ON THE RELATIONSHIP OF THE PHYSIOLOGY OF THE BRAIN TO SPIRITUALITY

by Stuart J. Malkin, Ph.D., F.R.C.

Browsing through a bookstore one day, probably five years ago as I write this, I came upon a huge tome, some 900 pages, which dealt in its entirety with revelations about the human brain. Skimming the work, I was reminded that the seats of certain emotions, memory, and other human thought processes had some identifiable sites in the brain. Further, there had been some substantial investigation as to the functionality of these sites. What is it exactly that happens physiologically within the brain that produces such wondrous phenomena as thought, memory, or creativity? That was the question I asked myself, and I pledged to someday investigate this idea. Compounding that query, I subsequently added to my quest the task of learning if the Spirit has a site of its own. If so, how does that work?

BACKGROUND

During the past decade, some significant discoveries have been made identifying the mechanisms within the human brain that are the physical centers for human thought. As well, the operation of those mechanisms has come to be understood, at least on an elementary level. I will describe some of this briefly, using some empirical knowledge gained haphazardly over the past few years (as a result of my curiosity outlined in the first paragraph). As well, I have secured a wonderful and very current text, *Brain Story,* by Susan Greenfield.[1] She is, today, the quintessential authority on the aspect of the subject in which I have the greatest interest. Direct quotes are from this source. All else is either paraphrased or knowledge resulting from my generalized interest.

The brain itself may be the most wondrous organ in the human body. Many creatures have brains. And Mother Nature has done her job beautifully. For instance, the sea squirt has a brain only in the larval state. When it is necessary for the baby squirt to locate a permanent living a place, its brain functions. After locating its place, the brain is no longer necessary, and it disappears. The remaining life of the sea squirt is autonomic and no brain is required! The mouse, of course, has a brain. But it is smooth, as not much space is required for the functions asked of it.

RESEARCH

“Recent brain scanning techniques give us powerful tools to watch the brain at work, without the need for surgery. Two of the new techniques exploit the fact that brains are very greedy for oxygen and glucose. PET scanning monitors how much oxygen or glucose different parts of the brain are using. MRI monitors which parts of the brain are using energy most quickly.”

There is another scanning technique, called magnetoencephalography (MEG), which measures the activity of the brain cells themselves. And, by placing electrodes on the scalp to detect electrical brain waves made by different parts of the brain, researchers can understand what goes on in the cortex when a person makes a conscious decision (to move, for instance). A second or two before movement there is a change in the pattern of the brain waves. Given

this arsenal and carefully controlled scientific experiment, it is possible to begin to answer some of the queries originally outlined herein.

PHYSIOLOGY

Every brain consists of cells, called neurons that form a large interconnected network. The networks are further formed into sections: the cerebellum and the cortex. The cortex is the one that actually had to fold up within the confines of the skull, as human evolution demanded of it. The human brain (and that of other primates) is convoluted, with a myriad of fissures, resulting in a huge area. The brain stem connects the spinal cord to the brain and, in the center and lower portions of the brain are the thalamus, hypothalamus, amygdala, pituitary gland, and the hippocampus.

There are 100 billion or so neurons in the brain, and another trillion cells called glial (related to the Greek word for glue). The latter serve mainly as a maintenance and repair function. The neurons are part of a very complex system, consisting of root ends (called dendrites), stem like connectors (called axons) and very close, but open, connections (called synapses). Everything we think and feel can ultimately be explained as an alternating sequence of electrical and chemical events within these components. Impulses are transmitted to the various parts of the brain and spinal cord as necessary. The physiology of the transmissions is extremely complex and beyond the scope of this commentary, but the end result is that every thought is transmitted to that part of the brain required for the desired functionality. That could be a desired movement, or a thought, a search within the memory, a stored response, or one of the many autonomic (involuntary) functions. By the way, the number of connections grows as one learns, retains, thinks, or creates.

Certain chemicals called neurotransmitters make it possible for a nerve impulse to travel from the axon of one neuron to the dendrite of another. An impulse cannot be transmitted electrically across the synaptic cleft, the tiny gap between the axon and the dendrite. Instead, when an impulse reaches the end of the axon, it triggers the release of neurotransmitter molecules from the cell. These molecules cross the synaptic cleft and attach themselves to sites called receptors on the dendrite of the other neuron.

EXAMPLE

Here is just one example of the complexity. It is how we “see”: “We use the same areas for vision as for our visual imagination. Scientists studying vision have known for long time that the visual system is far more than a one-way street from retina to cortex. We now know that for every connection in carrying information from the eyes, there are and least ten coming in exactly the opposite direction from the higher areas of the brain. It seems that information leaving our retina is not complete enough to create a full and rich interpretation of the world. Our imagination, then, allows us to fill in the gaps and convert the distorted image from the eyes into the complete and vibrant world that we see.”“ Similar complexities exist for all the separate body physiologies.

MEMORY

Evidence suggests that memories may be formed through the establishment of new brain circuits or the alteration of existing circuits. Memory is either short term or long term ... and the latter is either experiential or semantic (that is, either as a result of a specific experience or a learned fact). Scientists have only an elementary understanding of the extraordinarily complicated processes of thinking and remembering. Thinking involves processing information over circuits in the association cortex and other parts of the brain. Scientists are just beginning to understand the brain's simplest circuits. Forming abstract ideas and studying difficult subjects must require circuits of astonishing complexity.

Generally, all parts of the cortex contribute to memory. The prefrontal cortex (at the very front of the brain) is the site of the "working memory," that is, the "keeping track of current tasks" area. But there is some thinking that memory (and its varied aspects) might be spread all over the cortex and recall of the same "fact" not necessarily seated in the same location each time! That would make a brain "message" quite similar to Internet messages (which travel in small packets, spread all over the system, and reassembled before "delivery"). A rather amazing coincidence, I think.

EMOTIONS

As learned in the study of memory "sites," it is not a clear cut notion that higher states of thought (memory, emotion, etc.) can be "assigned" to a particular cortex area...further adding to the complexity of our understanding! But some research suggests that there is a connection (of emotion) with the brain stem (the mass between the spinal cord and the brain). This area includes the thalamus, hypothalamus, amygdala, pituitary gland, and the hippocampus. It is the "production" area for hormones, long regarded as emotional stimuli. (Hormones are a group of chemicals similar to neurotransmitters.) And it is established that the brain stem/amygdala area "processes" the senses.

Arousal (a precursor of emotion) is centered in the hypothalamus and the brain stem. Further, the amygdala has been linked to sexual arousal. These areas are quick acting with respect to human reactions and needs, and, it is thought, operate directly without being routed through the cortex. Arousal is linked to emotion, but is not emotion itself! Having said that, Susan Greenfield postulates that the dynamism of the brain is far too complex to isolate the seat of emotion. She points out that every one of the brain functions relies on the brain chemicals (hormones and neurotransmitters), and that their interaction is complex. She thinks that the entire process of higher thought (which would include consciousness, emotions, feelings, and the operation of the subconscious) involves a complex interconnection of chemical releases.

Greenfield postulates this notion and then demonstrates it in a sub-treatise that experiments with brain drugs. By studying the effects of recreational drugs (those which are the same as brain chemicals), over many tests, she does establish a chemical/emotion relationship.

"The net state of feeling is the product of a holistic brain, involving the coordinated activity of many brain regions." This is the beginning of a "clue" within our search for a physiological relationship to Spirit.

CONSCIOUSNESS AND SPIRIT

One of the major considerations in human development is language, It, too, is a very complex subject. But the traditional idea of a 'language area" in one side of the cortex is no longer valid. New research suggests that both sides of the cortex are used for language, one for verbal processing and one for background "checks!"

"As soon as we have a simple word for ourselves, then we can interrelate the self as a context. We can become self-conscious. This, and the ability to escape the here and now is what distinguishes us from all other (species)."

Current imaging techniques (discussed above) do enable us to see the structures of the brain and, even, brain cells. But "the techniques might be too slow to capture something else, some vital process that somehow unifies all the brain regions and is fast and transient enough to match up to a moment of global consciousness."

This is as close as we are going to get to an answer. Until the imaging technology improves to the point where we can capture a fleeting instant, or less than an instant, we can only postulate. Half a second is a long time in brain dynamics...an action/reaction in the brain takes less than two milliseconds. It is an amazing and complex idea that something beyond consciousness and the subconscious (what we call spirituality and Cosmic connection) does, possibly, exist in the form of tens of millions of interconnections and neurotransmitters that manifest in a time so small it cannot be measured! If there is a physiological site for the Spirit, it is as elusive and ethereal as Spirit itself.

[1] Susan Greenfield, *Brain Story: Unlocking Our Inner World of Emotions, Memories, Ideas, and Desires* (New York: Dorling Kindersley, 2001).