What Is The Autonomic Nervous System?

How The Brain Regulates Our Body

Virtually every function of the body must work in a coordinated fashion with others. For example, while working in the fields, a farmer needs more than strong muscles to endure the daily physical demands of farm work. His cardiovascular system must increase blood pressure and heart rate to keep up with the physical exertion, the lungs must increase gas exchange and the gastrointestinal system must provide adequate nutrients. Coordinating all of these systems is a crucial role of the brain.

All our organs are essential to remain healthy and none could function without the coordination and management provided by the brain. Although your brain comprises only 2-3% of your body’s total weight, it requires 25% of your total blood flow, consumes 25% of your total energy you consume daily and 20% of the oxygen you inhale. These numbers indicate how much ongoing metabolic activity is occurring within the brain 24 hours per day.

Your brain collects information through the five senses: smell, taste, vision, touch, and hearing. Your brain also monitors many things about our internal worlds and does this in two basic ways. First, the brain collects information about the internal organs through what are called visceral sensory nerves. The most important of these is the vagus nerve. It tells your brain how full and acidic the stomach is, what your body’s blood pressure is and how fast the heart is pumping.

The second main way your brain judges what is happening to your body is by monitoring the bloodstream. The brain shares the same blood as the rest of the body and senses the levels of oxygen and carbon dioxide in your red blood cells, blood temperature, the presence of sugar and a variety of nutrients and minerals such as sodium, and levels of various chemical hormones including the hormones made by white blood cells that signal infection or other inflammatory illnesses.

All of this information is necessary for your brain to detect any abnormal function of your body or to respond to such threats as infections or pain. At the same time, your brain needs to coordinate all of these functions with your daily sleep-wake cycles as well as the seasons of the year. To do this, the brain uses its
internal clock to measure time and keeps track of cues such as the length of the day. This time coordinating function allows the brain to establish your circadian rhythms that affect your rest and activity throughout the body. The most important cue it uses is sunlight which travels from the eye directly to the hypothalamus, the most primitive portion of the brain.

The hypothalamus is thus the master regulatory site in the brain. It is a tiny area: out of the brain’s total three pounds, it weighs only a bit more than an eighth of an ounce. Yet the hypothalamus is necessary to coordinate your bodily function with your behavior and the world we interact with. It is the most protected part of the brain and receives blood from all of the major blood vessels that supply other parts of the brain, protecting it from damage if one of those vessels is blocked by an injury such as a stroke. It is also located in the deepest part of the brain, just behind the eyes in the middle of the head, so it is rarely injured by trauma.

The hypothalamus regulates bodily functions by coordinating three main systems:

- The autonomic system of nerves that controls the function of your internal organs.
- The endocrine system which provides hormones that affect the body’s organs.
- Basic behaviors such as eating, drinking, sleeping and reproductive behavior.

In addition, the hypothalamus’s activity influences the immune system.

**The Autonomic Nervous System - The Basics**

Our autonomic nervous system is essential for your survival. This system of nerve cells continuously monitors and controls your organs: the heart and blood vessels; the pupils; the glands for tears, saliva, and sweat; the airways of the lungs; the stomach and intestines; the bladder; and the sexual organs. Control of these organs regulates your body’s response to exercise, emotion, and environmental challenges.

Several areas of the brain that are involved in the working of the autonomic nervous system include the cerebral cortex, amygdala, hypothalamus, brain stem and spinal cord. Nerve cells of the brain stem and spinal cord send nerve fibers
through a specialized network called the autonomic ganglia which in turn send nerve fibers to all your organs.

The autonomic nervous system has two main divisions, sympathetic and parasympathetic. The sympathetic system is activated in response to stress, exercise, exposure to heat or cold, low blood glucose, and other environmental challenges. This system is critical for maintaining blood pressure as we stand up.

An autonomic reflex constricts the vessels in our legs and abdomen to keep blood from pooling in these regions and rushing away from our head. The sympathetic system also increases the frequency and strength of heartbeats during exercise and controls sweating and blood flow to the skin to maintain healthy body temperature.

The parasympathetic system is important for digesting and absorbing nutrients, slowing the heart during sleep, emptying the bladder and bowel, and penile erection. In many organs, the effects of the parasympathetic system oppose those of the sympathetic; for example, the sympathetic dilates the pupil in darkness and the parasympathetic constricts the pupil when exposed to bright light.