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## UNIT 3 BIOLOGICAL BASIS OF MIND

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### 3.1 INTRODUCTION

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The French philosopher Descartes believed in dualism which distinguishes between mind and body. According to Descartes, the mind was located in the brain's pineal gland and was responsible for the body regulation through the brain and nerves. It was considered to be non-physical and non-material unlike the body. He believed that what made humans different from animals was that humans possessed a soul or mind. This notion was popular until the behaviourists asserted their views on human behaviour. If the mind and body are two different entities then the question that arises is how are they related to one another.

#### 3.1.1 Different Views Towards Biological Basis of Body and Mind

The present unit will try to enlighten you in this area in further discussion. It is interesting to know that there are three different ways of viewing it from the dualistic point (body and mind) of view.

- 1) **Interactionism:** According to this viewpoint, there is a two-directional causal relationship (vice-versa relationship) between body and mind. The mind has an effect on the body functioning as well as the body or physical changes in the body affect the mind. For example: cancer patients, who are able to fight their disease through determination to get better; changes in perception when hallucinogens (a kind of drugs affecting perception) are ingested; or changes in intelligence or personality after a brain damage or surgery. Thus there is a two way interaction between body and mind.

- 2) **Epiphenomenalism:** This view states that mental experiences or processes don't have any effect on the physical processes, while sensations, volitions or ideas can occur due to certain physical or material causes. Mental phenomena have no part to play in the explanation of behaviour, and various sensations and volitions are a result of material processes.
- 3) **Psycho-physical parallelism:** Psycho-physical parallelism says that mental and physical events occur together, but do not cause or influence each other. For example, depression could be associated with a variety of physical illnesses and similarly many physical states can be associated with a variety of psychological states.

In contrast to the dualist view, the alternate view is monism. Monism can take the following forms:

- **Idealism:** According to this view, physical events are reducible to mental ones, and only the mental phenomena are real. Humanistic psychologists were strongly influenced by this phenomenology. They stress on the fundamental nature of experience and our knowledge of the external world depends on how we interpret it.
- **Materialism or physicalism:** Materialism is opposite of idealism. According to this principle, physical phenomena are real and the mental events are reducible to physical ones. This view has been favoured by the behaviourists.
- **Identity theory:** This theory proposes another form of materialism which states that consciousness is a brain process, meaning that consciousness and brain process refer to the same thing (contingent identity) but they do not have the same meaning. Mental processes like the brain processes are capable of causally influencing behaviour.

According to the identity theory, mind functions are a kind of brain activities, but that does not mean that mind is the brain. Monism appears to be the most reasonable hypothesis. It has become easier to understand functioning of mind by the monism theory. A lot of progress has been made in understanding the concept of mind based on assumption of monism hypothesis. Studies have shown that stimulation of any brain area provokes an experience and any external experience evokes brain activity. Thus there cannot be a mental activity without brain activity. Mind or mental activities are only descriptions of the brain activity. Using the term mind to mean something that is ethereal, which is neither matter nor energy, is not helpful in understanding the functioning of mind.

The question of whether consciousness is a result of the brain activity or what kind of brain activity produces consciousness or alters consciousness is yet to be answered. Consciousness is a difficult concept to define, because we can neither observe it in ourselves nor know for sure that other people have it. One of the easy things is to look at the difference between wakefulness and sleep, and the mechanisms that enables us to focus at our attention. The best way to understand things is to determine what brain activity is necessary or sufficient for consciousness.

Early researchers attempted to find the exact location of brain structures determining consciousness, but could not succeed since they did not have the investigative facilities available, as they exist now.

From the mid-1970s onwards, there has been a rapid progress in understanding cognitive neuroscience with advancements in the medical technologies available to study the structure and function of brain. This has led to better understanding of the functioning of mind and the brain. Mental functions are now equated with neural processes and brain structures, instead of only the behavioural dispositions.

It is now well accepted that the mind and consciousness have a purely physical basis in the brain. This takes the form of various neural pathways, the intricately interconnected networks of neurons that vary in their activity levels in accordance with the kind of mental activity that is occurring. Functional brain imaging is, of course, the means by which theorists and researchers have arrived at these conclusions. The phenomenal experience of the mind, which means the subjective and personal experience that occurs when we think about any object or problem or engage in other conscious processes, has neural correlates in the electrochemical processes of the brain and its many billions of neurons.

A better understanding of the brain's complexity and adaptability will result in a better understanding of mind. With the help of the modern technology, neuroscientists are able to identify specialised organisation and distinctive neuronal circuits in various parts of the brain, and their relationship with the mental functions. But still our knowledge and understanding of these complex phenomena is not complete.

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## 3.2 OBJECTIVES

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Further, this Unit will help you to:

- understand the interaction between brain and mind;
- understand the functions of mind based on neuropsychological findings;
- understand the role of brain functioning in consciousness;
- understand the brain functions in emotions and cognitions;
- understand the brain functions related to memory; and
- understand the brain functions related to sleep and dream states.

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## 3.3 FINDINGS FROM NEUROPSYCHOLOGY

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Studies from participants, who suffered brain trauma, have shown that damage to specific regions of the cerebral cortex has precise and predictable effects on human perception, memory, language, and other cognitive functions. Different regions of the cerebral cortex process different sensory data simultaneously, just like a large-scale parallel computer. Such correspondence between the cortical areas and mental functions is fundamental to understanding the biological basis of mind.

### Self Assessment Questions 1

#### Fill in the Blanks:

- 1) Patients who suffered brain trauma, have shown that damage to specific regions of .....

- 2) Mental functions are now equated with .....and ....., instead of only the behavioral dispositions.
- 3) According to the identity theory, mind functions are a kind of .....
- 4) According to .....viewpoint, there is a two-directional causal relationship between body and mind.
- 5) Descartes believed in dualism which distinguishes between ..... and .....

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### 3.4 CONSCIOUSNESS AND THE BRAIN

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Many types of causal relationships between the mind and brain have been discovered by cognitive neuroscientists, including specific correlations between particular neural activities and mental activities in such ways that the occurrence or cessation of the former is linked to the occurrence or cessation of the latter or vice versa. Cognitive neuroscientists believe that consciousness is not independent of the brain.

It has now been well established that the brain is the seat of consciousness. A complex interaction in the neural networks that involves a range of neurophysiological and neurochemical activities, results in the various diversities of the mental functioning.

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### 3.5 BIOLOGICAL BASIS OF EMOTIONS AND COGNITIONS

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Another area that enjoys the results of neuro-scientific research is the study of the biological base of emotions and the relationship between emotion and cognition. There is no one center in the brain for a mental function as complex as emotion. Several regions of the brain have been identified by neuroscientists as critical for emotion regulation or arousal, including the frontal lobes in regulating emotions, the amygdala in activating emotions, and the hippocampus in appreciating the context of emotional arousal. Moreover, neuro-scientific evidence suggests that regions of the frontal cortex in different brain hemispheres play an important role in different emotions, with the left frontal cortex relating to positive emotions and the right frontal lobe relating to negative emotions.

#### 3.5.1 Emotional Arousal and Emotional Regulation

The emotional brain works faster than the rational brain. The brain areas responsible for initially activating an emotion (the amygdala) are different from the one responsible for regulating an emotion (the prefrontal cortex). Emotional arousal works faster than emotional regulation. Emotions tend to be activated mainly in the amygdaloid area and interpretations from the cortical centres of the brain are ignored, when these emotion centre are activated.

**Self Assessment Questions 2**

**Answer the following questions in one word:**

- 1) Which brain works faster than rational brain?  
.....
- 2) Which part of the brain is critical for emotion regulation and arousal?  
.....
- 3) Is there any relationship between neural and mental activities?  
.....
- 4) Which field of research helped in finding out the relationship between emotion and cognition?  
.....
- 5) Do you feel that emotional arousal works faster than emotional regulation?  
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### **3.6 CHANGES IN THE STRUCTURE OF THE BRAIN AND LIFE EXPERIENCES**

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Contrary to the earlier thinking that the brain structure does not change, research done with advances in structural and functional imaging has established the concept of neuroplasticity. Studies have shown that the frontal lobes, the amygdala, and the hippocampus continually change as a result of life experiences. The changes are, however, not in the gross structure, but happen at the neuronal and receptor levels.

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### **3.7 MEMORY**

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Neuroscientists have also studied the biological basis of memory and learning. Like the association of brain regions to emotion, memory has also been found not to be stored in any specific region but spread out through different areas of the brain. But a few brain regions are vital to the formation of new memories, such as the hippocampus and the thalamus. Changes in the strength of neural connections, which may result from life experiences, affect the recording of memory in the brain.

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### **3.8 SLEEP AND DREAM STATES**

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Brain regulates the various stages of sleep and the dream state. The regular alternation of the cycle of waking and sleeping states is controlled by the brain stem, which alters the production of specific neurotransmitters responsible for arousal and relaxation in a reciprocal way. In experiments with animals,

neuroscientists have shown success in the control of altering states of wakefulness and sleep. Although the neuroscientists can objectively measure and identify distinctive sleep states and associated REM (rapid eye movement) sleep with dreaming, the purpose of dreaming still remains one of the great mysteries in the study of sleep.

### Self Assessment Questions 3

State whether the following statements are true or false:

- 1) Body regulates the various stages of sleep and the dream state. ( )
- 2) Hypothalamus and Spinal cord are vital to the formation of new memories. ( )
- 3) The regular alternation of the cycle of waking and sleeping states is controlled by the brain stem. ( )
- 4) Studies have shown that the frontal lobes, the amygdala, and the hippocampus never change as a result of life experiences. ( )
- 5) Changes in the strength of neural connections affect the recording of memory in the brain. ( )

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## 3.9 LET US SUM UP

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It should be clear to you by now that the dichotomy between mind and brain has been disputed by views which focus on the biological basis of mind. This view has been supported by the current development in investigative methods of the brain and its functioning. With the advent of technological development in investigations, it has become easier to understand the complex functioning of the brain. As a result of this, the mind and its functions have been understood as different from the age old concepts of mind.

With the rapid development in cognitive sciences, especially the remarkable progress in neuroscience during the past several decades, the world has observed tremendous growth in the knowledge of mind and mental states.

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## 3.10 ANSWER TO SELF ASSESSMENT QUESTIONS

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### Self Assessment Questions 1

- 1) Cerebral cortex
- 2) Neural processes and brain structures
- 3) Brain activities
- 4) Dualistic view point
- 5) Body and mind

## Self Assessment Questions 2

- 1) Emotional brain
- 2) Prefrontal cortex and Amygdala
- 3) Yes
- 4) Neuro-scientific research
- 5) Yes

## Self Assessment Questions 3

- 1) False
- 2) False
- 3) True
- 4) False
- 5) True

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## 3.11 UNIT END QUESTIONS

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- 1) Explain the role of neuropsychological studies in understanding the functions of mind.
- 2) Explain the relationship between consciousness and the brain functions.
- 3) What are the brain functions that are related to emotions?
- 4) Explain the concept of monism.

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## 3.12 REFERENCES

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