressure increases
Arterial blood flow increases
Arterial constriction / elastic distention
Peripheral arterial pressure increases
Venous blood flow accelerates
Venous reservoirs fill



**Inhalation** ideally occurs coincident with the **sympathetic** phase, and **exhalation** ideally occurs coincident with the **parasympathetic** phase. When exhalation occurs coincident with the parasympathetic phase, a "**relaxation response**" naturally occurs with each exhalation. A key reason that people become "tense" is that this response is not elicited frequently.

When in the state of rest or semi-activity, the **autonomic nervous system takes its cue from the breathing frequency**. Breathing at a relatively **rapid pace**, even while seated and otherwise relaxed, results in an autonomic shift toward **sympathetic emphasis** - the "fight or flight" response. The degree of emphasis varies directly with the rate of breathing.




**Why 1 cycle in 12 seconds**? For adults in the state of rest or semi-activity, if the breathing cycle is synchronized with the heart rate variability cycle, the resulting heart rate variability spectrum is 1 cycle in 12 seconds. Because this is the "natural frequency" at which the cardiopulmonary system including the nervous system resonates, at this frequency, coherence is maximal.

Autonomic balance is not just about cardiopulmonary synchrony. It affects the entire organism! During the state of coherence, the heart rate variability rhythm can clearly be seen to modulate **brainwaves** as measured by an electroencephalograph.

In **neurofeedback** therapy most people can quite easily learn to control their brain wave frequencies by changing the way they breathe.

Because, while at rest, the **average adult breathes at a rate of 10-20 breaths per minute**, they exist in a state of **persistent sympathetic emphasis**. By breathing at the frequency at which the cardiopulmonary system naturally resonates, one can achieve optimal **autonomic balance** and avert sympathetic dominance.

## Good Versus Bad Hyperventilation

**Of course, nothing is quite that simple....**

People can breathe intensely for hours without any signs of distress, but rather with signs of bliss and joy. The key to "over-breathing" is also very much about **balance between the high chest and abdominal breathing pattern**. The **way** one takes an in-breath stimulates the ANS in a good way or a bad way or something in between.

**High chest dominated** "sympathetic" breathing causes constriction and "hyper vigilance", a stronger connection to the **reptilian survival brain. Abdominal breathing** invites expansion and increased energy toleration. It has much more of the vagus (parasympathetic) action engaged with it and allows for the parasympathetic relaxation response to **"buffer" the survival instinct.**

Insights from Pranayama, transformational breathwork, and martial arts, demonstrate that Low CO2 caused vasoconstriction does not happen so much, or at all, when the parasympathetic nervous system is strong enough to maintain parasympathetic dominated balance. **Healthy hyper-inhalation or balanced deep breathing** is an energizing or fully charged aspect of "quiet" breathing.

**Abdominal (diaphragmatic) deep and / or rapid breathing** produces "safe" increased levels of oxygen, peptides, endorphins and subtle energies - what breathing practitioners call chi, ki, prana, pneuma, spiritus etc. The arteries remain more open, thus allowing increased flow of blood throughout the brain and body.

It feels great, sometimes even ecstatic. Gospel singing is an example of this experience, as well as some forms of chanting, and transformational breathwork.

Quick-deep or quick-shallow breathing, **if dominated by belly, back and side breathing**, most often increases the level of oxygen in our blood. Diaphragmatic breaths allow the nervous system to remain calm and to stay out of the potentially vaso-constrictive anxiety/survival response due to CO2 depletion.

We get more energized and in touch with our power without being overwhelmed with oxygen deprivation. The key is **HOW** the breathing occurs.

The **good kind of hyper-inhalation** is balanced deeper-easier-smoother-grounded faster breathing. This is relaxing and energizing, such as bastrika breathing in yoga. **Bad breathing** is over-stimulation (high chest dominant).

Fast chest breathing can be **appropriate** when it resolves an immediate emergency, or during a joyful activity, and then **reverts back** to healthy slower breathing. Wild animals seem to do that (adapt and recover) much better than most humans.

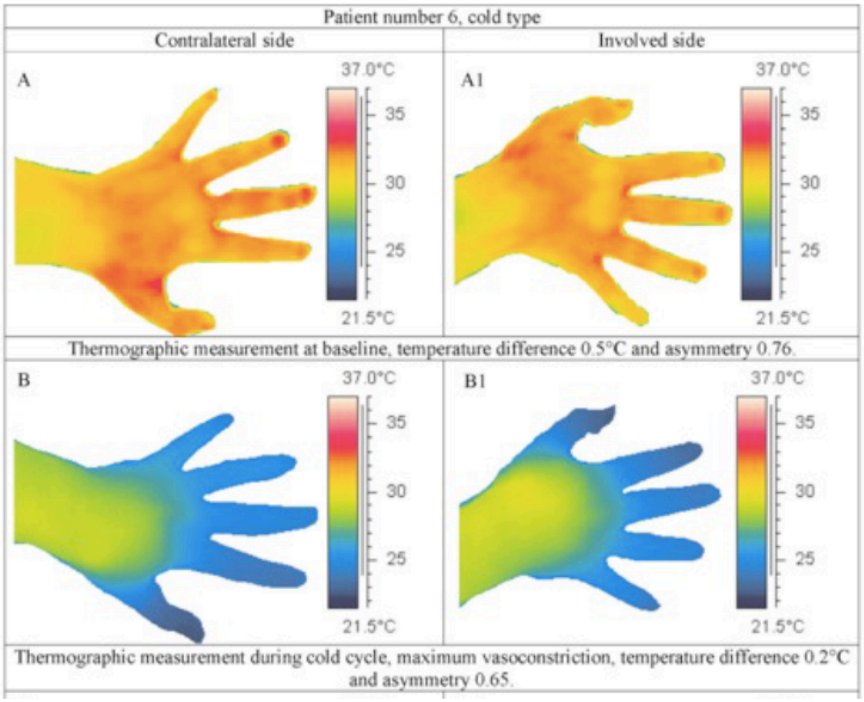
Breathing practices are safe when the body's **sensing mechanisms** are engaged on a moment-to-moment basis to **monitor** against inappropriate breathing related energy. But many people are so far out of balance that they may have forgotten about or never have felt a state of wholeness and balance.

Qigong and Pranayama teachers are often at a disadvantage because their students may be lacking **body awareness**, and do not internally sense themselves in ways familiar to these paradigms.

## Benefits of Diaphragmatic Breathing

The diaphragm, in normal health, does over 75% of the work of breathing at rest. Most modern people, as it is easy to observe, have predominantly chest breathing. What are the benefits of diaphragmatic breathing?

**Vasodilation** (expansion of arteries and arterioles). Hypocapnia (low CO2 concentration in the arterial blood) is reversed, usually first noticeable in the warming of the hands.



Thermographic measurement at baseline, temperature difference 0.5°C and asymmetry 0.76.

Thermographic measurement during cold cycle, maximum vasoconstriction, temperature difference 0.2°C and asymmetry 0.65.

**Bronchodilation** - dilation of airways: bronchi and bronchioles are relaxed by carbon dioxide, breathing is easier, and anxiety is reduced.

**Blood pH regulation** and regulation of other bodily fluids. The lower acidic and higher alkaline levels will change the taste in the mouth - sweeter!

**Muscle relaxation** or causes a general feeling of ease and comfort in the body.

Free radicals are eliminated by mobilizing the natural antioxidant defences of the body.

Better breathing is an **anti-inflammatory** agent, as well as enabling the **immune system**.

**Brain and nervous system stabilization**. The spontaneous and asynchronous firing of neurons associated with hypoxia is eliminated, as well as alleviating anxiety, panic attacks, obsessive-compulsive behaviour, irritability, sleeping problems, etc.

The upper 7% of the lung delivers 4 ml of oxygen per minute, while the lower 13% of the lung brings in 60 ml of oxygen every minute. In diaphragmatic breathing, the **lower parts of the lungs are opened up** when the diaphragm floats down into the stomach cavity. This means that **oxygen transport is about 7 times more productive**.

Normal breathing at rest has a small tidal volume (only about 500 ml for a 70-kg person).

In contrast, chest breathing is usually larger (up to 700-900 ml for tidal volume, and 18-25 breaths per minute in mild forms of heart disease, diabetes, and asthma). But during thoracic breathing, blood oxygen levels are actually *reduced* because the lower parts of the lungs do not get fresh air supply. With diaphragmatic breathing, blood oxygen levels are optimal.

The diaphragm is a lymphatic pump since about 60% of all lymph nodes in the human body are located just under the diaphragm. Diaphragmatic breathing **stimulates the cleansing of the lymph nodes** by creating a negative pressure, pulling the lymph through the lymphatic system. This increases the rate of **toxic elimination** from the body.

Diaphragmatic breathing is an excellent **stress buster** and **increases energy levels**, not to mention the fact that it helps **curb insomnia** and is helpful when it comes to **weight loss**. There are several ways in which stress can contribute to weight gain. One has to do with cortisol, a stress hormone. Eliminating stress, as well as the extra oxygen allows you to burn calories faster, thus speeding up your metabolic response.

Diaphragmatic breathing is the most effective way to **quiet and calm the mind and soul**. It helps contribute to an **overall feeling of wellbeing**. And who doesn't need that? Better breathing also allows oxygen to be more freely distributed to every cell in the body. The brain and all of the body's organs work much more effectively. The relaxation response has a very positive effect on the body's overall **health, including physical, mental and even spiritual wellbeing**. Our nervous system, which is so often filled with tension, is soothed and stress is reduced.

Deep breathing exercises are physically energizing and help one **charge one's overworked batteries**. It is beneficial for those who suffer from frequent headaches. Deep breathing has the ability to change extreme tiredness into **energy** and restlessness into **tranquillity**.

Breathing a whole cantering breath takes us from the **centre of our physical being while uniting us with our mental and spiritual capacities**. The physical, spiritual/ emotional, and mental capacities work **in accord**. From here, we eat better, we exercise more regularly, we rest when needed. We simply make better judgments that empower life in balance.

**Endorphins** are **endogenous opioid peptides that act as neurotransmitters**. They are five hundred times more potent than morphine. They have physical and emotional **pain-relieving** capabilities, and they give a person a sense of ease and peace. I can tell you from personal experience that deep diaphragmatic breathing releases endorphins.

Following Qigong breathing practices, I now call diaphragmatic breathing **"tan den" breathing**. They are not exactly the same. Diaphragmatic breathing speaks of a physical anatomical structure performing an act. "Tan den" breathing speaks of an **energetic transformative act**. It has a broader meaning.

## And There Are More Benefits!

**Better breathing helps in defecation, urination, and vomiting by increasing the intra-abdominal pressure**. All these processes are mainly reflexive, and the contribution of the diaphragm to these processes, in health, is small but valuable. Whereas alveolar hyperventilation due to thoracic breathing can lead to spasm in the muscles of the lower digestive tract causing constipation, IBS, spastic colon. etc., all of which are improved when we breathe better, because each and every diaphragmatic breath is like a little massage of the entire digestive system.

People with constipation strain themselves too much (in the elderly, this often results in the formation of diverticula). But with regular, gentle diaphragmatic breathing, **bowel movements occur more easily** - and it becomes unnecessary to use the diaphragm forcefully.

**Diaphragmatic breathing helps in the production of speech (voice) and other sounds (e.g., laughter) by changing the intra-abdominal pressure**. In normal health, high CO2 levels dilate the airways making air movements easier, while the diaphragm naturally remains relaxed. In this case, the diaphragm plays a main role in the generation of speech sounds and voice sounds.

When we switch to thoracic breathing (as during unnoticeable hyperventilation), this function of the diaphragm is taken over by the chest muscles. The resulting hypocapnia constricts bronchi and bronchioles leading to a tenser voice and higher pitch of the voice. This effect is especially noticeable during singing, so it is not a surprise that singing teachers encourage diaphragmatic breathing in their students.

**Eliminates neck and back pain**. The most obvious visual means to detect upper chest breathing, is the raising of the upper chest structures by means of the upper fixators of the shoulder and the **auxiliary respiratory muscles** (*upper trapezius, levator scapulae, scalenes and sternomastoid*). Not only is upper chest breathing an inefficient means of breathing, the constant **strain on the muscles** in the cervical region, leads to **postural changes**.

This is because the **diaphragm is also a major structural muscle**. A dysfunctional respiratory diaphragm provides **inadequate support to the spine**. Affecting the function of the pelvic floor, potentially causing lower back pain.

These changes run physically and physiologically against biologically sustainable patterns, and in a **vicious circle**, promotes abnormal function, which **alters structure**. Diaphragmatic breathing allows a return to normal function.

An infant is the easiest example to observe on how your **functional breathing** should appear. **Their stomach is what is moving up and down when they use their *diaphragm*, not the upper chest**, as they lay there sleeping and utilizing "resting breathing". And when they decide that their world is troubled, and they need to scream out; they utilize "forced breathing". We can observe the upper two ribs rise up; the shoulders raise and pull back - all just before that first scream....

## Restoring Natural Healthy Breathing

**Healthy breathing patterns** can be restored using simple **diaphragmatic breathing exercises**. Clinical trials also suggest that resistive breathing, e.g., pursed lip breathing and yogic ujjayi (constricted) or nadi shodhana (alternate nostril) breath are helpful.

To breathe *naturally* is to **breathe with our whole body**, the way a baby or animal does. For this to occur, we not only need a **flexible, un-constricted ribcage and spine, but also a supple belly**. Our belly needs to be able to expand on inhalation and retract on exhalation.

This bellows-like movement of the belly supports the upward and downward movement of the diaphragm. When the **belly expands on inhalation**, the **diaphragm expands downward into the abdomen**, creating a **vacuum in the chest**, which allows the lungs to **expand effortlessly**. When the **belly retracts on exhalation**, the **diaphragm can relax upward**, helping to empty the lungs effortlessly.

With fewer, slower, more coordinated breaths, the average **brain wave frequency changes** - dysfunctional high Beta waves decrease, and more Alpha, Theta, and Delta waves are produced.

These slower brain wave frequencies are associated with **relaxed focus, creative visualization, lateral thinking, insightful problem solving, whole brain functioning, peak performance, meditative and hypnotic states, as well as transformational and transcendental experiences**. This enables the **release** of stuck emotions and unproductive thinking patterns, as well as the **integration** of more resourceful visions, as in therapy.

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*Artwork artist unknown*