New Trends in Psychology

# Neural Circuits Involved in Activating Emotions

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**Abstract:** We are particularly interested in emotions and their regulation for a better functioning in general, both personally and professionally. We believe that a better emotional education would help us in the future as a better understanding of interpersonal relationships. We would like to study this subject even more, starting with scientific research, so that we can fight occupational diseases such as burnout or those in schools such as bullying. In the dialectical behavioral approach, DBT, (Linehan, 2015) are approached those who cannot control their emotions very well, subjects with pathology of borderline Cluster B personalities (DSM 5, 2020). They are taught through skill trainings how to respond emotionally functionally to triggers. In DBT, emotions are defined as short, involuntary, systemic responses to internal and external stimuli. Among the solutions given by this form of therapy we find: mindfulness techniques, balancing emotions, interpersonal efficiency, tolerance to stress. So, starting from the analysis of a borderline patient, I found the theoretical research of the neural circuits involved in activating emotions useful.

**Keywords**: emotion; neural circuits; system; thalamus; hippocampus; frontal cortex; feeling; sensations

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## 1. Introduction

In humans, emotion (Flonta et al, 2021) is an old system of preverbal communication that occurs immediately after birth when emotional signals of hunger, discomfort, fear, despair, disgust, satisfaction, joy are emitted. We can say that emotions are a crude language of the body's functioning, while cognition is a fine-tuning of the processes that ensure evolutionary finesse.

## The Emotional System is Fear

"The fear emotional system is made up of a neural circuit that avoids pain, injury, and danger. The amygdala is the main structure involved, as evidenced by experimental observations. This structure receives many afferents and is at the origin of many other efferent.

Tonsil afferents come directly from the olfactory cortex, without passing through the thalamus, which explains the ability of odors to evoke emotional memories, they also come from the temporal auditory cortex, the orbital and cingulate cortex, the thalamus and the nuclei in the brainstem and from the vicissitudes through the hypothalamus and septal area.

From the amygdala there are efferent to the thalamus, hippocampus and frontal cortex, to the facial muscles that become a vehicle for expressing emotion, and to the hypothalamus and the vegetative nervous system that provide homeostasis of the body.

Emotion processing is done in two ways: the fast-short path that passes through the thalamus and reaches directly into the amygdala and the slower long thalamo-cortico-amygdala path that allows the processing of the stimulus and the generation of a conscious response.

Fear regulation is done by top-down influences, which are exerted from the cortical structures to the amygdala. Reassessing or reinterpreting events that have produced fear can alter both subjective experience and physiological responses.

Recent studies indicate that learning and forgetting fear are modulated by noradrenergic neurons in the Locus coeruleus, some of which project to the amygdala and are active in the learning process and others to the median prefrontal cortex that are active during forgetfulness" (Flonta et al, 2021, pp. 173-174).

## 2. An Explanation

Damasio (2013) proposes the following approach: essential cells are located in the interoceptive system and are non-myelinated neurons that lead to the spinal cord and brainstem signals about the state of the viscera and hormones. For example, the spinothalamic pathway in lamina I of the spinal cord contains small-diameter, unmyelinated (type C) or weakly myelinated fibers. Several such fibers are surrounded by a single Schwann cell, forming what is called a Ramack bundle.

The conduction velocity in these fibers is low (1-8 m / s) in contrast to the myelinated A∞ and Aβ fibers that conduct exteroceptive signals with a velocity of 14-60 m / s. The vague nerve consists of 80% non-myelinated fibers and a remaining 20% weakly myelinated fibers.

The absence of myelin allows a transverse transmission (ephaptic transmission) of signals from one fiber to another and thus a local synchronization of the membrane potential of various parallel neurons.

Effective transmission is the opposite of synaptic transmission that operates longitudinally in the neural network.

## How does the Feeling Appear?

Changes at the cellular level would temporarily synchronize several neighboring neurons through ephaptic transmission. Small changes in the function of the viscera or internal environment (oxygen, Co2 or glucose) activate a small number of neurons, while larger changes activate a proportionally larger number of neurons.

*The conscious experience of emotion is the feeling, which being described by the subject can be a signal to the lower neural centers that accentuates or inhibits the somatic manifestations of emotion.*

Feeling as a mental expression of the body's homeostasis is important in regulating life. It provides information about basal homeostasis and the social conditions of the body's life. It signals danger, risk, crises, on the one hand, but also advantageous opportunities. Primary feeling can be associated with ideas, thoughts, interpretations. Thus, appears an intellectual description of the situation that generated the emotion and feeling.

The involvement of the brainstem and hypothalamus in the generation of emotions and structural feelings in reptiles, birds and mammals suggests that emotions and feelings are not exclusively human and have appeared in simpler forms in organisms below the scale of human evolution.

Joseph LeDoux (1998) formulated an exposition of affective consciousness based on his pioneering research in the field of cerebral affective systems. Affective states are organized out of consciousness by deep brain structures located in the sub-cortex such as the hypothalamus and amygdala.

In order to be aware of an emotional state, it is necessary for the information from these deep structures to reach the cortical system. According to his hypothesis, affective consciousness contains two parts: the information that defines the emotional state and the information that defines the consciousness. Just as the brain can operate with "I'm aware of the apple" it can operate with "I'm aware that I have this emotion."

Michael Graziano (2021) asks in his book Consciousness from a modern perspective "what information defines emotion" and starts from the ideas of William James and Carl Lange. "According to their theory, emotion starts with a bodily sensation. The heart beats harder, the stomach secretes acid, the skin cools and moisturizes. Then by detecting these body changes and evaluating the context, the brain builds a story: "I'm anxious" or "I'm tense."

One of the best demonstrations of this effect was the famous experiment on the Vancouver Bridge in the 1970s.

The experiment involved a woman stopping a man walking down the street and asking him to answer a few questions for a questionnaire. In some cases, the men were questioned in an anxious situation, in the middle of a bridge swaying over a ditch. In other cases, the men were standing on a solid, stable bridge. In the end, the men were asked how attractive the woman who had interviewed them was. Men on an unstable bridge rated women as more attractive than men on a stable bridge. The swinging of the bridge probably caused the heart rate to accelerate and made their skin cold and damp, changes that were wrongly attributed to sexual attraction.

In modern psychology the James-Lange theory is still considered largely correct today. Part of the emotion is anchored in the physical sensations in the body and another part involves a rich high-level representation of the two interacting in a complicated way" (Graziano, 2021, pp. 155-158).

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