

Functions of the parts of the human brain psychology essay



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The brain forms part of the central nervous system together with the spinal cord. The body's nervous system is the center for communication and decision making. The nervous system is composed of the central and the peripheral nervous system, and the peripheral nervous system is made up of nerves in turn. The nervous system as a whole is in charge of every part of a human being's daily life, ranging from breathing and blinking to assisting one to memorize facts in a test. Nerves connect the brain with the face, eyes, ears, nose, and spinal cord, from where they link to the rest of the body. Sensory nerves is the group of nerves responsible for gathering information from the body's environment and relaying it to the spinal cord, which in turn speeds the message to the brain. The brain then integrates the message and produces a response. Another group of nerves known as the motor neurons distribute the instructions from the brain to the all the body parts. The spinal cord is a superhighway of messages, composed of a collection of nerves going up and down the spine, transporting messages to and from the brain continuously.

The brain is composed of three main segments namely: the forebrain, midbrain, and hindbrain. The forebrain includes the cerebrum, the thalamus and the hypothalamus. The midbrain is composed of the tegmentum and the tectum. The hindbrain consists of the cerebellum, pons and medulla. The midbrain, the pons, and medulla are regularly referred collectively as the brainstem.

Below is a visual representation of the brain and its various parts:

The cerebrum, also known as the cerebral cortex, is the biggest portion of the human brain, linked with higher brain functions such as action and thought. The cerebral cortex is partitioned into four segments, referred to as lobes: the frontal lobe, parietal lobe, occipital lobe, and temporal lobe.

Below is a diagram of the cerebrum:

(Matlin, 1989).

Each of the lobes carries out different functions as explained below:

Frontal Lobe- connected with planning, reasoning, emotions, parts of speech, movement, and problem solving

Parietal Lobe- associated with orientation, movement, recognition, and stimuli perception

Occipital Lobe- related to visual processing

Temporal Lobe- associated with memory, perception and recognition of auditory stimuli, and speech

The cerebral cortex has numerous folds to increase the surface area of the brain and enable it fit into the small space in the skull. An increased surface area means more neurons per area hence increased efficiency. A deep groove divides the cerebral cortex into two equal parts, called the left and the right hemispheres. The two halves appear almost symmetrical yet it has been proven that each hemisphere functions differently from the other. The left hemisphere is associated with logical decisions while the right

hemisphere is linked to creativity. The corpus callosum is a group of axons connecting the two hemispheres. The grey part of the cerebral cortex is composed of nerve cells. Below the grey surface are white nerve fibers which relay signals from the nerve cells to the other brain parts and to the rest of the body. The neocortex is a six-layered structure of the cerebral cortex which occupies the better part of the cerebral cortex and only occurs in mammals. The structure is thought to have evolved recently and is linked to processing of more complex information by animals that are more fully evolved such as human beings and primates. It is where logical and rational thought takes place. The neocortex is the thinking part of the brain; it thinks through problems, makes decisions, reasons, organizes, concentrates, and controls the impulses.

The corpus callosum is closely involved in cerebral organization, equally during growth and throughout adulthood. It is a thick bridge of neural tissue that conveys information from one hemisphere to the other. It plays an active role of directing the brain development beginning infancy into the highly lateralized organ it is known to be. The corpus callosum helps to maintain a balance of attention and arousal between the two hemispheres that allows each side to make its contribution to attain an integrated whole. It thus allocates each type of processing to the particular brain area that is programmed for the job, controls the distribution of attention between the two sides and facilitates sustained attention in difficult cognitive tasks. The corpus callosum also plays part in controlling certain types of eye movements. When the eyes make a movement, like in convergence, or in making saccades, information pertaining what to do is delivered to the brain

from two sources: the two retinas, which see somewhat different things, and the eye muscles that inform where the eyes are now. The input is conveyed to both hemispheres, and smooth integration of this information needs quick and accurate interhemispheric communication. The corpus callosum is therefore closely involved in smooth convergence, smooth tracking, matched focusing, and stable ocular dominance. Transfer of information about the locus of touch from one hand's fingertips to the other without looking also needs the functioning of the corpus callosum. The information on which finger the touch occurred has to cross the neural bridge to reach the opposite hand.

The cerebellum, also known as "little brain", is analogous to the cerebrum due to its possession of two hemispheres and a well folded surface (cortex). This part of the brain is related to regulation and coordination of posture, movement, and balance. It is presumed to have evolved earlier than the cerebrum hence performs more basic functions compared to the cerebral cortex. The limbic system, often called the "emotional brain", occurs deep within the cerebrum and is evolutionary old, like the cerebellum. This system is composed of the thalamus, amygdale, the hypothalamus, and hippocampus. The following is a midsagittal view of the human brain showing the limbic system:

(Ford, 1992).

The amygdale is an almond shaped nuclei mass which occurs deep within the temporal lobes adjacent to the hippocampus and medial to the hypothalamus. It plays various roles in cognition including:

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Emotional responses

Arousal

Control of autonomic responses related to fear

Hormonal secretions

The thalamus is composed of a lamellae (comprised of myelinated fibres) system dividing various thalamic subparts. Other regions are identified by distinctive clusters of neurons, such as the “ nucleus limitans”, the periventricular gray, the intralaminar elements, and others. These clusters of neurons, which differ in structure from the main part of the thalamus, have collectively been grouped into the allothalamus. The thalamus obtains its blood supply from the posterior cerebral artery. It is known that the thalamus has numerous functions. It is deduced to act as a translator for processing various prethalamic inputs into readable form for the cerebral cortex. It is thought to process and relay sensory information to different parts of the cerebral cortex selectively, as one thalamic point might serve one or several parts in the cortex. The thalamus also assists in regulating states of wakefulness and sleep. Thalamic nuclei possess firm reciprocal connections with the cerebral cortex to form thalamo-cortico-thalamic circuits that are linked with consciousness. The thalamus has a major role to play in regulating arousal, activity, and the level of awareness. Injury to the thalamus can cause permanent coma.

The system composed of the thalamic parts is associated with many different functions. It is associated with sensory systems: somatic, auditory,

gustatory, visceral, and visual systems whereby localized lesions aggravate specific sensory deficits. The roles played by the thalamus are more directed towards motor systems. The relay of cerebellar afferences has been targeted by stereotactians especially for the improvement of tremor. The thalamus is thought to be involved in anterior nigral and pallidal territories in the disturbances of the basal ganglia system. The thalamus is known to play negligible role in tectal or vestibular functions. The thalamus has been considered as a “ relay” that just forwards signals to the cerebrum, but research have shown that the thalamus has more complex functions.

The hypothalamus, located directly below the thalamus, is mainly involved in upholding the body’s status quo, homeostasis. In homeostasis, factors such as body temperature, blood pressure, body weight, and fluid and electrolyte balance are regulated by the hypothalamus to a precise value known as the set-point. This set-point can change with time although it is fixed remarkably within a certain range. The hypothalamus acts as the control center for all autonomic regulatory activities of the body. It has thus been referred to as the brain of the brain. It is the center for regulation of endocrine and autonomic homeostatic systems such as temperature, visceral organs, and cardiovascular. It presides over all sensory processing, endocrine hormonal levels, and organizing body metabolism and ingestive behaviors. Almost all functions of the hypothalamus appear to be related somehow to the brain management and body connection, linking the mind to the body.

The figure below shows the location of the hypothalamus:

(Bandura, 1989).

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The hypothalamus controls not only the autonomic nervous system but also the pituitary output by producing particular chemicals into the pituitary's front lobe. The hypothalamus is involved in organizing and controlling many complex emotions, moods and feelings, together with all motivational states such as appetite, hunger, and food intake, and everything concerned with the perception of pleasure including comfort, satisfaction and creative activities. A number of neurotransmitters are synthesized by the neurons in the hypothalamus, which are responsible for relaying information and instructions to all brain and body parts. These neurotransmitters influence the pituitary gland directly leading to release of thyroid hormone releasing factor, growth hormone and other neuropeptides through hypothalamic input. The hypothalamus is closely linked with the integration of all physiological stimulation, taste, sight, smell, touch, and sound, which it then translates, refines and gathers into one distinct package linking all the elements of experience and all the stimulation associated with it into one vivid harmonious concept, and one memory. This therefore results in a concise emotionally rewarding understanding and verdict of the experience itself.

The hippocampus is seen as being fundamentally involved in the fast encoding of events as relations amongst stimulus context and elements, during the encoding of episodes as event sequences, and in connecting episodes by common aspects into relational networks that sustain elastic inferential expression of memory. There is evidence that the hippocampus plays a major role in encoding of associations amongst actions, stimuli and places that make up discreet events (associative representation). The

hippocampus is also thought to be involved in learning the context of events, for example contextual fear conditioning. It is also proposed that the hippocampus is involved in sequential organization. This is the organization of an event as a sequence of events that discloses with time. Another cognitive function of the hippocampus is the connecting of similar features of different memory episode to form flexible presentations. This can be explained as the abstraction of similar features of different episodes to create representations, or the formation of semantic information from intermittent memory. The hippocampus quickly learns on individual experiences and avoids interference by sorting out representations of those experiences.

Limbic system-coordinates memory and emotion

Hippocampus and temporal lobes- processing of verbal and visual memory, and control of short-term memory and new learning

Parietal lobes-controls sequencing of activities and understanding of spatial information

Frontal lobe- regulates social judgment and behavior

Occipital lobe- regulates vision, and the skill to see and combine shapes, colors, angles and movement in coordinated patterns.

As a result the following abilities are impaired:

Mental abilities:

A person's skills of understanding, thinking, remembering, and communicating are impaired.

The capacity to make decisions is reduced.

An individual forgets performing simple tasks that he/she had been performing for years.

Persons easily get confused and loss of memory, for short-term and eventually long-term events.

An individual's ability to find the right words in a conversation will be affected.

Emotions and moods:

An individual loses interest in generally all activities and may appear apathetic.

A person loses control of emotions and mood.

Some individuals appear more withdrawn and less expressive.

Emotions may vary across joy, anger, love fear, and sadness, even in the advanced stages of the disease.

Behavior

An individual's behavior changes in the way he/she interacts with his/her environment including:

Hiding his or her possessions

Repeating the same words or actions

Restlessness

Physical flare-ups

Physical abilities

The disease affects an individual's mobility and physical coordination resulting in steady physical impairment. The individual's ability to perform day-to-day chores independently, such as bathing, eating, and even dressing up, is affected (Tiraboschi, Hansen, Thal, & Corey-Bloom, 2004).

The Biopsychosocial concept played a key role in helping people cope with the daily global changes and challenges due to modernization and civilizations. Hans then went on and coined the terms “distress” meaning negative stress, and “eustress” referring to positive stress. He also came up with the term “stressor” during this time which referred to the stimulus causing stress. This created a lot of interest among psychologists who ventured in diverse researches to know the links which existed between some diseases and stress. By the year 1970s, stress had become a major area of focus in research by medical practitioners as a way of addressing the issue in a better way amongst the population (Zapf, D., Dormann, C., & Frese, M., 1996, p. 96).

It is evident that the social, political and scientific changes have had an adverse effect on the researches being carried out on the topic. It has

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become a problem to undertake researches due to the pressures from science, politics and social changes. According to Anderson a researcher on stress, " Our lifestyle has also made us far more susceptible to stress and stress is therefore on the increase in our society. We have more pressure put onto us in day to day living. We may live far away from the support of our immediate family, we may have very little family support and have no one to talk to...we have less job security and fear redundancy...the pace of life is much, much faster. We are inundated with e-mails, mobile phones ring constantly. We can never switch off or escape. All these factors together with many more others make for a more stressed out society." Individuals go on to argue that such aspects drive much pressures to human beings than before. There have been a lot of political instabilities with the advancements which have also had a negative impact on undertakings of researches on stress, on top of increasing chances of stress to people. This in return has led to making the lives of human beings more complicated and difficult. Stress researches have been made hard by political pressures and stereotypes which have preoccupied people. Scientific advancements have also posed a major challenge to researchers because of its many demands. This is in relation to the requirements that the researches should have testable hypotheses and the conclusions should be in line with the stated hypothesis. By the years of 1990s stress had already been integrated in the modern scientific researches in the areas of human functioning as well as in physiology. These changes have also led to new histories on workplace stress, and the development of new techniques of managing stress (Winefield A., H., 2002, p. 85).

Science is said to be a theoretical, empirical and practical knowledge of the natural world. The knowledge is said to be obtained by use of research findings through observations, explanation, and experimentation of the actual phenomena. Given that scientific researches insist on objective knowledge, it has improved the recent researches on the concept of stress, and has done much in improving the history of stress. The scientific advancements are considered to be very crucial and it considers earlier researches as being “ pre-scientific.” it has therefore brought about many changes in the history of stress by forcing the current researchers on the topic of stress, to come up with what they call scientific and up to date research findings on stress. Social advancements have also depicted a major impact on the history of stress. The last 20 years have registered significant changes in the structure of the society. This is because of the demographic developments, technological advancements, and socio-economic changes. These in turn have affected our family structures, social networks, and our working patterns. These changes have been said to have increased the levels of stress and the causes of stress as well. This has therefore raised a new challenge of addressing the structural changes and how they affect the life of a human being. This is because in the early history of stress, such issues as society structures and technological advancements were not considered (Aldwin, C. M., ed., 1993, p. 46).

Different people have had differing reactions to the researches and research findings on stress. The topic has been accorded a negative name in the past years. Some have said that they have had difficulties in figuring out between the stress-vulnerable individuals and the stress-resistant ones; hence

demanding that these aspects should be clarified as a way of enabling students deal with stressful moments effectively. Others have argued that recent researches did not fully cover on the issue of stress well, hence such publications are not fit for curriculum, and they should be edited or removed from the curriculum. Others have credited authors and researchers on stress for providing them with relevant information on how to cope with a situation which is very common amongst human beings. Other reactions included misunderstandings. For instance; Hans Selye is seen apologizing in some recent memoirs for having used stress as a wrong word, though he is believed to have been the sole creator of the “ biological stress” concept. He says he should have called it “ strain syndrome” instead of biological stress. This poses a major challenge for the researchers because people tend to question the validity of their research findings. It has become certain that stress is always in the head of a human being, and that people are the ones who make it to be what it is. Suicides continue to happen at a higher rate, divorce cases are increasing everyday, and generally life does suck for almost everyone, and we want to talk of being stress-free! It is certain therefore that the life of a normal human being cannot run without the word “ stress.” Today, the term has several connotations and meanings and is also used differently by people. It is said to be a phenomenon of physiology, a state of mind, and also a marketing tool and an excuse for human beings. Much of its attention has been initiated by the scientific discoveries as well as efforts by medical practitioners. Since then the term stress became common all over and it achieved what can be called a “ zenith” cultural significance. It is of late a fact of every day life (Mason JW., 1975, p. 7).

The term has since then gained a lot of popularity and become a common field of research for many scholars. In the ancient times such researches were geared towards knowing how the body reacts to different forms of stress and the cognitive processes that influence a human minds functioning. Its beginning of use was in the 1930s by the endocrinologist Hans Selye. He carried out a stress research to test how laboratory animals did respond to physiological changes. He later broadened his research and tested how human beings would respond to their daily life challenges. According to his research, stress was the outcome or reaction showed by organisms and the “ stressors” to their known threats. He said that stress can be adapted positively especially when it is involved in the struggle to achieve certain goals in life, but on the other hand it could very harmful to human beings if managed poorly (Mason JW., 1975, p. 9).

After that the term has been used constantly by laymen in a metaphorical way as opposed to the biological meaning to refer to the difficulties experienced in our daily activities. It also continued to become a euphemism of referring to our problems when we do not want to be explicit. Hans’s first research was practiced on rats which he exposed to some harmful stimuli, and he found out that all animals did produce similar reactions to such stimuli. In the year 1936, he described this universal reaction as a “ general adaptation to syndrome or GAS.” according to those original researches it is a process which is initiated by an alarm which detects the stressor, then the second process is resistance whereby a mode of coping with the problem is initiated. The third stage is the exhaustion stage which can be found in the GAS model. According to Hans, it is during this stage when all the available

resources are fully depleted and the body becomes unable to cope with the situation which then leads to what people call stress. The researches then found out that when such a condition is arrived at the individual can have ulcers, digestion problems, depression or even develop some cardiovascular complications among other illnesses (Mason JW., 1975, p. 9).

Some of the frequently asked questions when carrying out a research on the topic of stress include the following: what causes stress? What are the major symptoms of a stressed person? What are the effects of stress? Is stress a permanent situation or not?

How can one manage stress in their daily lives? How can stress be avoided? How can the condition be dealt with under normal circumstances? How can people lead stress free lives? Which age/gender is prone to stress? Among many other sub-topics and questions. Seeking answers to such questions related to stress has been undertaken by several individuals (Kearney, G., E., et al, 2003, p. 120).

Several key personalities in our history can be credited for having ventured into carrying out thorough researches on the topic of stress. A group which called itself the “ Work and Stress Research Group” was formed with the aim of addressing issues related to stress and work in the daily life of a human being. Among them were: Saswata Biswas, Maureen Dollard, Philip Heffernan and Jane Farin. They were committed to providing information on stress and consultations. It is a group which was officially registered with the University of South Australia when they started their research. This was back in the year 1996, and they dealt with issues which caused stress like

unemployment, work violence, ergonomics, and drug addiction. The group has been since then collaborating and uniting with other organizations with the aim of collecting enough information on their topic of research. The group has been commended and credited for its competency and trustworthy in the research, something which has gained it popularity from international organizations and institutions