

Autonomic Nervous system

The Autonomic nervous system (ANS) is often called the “automatic” nervous system because it is said we do not consciously control it (Some yogi’s and individuals that practice biofeedback would disagree.). Whereas the Somatic nervous system (SNS) is hooked up to skeletal muscle, the ANS is hooked up to involuntary structures such as smooth and cardiac muscle, and both endocrine and exocrine glands. The ANS coordinates all the systems *except* the muscle system. The ANS links with the hypothalamus and is controlled by it at all times except extreme emotional stress. During the stressful times, the cerebrum takes over. The ANS is divided into two systems, the **Parasympathetic nervous system** “rest and digest” and the **Sympathetic nervous system** “fight or flight” system. It is here, within the Autonomic Nervous system, we will discuss the physiological effects of stress and relaxation.

The Stress Response

Throughout time animals, humans included have had to evolve a quick and efficient response to any real or perceived threat. Our environment has included large teeth and claws of individuals who would like us for lunch rather than conversation. Lacking an equal defense, we’ve evolved our “fight or flight” system to liberate energy and attention to the areas of our body which will allow us to fight or run away with our big muscles, or outsmart the threat with our brain (this may include “freezing” or hiding).

The interesting thing about stress is we get to determine what is stressful every time we are confronted with a situation (the hopeful point is we can in the future change it too!). What is considered stressful can always change. Seeing a monster today may not be stressful, but seeing one tomorrow after a night of little sleep may be. Now with the evolution of our creative and imaginative brain (and t.v.), we can even invent the monster internally with our thoughts, independent of the one under our beds. Some physiological stressors that affect *all* people regardless of their television watching, are extreme heat or cold, environmental poisons, toxins by bacteria or viruses, and increased bleeding. Regardless of *what* the stress is caused by, the body responds the same everytime, utilizing the following stress response. Now let’s look at it in detail.

Remember back to a time when you almost hit an animal on the road...or when you were really angry. These are examples of the body going into the fight or flight response. Can you think of the changes that occurred in your body? Let’s list a few below.

Immediately the heart rate and breathing rates go up. The body systemically liberates more oxygen and glucose into the blood for the heart, brain and skeletal muscles so they can get us out of there. Blood is shunted away from places not immediately helpful for our survival, like the digestive, immune and urinary systems. What good will digesting our dinner do if we don’t live long enough? When the above processes are put into motion the organism is prepared to efficiently deal with the situation with the surge of energy and oxygen flooding the system. This “**alarm reaction**” is quick and carried out by the Nervous system. If the threatening situation is resolved, all body systems can return to equilibrium and the rest and restore phase. If it isn’t resolved, a more long-term phase kicks in called the **intermediate reaction**. The intermediate reaction allows the body to continue fighting the stressor after the alarm reaction stops. It provides energy and circulatory changes to meet the crisis, perform strenuous tasks, or resist the threat of bleeding to death. One hormone that continues these body changes started in the alarm reaction is **adrenaline**, which is released from the adrenal gland.

If the stressor remains for more than two hours the next phase, the **Resistance Phase** begins. Another major hormone of this phase is **cortisol**. Cortisol works to increase blood glucose so it is available to the brain and muscles. It does this by basically breaking down the body’s stores of glucose, fat and protein. Our body begins to digest **itself** rather than the food we eat. Other major functions of cortisol are

decreasing inflammation, allergic and immune responses, and wound healing. These all may be beneficial in the short-term because we don't want to waste energy on healing or inflammation when we're running away from the saber-toothed squirrel, but when this system is chronically stimulated, we are chronically not healing. The system actually starts overdosing on adrenaline and cortisol. In doing all this, the body is less able to fight infection, repair from injuries or even have an inflammatory reaction. Eventually if left unchecked, it all can lead to exhaustion and an increased vulnerability to pathogens or pathological conditions. Ultimately with long-term stress, the body is vulnerable to dis-ease.

Western science now recognizes the link between stress and the following conditions: gastritis, ulcerative colitis, hypertension, rheumatoid arthritis, anxiety, irritable bowel syndrome, peptic ulcers, asthma, migraines, depression, increased risk of chronic diseases, sterility and personality changes. Realistically, all disease has a mismanagement of stress as some component.

Any activity allowing the body to move out of this reaction once the threat is gone is highly beneficial. Calming and nurturing herbs such as chamomile or oats will help the entire system relax, move out of the anti-healing fight or flight and into the healing rest and digest phase. A healthy system is one that is able to find home in the rest phase, and move out of it into fight or flight and most importantly **return to rest** as soon as the threat is over. Unfortunately most people spend a lot of time in this stress response as they travel from news cast to car ride to cubical and return home the same way. We are also at higher risks now because of the increase of environmental toxins we are surrounded with. Now, more than ever we must support others and ourselves in finding ways to access the more nurturing and hopeful, parasympathetic system.

And now let's hear it for relaxation! R-E-L-A-X-A-T-I-O-N!

A period of calm or the ability to enter a state supporting restoring and resting is imperative for health and a healthy stress response. Relaxation stimulates the Parasympathetic nervous system and all its restorative responses. When the body is given the opportunity to rest, it can readily move into fight or flight if need be, and just as important, move out of the stressed state.

The relaxation response is well documented by individuals practicing meditation. A meditative state is defined as an inner mental calm, yet alert. This does not mean you must be in some strict "meditation" posture. It can be a quiet walk with the plants, a gentle rest on a sunny hillside, the space we move into during massage or yoga, or listening to soothing music while we lie on the floor. This "meditative state" has been proven to reduce heart rate, blood pressure and blood carbon dioxide levels lower than when an individual is sleeping. Blood and oxygen levels increase in the muscle also. Muscle tone is lowered. An inner mental calm causes a lowering of muscle tone or relaxation. Ready for this news flash? By lowering the muscle tone during any of the above activities, we initiate the PNS, which causes an inner mental calm! The equation works both ways. ***Touch the body to affect the mind, or touch the mind to affect the body.*** It doesn't matter how you engage the PNS, either way works to induce the relaxation response of the body, mind and spirit.

One more interesting and exciting thing about the Nervous system.

Science is just beginning to explore other ways the Nervous system communicates...other than the nerve impulse traveling along the nerves. A new area concerning molecules released by cells that travel through the blood and have effects on other cells (nerve, digestive, immune, muscle, endocrine...any cell in the body). This idea is not new to other systems (endocrine for example), but that the Nervous system may be involved and involved in a receiving way...this is new. One exciting area is with the Immune system. It has been found that immune cells (macrophages to be exact...a type of white blood cell) can release certain peptide molecules, which have effects on the brain, digestive system and other systems. AND...that the brain can release these very same chemicals and have effects on all the other systems. What does this mean?...that the brain and its functions are linked to the entire body via a web-like structure, rather than a hierarchy....that the body and mind are much more intimately connected than thought before...by science at least (wink).

Olfaction.

Our sense of smell is the oldest sense we own. The sense of smell developed before the brain did. Some believe it is our sense of smell that initiated the growth of the enormous brain we now find ourselves with. We are born with the ability to recognize certain smells, rotten food for example...mother's milk...mom herself. The amazing thing is on top of the smells we're born being able to recognize, we develop the ability to recognize up to 10,000 different scents! How this all happens is not completely known at this time, but let's see what is known for now.

What's the anatomy of the olfactory area anyway?

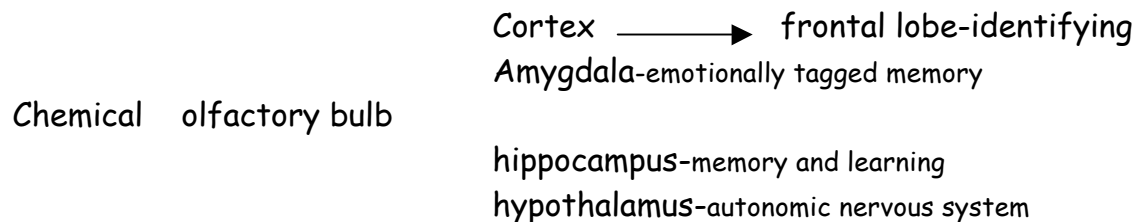
High up in the roof of the nasal cavity lies a one-inch square of specialized cells called the *olfactory epithelium*. Thoughtfully they are positioned so they receive high concentrations of inhaled air as it enters the nose. There are four different populations of cells that make up this specialized area. And their names and functions are:

1. **Olfactory receptors**-10-100,000,000 (not such a big number when you consider dogs have over 220,000,000) of these specialized nerve cells live and respond to the various air-borne odor molecules as they enter the nasal cavity. Their job is to bind or attach to the odor molecule and "convert" this binding to an electrical current a.k.a. the nerve impulse.
2. **Supporting cells**-offer physical support, nourishment, electrical insulation for the olfactory receptors and detoxify incoming chemicals.
3. **Basal Stem cells**-these cells are responsible for making new olfactory receptors every month! This is unheard of in the Nervous system...most nerve cells do **not** reproduce themselves.
4. **Olfactory glands**-make mucus to keep the area moistened. They can be stimulated in conjunction with the lacrimal apparatus (tears) when a noxious substance is inhaled, thus causing a runny nose and teary eyes.

How is our sense of smell different than the other senses?

Our sense of smell has a direct link with the emotional brain and memory (the limbic system) and a weak link with the language area. (Ever try to describe a smell in words and not use the thing you're describing?) Our sense of smell triggers powerful images and emotions **before** we have time to edit them with our "higher" brain, the cerebrum. The other senses, taste, touch, sight and hearing must pass through many more "centers" or filters on their way to the cerebrum or consciousness. What does this really mean? The other senses, as they pass through the "centers" can be filtered or altered and ultimately can be "tricked" or manipulated. We cannot be fooled with our sense of smell, there are not as many centers to pass through. Why would this be important? When we are gathering food, our nose and brain have to detect and respond to a possible poisonous or rotten food before we put it into our mouth. *That is very fast.*

The odoriferous molecule enters the nose and binds the olfactory receptor. This starts the nerve impulse traveling up towards the brain. The next stop is the olfactory bulb and from here the information about the smell branches and travels to the amygdala of the limbic system, the area responsible for pleasure, nurturing, fear conditioning and memory. The information also travels to the hippocampus of the limbic system, the area for learning and memory. The cerebral cortex receives the information directly from the olfactory lobe and sends it to the frontal lobe (the highest brain center) where we identify the smell and register it consciously. Please note here that we identify the smell consciously **after** we've determined whether or not the smell is poisonous. The last direct link goes to the hypothalamus, the area responsible for controlling all of our automatic functions. Here's an overview.



The other senses look quite differently in their pathways. There are more places for filtering.

Hearing
Sight

Brainstem

thalamus

cortex

limbic

Taste
Touch

So what does this have to do with Herbalism and Aromatherapy?

Essential oils enter through this unique pathway of the nose and our sense of smell. The oil molecules themselves can bind with the olfactory receptors and initiate the nerve impulse/ information traveling to the various centers of the brain. The smell of lavender is relaxing in part, because it binds an olfactory receptor which transmits a message (direct nerve impulse) to the hypothalamus and the hypothalamus signals to the *rest of the body* to go into the rest and digest mode. Science is still trying to work out the particulars of **how** this all happens.

The second entry possible begins with the essential oils directly absorbing into the bloodstream at the olfactory epithelium. We sniff, the oils enter the nasal cavity, and diffuse directly into the blood. Once an oil is in the blood, it is free to travel anywhere in the body to carry out its effects.

The third entry is the essential oil diffuses into the covering of the nerve in the olfactory epithelium. The covering of the nerve is continuous with the subarachnoid space of the brain and spinal cord, and the essential oil is free to circulate around and within these structures and ultimately diffuse into the brain to carry out its effect. This is an interesting and exciting route because the oil does not enter the bloodstream immediately where it could be broken down by the liver. Here, the oil can travel to different areas of the brain tissue and carry out its effects for much longer than if it entered via the bloodstream. Wow!