

Chapter 3

Neurophysiological and Neurobiological Basis of Emotions and Mood

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ABSTRACT

Emotions and mood are complex psychic phenomena that play important roles in everyday behavior. No anatomical structure can be identified as a specific brain center for emotions, and a neurophysiological basis of emotions is unclear and hard to define. Today, it is thought that neurotransmitters such as dopamine, serotonin, and norepinephrine have important roles in mood regulation, and much of the evidence for this assumption is based on the effectiveness of antidepressant medications currently available in psychiatric practice. James-Lange, Cannon-Bard, and Schachter's and other theories historically tried to explain the origin and formation of emotional responses. Despite extensive research efforts on this topic, many aspects regarding the nature of emotional responses remain unclear. Multidisciplinary approach, including the adequate cooperation of psychiatrists, neurophysiologists, and experts from other areas, is needed to provide us with a more comprehensive insight on biological basis of conative psychic functions.

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INTRODUCTION

Emotions are a complex psychic function for which there is no precise and comprehensive definition. Emotions reflect the individual's mental attitude towards an object (i.e. another individual) or a phenomenon, as well as a consequent mental reaction that influences an opinion about that object or phenomenon (or interaction with it). Mood differs from emotions in terms that it lasts longer, is less intense and less focused on a particular object. In mammals, it is considered that the limbic system is the main structure in the central nervous system responsible for the emergence of emotions. However, with regard to the maintenance and modulation of emotions, many regions in the cortex, thalamus and basal ganglia are also of great significance.

There are numerous classifications of emotions according to the level of intensity, or satisfaction associated with them. Paul Ekman, a famous American psychologist, defined six basic emotions in the middle of the twentieth century: anger, disgust, fear, happiness, sorrow and surprise. These emotions are present in every person, regardless of their affiliation to a particular culture / subculture, religion, customs and attitudes.

Positron emission tomography (PET) technique, as well as various other methods for in vivo monitoring the activity of the brain regions, have opened new possibilities in researching the neurophysiological basis of emotions. A number of experimental animal models have also been developed to examine oxygen consumption, glucose metabolism and other substances in the central nervous system, and based on their conclusions, the specific regions of the brain were proposed to be involved in the modulation of emotions and mood (Young et al., 2018).

There are three major brain neurotransmitters that have been suggested to have an important impact on mood regulation in physiological and pathological conditions: dopamine, serotonin and norepinephrine. Dopamine is the most important neurotransmitter in brain reward circuits, and regions that act as the "pleasure centers" of the central nervous system are abundant with dopaminergic neurons. Norepinephrine has a major role in arousal and sleep/wake cycles, but is also a potentially important mood regulator in both mentally healthy and depressed individual. Today, one of the most frequently prescribed classes of antidepressant medications are selective serotonin reuptake inhibitors which may increase serotonergic brain transmission. However, despite significant advances in the field of neuropharmacology, it is still impossible to fully understand the relation between brain neurotransmitter

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