## **Chemical Control of Behavior and Emotion**

The body's response to emotional situations is mediated by two systems the **autonomic nervous system** and the **limbic system**.

The autonomic nervous system (ANS) consists of three divisions. The **sympathetic division** prepares the body for excitement. The **parasympathetic division** prepares the body for rest and promotes digestive processes. The **enteric division** is located in the wall of the digestive tract and mediates the reflexes responsible for digestive tract reflexes. In lecture I focused on the sympathetic and parasympathetic divisions. These divisions innervate the smooth muscle of the body, and the heart. Together with the somatic motor system, the sympathetic and parasympathetic divisions constitute the total motor output of the central nervous system.

The main regulator of the pre-ganglionic motor neurons of the sympathetic and parasympathetic divisions is the **periventricular zone of the hypothalamus**. This part of the hypothalamus also contains nuclei that control the release of hormones from the anterior pituitary gland. So, it is also where the endocrine and nervous systems interface. The book discusses the control of hormone release from the pituitary gland, but you will not be held responsible for this material. Through its control of the release of hormones from the pituitary, and its control of the parasympathetic and sympathetic divisions of the ANS, the hypothalamus regulates involuntary body functions (ex. heart rate, blood pressure, etc.) and maintains homeostasis of the internal environment. The other two zones of the hypothalamus, the **medial** and **lateral zones**, are responsible for aggressive behaviors. The medial zone mediates **affective aggression**, and the lateral zone mediates **predatory aggression**. I defined each of these terms in lecture.

The limbic system includes parts of the brain that are united by their function more than by axonal connections. The neural centers that are included in the limbic system are generally involved in emotions and memory. As discussed in lecture, the concept of a limbic system (emotional system) evolved over time starting with Paual Broca in the late 1800's. Broca defined the limbic lobe, which includes the cingulate cortex and the hippocampus. Broca didn't attach any behavior to the limbic lobe. However, later neurologists, including Papez in the 1930's, noted that patients with damage or tumors involving this lobe exhibited emotional changes. Because it was known that the hypothalamus was also involved in emotional responses (particularly autonomic responses, i.e. increased heart rate, vasoconstriction, sweating, ect.) it was thought that there must be a connection between the limbic lobe and the hypothalamus. Papez described this circuit (Papez circuit) in the 1930's. More recently, some of the parts of this circuit, like the hippocampus, have been thought to be more involved in memory than emotion. Nevertheless, the concept of a limbic system for emotion has expanded to include neural centers beyond those described by Broca and Papez. One such center is the **amygdala**, which is an almond-shaped group of nuclei located in the temporal lobe at the rostral end of the hippocampus. The amygdala consists of a collection of nuclei that receive inputs form the sensory cortices (visual, cortex, auditory cortex, gustatory cortex, etc.) and the olfactory system, and has its primary output to the hypothalamus. Bilateral ablation of the amygdala decreases aggression, and also abolishes fear and anxiety responses. It also, appears to be responsible for what is called learned fear.