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THE HUMAN BRAIN: MEMORY

PREFACE:

--A cold winterÆs night, snowing lightly outside; a warm, glowing fire shimmering in your cozy living room. A perfect night to read. Excitedly you find the book in which you have been adventurously engaged for a few weeks. Quietly you nestle before the fire, and anxiously open to the bookmarked page. You begin reading.....The Neurobiology of Memory by Yadin Dudai.--

As much as I would like to claim this as my usual Saturday evening, it is my estimation that at least 90% of the population (including myself) find some alternative to this occasion. In a general survey I find that this is not due to a lack of interest, but rather, a lack of patience with the type and quality of text. A great portion of the general population finds it uninteresting to read a book where every other word is at least 16 letters and ends with ðus,ð ðism,ð or ðology.ð Thus I would like to make my supreme goal for this paper to be an easy-to-read, interesting, and informative reading. I will do my best to do the ðdirty workð of meticulously studying the texts, so that I may portray a general idea in a simple way. So let us begin our enthralling search into the anatomy of the human memory....

THE HUMAN BRAIN

The human brain is the most interesting of any biological substance on the earth. It contains a complex system of networks, extraordinary amounts of knowledge, mysterious abilities, and is contained within the skull of every living human (some personal acquaintances may seem to prove otherwise). With its diverse functions, the brain remains the most complicated and undiscovered territory spanning the scope of human existence. All of the knowledge uncovered on this subject remains a mere scratch of the greatest of comprehensible surfaces. Due to the plethoration of subtopics, the main focus of this paper will be the remarkable ability for the brain to *remember*. However, before delving into this vast motif, we must first cover the very basic principles of brain anatomy.

The brain is the main organ of the nervous system. The nervous system is like the telephone system for our bodies. It controls all of the sensations and reactions occurring throughout our lives. When one particular sensation is felt, the brain recognizes, and reacts accordingly. The brain acts as the central computer, receiving, processing, packaging, and sending all sorts of information.

The brain is made of complicated networks of neurons. A neuron is a highly specialized cell used for the process of transmitting information. The neuron is made of three regions: the soma (cell body), dendrites, and the axon. The soma is not unlike (double negative) most other animal cells. It contains the same *ingredients*: a nucleus, nucleolus, chromosomes, endoplasmic reticulum, ribosomes, mitochondria, ect. (Unfortunately, the individual elements of the cell are more than is coverable in this paper). The dendrites are branchlike structures that communicate with other nerve cells. The axon is a wonderfully long fiber (sometimes up to 30 feet!!) which also is used to connect and transmit information between neurons. There are also other parts of the neuron that are used for the purpose of transporting materials and creating impulses through the neuron. (Thinking about all of this kind of makes my spinal chord tingle as I imagine all those fibrous roots tunneling through me.)

Different neurons serve different functions; these are classified by polarity. Thus, the diverse polarities accommodate various functions. Receptors are of the most vital. A Receptor is something that brings information into the nervous system. Science has wonderfully divided these sensory perceptions into these forms: chemoreception, electroreception, mechanoreception, photoreception, and thermoreception. I personally like to refer to these relaxedly as hearing, vision, taste, touch, and smell (youÆve gotta love science). I believe we have adequately covered the neuron. If you are further interested in this particular subject, then I highly suggest looking up ðneuronö in almost any of the sources in the bibliography. Some of these sources contain some

really interesting stuff about electrical polarization and function of the nerve cells. But now, we must press forward.

The neurons make thousands of connections with other neurons. These connections make up the intricate networking system of our brain. The various connections represent something similar to a code. One distinct path of neurons may represent the recognition of an apple, while a separate pathway may cause a person to sneeze. With this slight perception of just how intricate our bodies are designed, one should realize the importance of keeping these connections healthy. Unnecessary damage to the brain results in tremendous complications. However, despite the fact that nerve cells cannot be replaced, the connections between them can. In fact, our brains are constantly making new connections every day. Every new perception, thought, stimulus, or message creates a new connection in this complicated neural system. This is the important and exciting part that is necessary to understanding the human memory.

There are vast stores of information about the brain's anatomy that are not necessary to cover for this topic. I highly encourage anybody who is interested to read the many different books there are pertaining to this subject matter. The brain is a fun organ to study. There is so much involved with this miraculous power. It is definitely worth the time in reading more about how the brain functions (what the brain does when it is asleep is especially interesting!).

THE BRAIN II : MEMORY

--After a long day of Christmas shopping, you exit to the parking area of a large mall, only to realize that you have forgotten where you have parked the car. You stumble to remember--was it section D3 or B3? After hours of laborious searching, you finally stumble upon your vehicle parked mockingly in section H9-- This is the type of situation that most people think of when they think about their memory.

Memory lapses such as this are quite common among all of God's creatures. Especially humans. Memory is usually thought of as being some dark chasm in the brain where sits a huge filing cabinet full of various stimuli (I love the word "stimuli"). This is not altogether correct. In fact, it is far from being correct. The memory works as one of the complicated networks just discussed in the previous section. The memory works as a system of tunnels, rooms, bridges, valleys and hills-- not just a filing cabinet.

Unfortunately, in the history of brain research, a brain was unavailable for study unless it had been damaged. This creates a definite problem. This would be like trying to discover how a computer worked by looking at its broken and mangled components. Not very useful. Fortunately, the brain has become more available for study, and great knowledge has been gained. It has been learned that mental processes are not quite as localized to one "region" as was previously thought. The brain functions as one organ, not a team of regions.

Memory is still divided into basic interpretations of long and short term memories. Short term memory is the type that one would especially like to excel at, while searching for his car in the parking lot, or rampaging through the house looking for the glasses on his head. Short term memory consists of recent stimuli that create a connection in the brain. The greater the connection, the longer the memory seems to last. In various studies, it was apparent that if a person could group a stimulus into an already existing memory, this new stimulus was more likely to be recalled. For example, if one were to try to recall the following letters with no association, it might be difficult: M D E P W G J E D

But when an association is applied, the letters are much easier to remember: My Dog Eats Pancakes With Grape Jelly Every Day. This particular type of letter association is called mnemonics. Associating words with images or other words is very useful in creating a short term link with many things. This is useful because a short term link can be developed into a long term memory. So the next time you are on your way into the

mall, it might be useful to make an association like "I parked in section H9 because I have 9 Hens at Home." The image of 9 hens in your home might not be something too quickly forgotten.

Other types of short term memories are associated with sensory stimuli. Although a stimulus of this nature seems more often to become permanent, they are easily associated with short term memories.

This association memory is explained by the organizational processes. The human mind tends to organize random thoughts into groups of some organization. In an experiment done with random words, people were asked to recall the words on a list. The list contained some animal names scattered very randomly on the list. When asked to recall the list, people would tend to recite the animal names in a group--thus showing some form of mental organization. This shows how important an organized way of thinking is to a person's own intellectual growth. By organizing randomness into coherent thought, learning and recollection increase dramatically.

The anatomical process of short term memory might simply be the brain trying to make new connections between neurons, by building off of familiar ones. However, to my knowledge there is not yet been any experimental proof of this idea. This is simply my own personal thought and opinion.

Long term memory is a much different subject. Long term memories consist of some sort of stimulus that appears permanent in the mental capacity. These memories are produced by the formation of new connections between the neurons involved. The exact function and purpose of these connections is still unclear, but that is what makes the field exciting and progressive. A 30+ year experiment with sea slugs showed a definite formation of new connections in the simple network of neurons. The slug was stimulated on its siphon and then given an electric shock, over time, the slug took "quick evasive action" (that's an interesting mental image) in order to avoid the shock. With an extensive study, it was shown that there was a definite change in the

connections of neurons. So what does it all mean? We are not exactly sure, but the continuance is very intriguing.

An interesting thing to note about the human brain is that 70% of a child's brain cells die off by the age of 8 months. This makes one wonder how powerful the human brain might be with that additional percentage of brain power. With each cell there are obviously an almost limitless number of subneuronic connections possible. This could mean more memory availability, better perception, quicker reaction time, or other benefits. However, it might also mean more possibility for dysfunction, greater risk factor, possible slower processing, ect. These are some of the wonderful mysteries we seek to know about the human brain.

The memory capacity of the human brain seems virtually limitless. It would seem logical that as a person gained more knowledge, it would become harder to hold it all, and yet the opposite occurs. As mental capacity is filled, it is strengthened, and grows.

This is a key idea in this life. Our mental capacities should be fully extended as we stretch through this mortal existence, our intellectual abilities enhanced at every opportunity, and, of course, our spiritual awareness enlightened and intertwined with our mind. These are things that we seek for, and perhaps through the studies of the brain and its functions, we may slowly begin to comprehend a portion of the great Plan behind it all.

BIBLIOGRAPHY

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McGaugh, Norman M. Weinberger, Gory Lynch: 1990
- 5- The Neurobiology of Memory Yadin Dudai 1989
- 6- Proceedings of the National Academy of Sciences v. 93 November 26, 1996 pp
13534-40
- 7- Grolier Interactive inc. 1997

RECOMMENDED READINGS

These books were not used as references for this paper, but are of great interest and I recommend them highly to those who are interested in this paper's subject matter.

<u>Your Brain and Nervous System</u>	Dorothy Baldwin	1984	24-25
<u>The Brain and the Nervous System.</u>	Steve Parker	1990	10
<u>ABC's of the Human Body</u>	Not given	1987	72-73
<u>Your Brain, Master Computer</u>	Margaret O. Hyde	1964	129,147
<u>Smart for Life</u>	Michael D. Chafetz	1992	63-66,81,86