CEREBRAL CHANGES WITH TIME

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It has frequently occurred to me that the days and weeks the calendar events, Easter, Labor Day and Christmas are going by at an increasingly faster rate. A short time ago your home was busy with children, then they began school, soon they were in Junior High School, quickly, taking part in high school events, suddenly in college and you were getting them back and forth during holidays, next married to someone special and then your home became fairly quiet except for special occasions. Where did the time go?

However when you were young, hours, days, months and the whole long ye yearly calendar went slowly and we nagged whomever was around with, "What can I do"? "I wish I had something to do!" "Dumb little town". Time passed slowly then. And it has been said that a fortnight can be a year to a teenager but a year passes like a fortnight to an older person.

Now I'd like to turn to something a little different, but as you will see later, closely related. I have read an article or a book and in discussing it, I wish to repeat the author but somehow at that specific moment, the particular phrase or story won't come to the surface and I have to extemporize--often a let-down to me and to the listeners. But I can tell you in detail about an event that I read or saw or took part in as a boy without hesitation. I think right now of Jesse Owens breaking 4 world records, a stocky guy by the name of Panther from Iowa in the discus, Metcalf warming up for the 440 on the back stretch--all in Ann Arbor in a Big Ten track meet long ago.

I would like to explore some of the things that may help us understa nd these mind-boggling every day occurrences.

The world is very old and human beings are very young. Significant events in our personal lives are measured in years or less, our lifetimes in decades, our family genealogies in centuries; and all of recorded history in millenia. But we have been preceded by an awesome vista of time, extending for prodigious periods into the past, about which we know little--both because there are no written records and because we have real difficulty in grasping the immensity of the intervals involved.

If we compress into the span of a single year all the cosmic chronology of the 15 billion year lifetime of the universe (since the Big Band or A Big Bang), then every billion years of Earth history would correspond to about 24 days of our cosmic year and 1 second of that year to 475, of our years real revolutions of the Earth about the Sun. On this scale, events of our history books are so compressed that a second by second recounting of the last second of the cosmic year is necessary to account for the events in all of recorded history. An equally rich tapestry must have been woven in other periods but we only have records for the very end of the cosmic year.

During this multi-billion year history, organisms developed. The simplist organism have as much evolutionary history behind them as the most complex. All of them have chromosomes which contain genetic material passed from one generation to the next. The hereditary nucleic acid is always the molecule DNA (desoxxyribonuceic acid). A typical human chromosome has one very long DNA molecule wound into coils. It is composed of smaller building blocks called nucleotides. Our hereditary information is determined by the sequence of the 4 different kinds of nucleotides. A typical chromosomal DNA molecule in a human is composed of about 5 billion pairs of nucleotides. All genetic instructions of all the other taxa on Earth are written in the same language with the same code book. This shared genetic language is a vital piece of evidence that all organisms on Earth are descended from a single ancester, at the time of the origin of life--some 4 billion years ago. A single chromosome contains about 20 billion bits of the heretary information which is about the equivalent of 3 billion letters or about 500 million words. This is to illustrate the enormous potential of the human brain--a culmination of evolution through the lowest form of life.

Comparisons have been made between brain mass and body weight with definite evidence that man has the highest ratio and we hope that humans are also the most intelligent. Evolution of mammals from reptiles over the two hundred million year period was accompanied by a major increase relative brain size and intelligence. Also the evolution of human beings from non-human

primates a few million years ago was accompanied by even more striking brain development. One observer considers our brain a triune one, having 3 interconnected biological computers each with its own special intelligence, its own subjectivity, its own sense of time and space, its own memory, motor and other functions. Each brain corresponds to a separate major evolutionary step. These parts can be distinguished neuroanatomically, and physiologically. The most ancient part is the neural chasis composed of the spinal cord, the medulla and the pons which comprise the hindbrain and the midbrain. Functions of reproduction, self preservation, heart regulation, blood circulation, respiration all come from a basic center in this area. An example is a survivor of a major accident who has nothing left but the functioning of this primative brain, it is a regression back several hundreds of million years. Drivers of the neural chasis are three-fold: The most ancient which surrounds the midbrain (shared by other mamals and reptiles), is 300 million years old and is called the Reptilian or R-Complex: (2) The Limbic which surrounds the R-Complex (shared with mamals and to some degree with reptiles) is 150 million years old; and (3) The Neocortex, clearly the most recent evolutionary addition, surrounding the rest of the brain. It is progressively more developed in the more advanced mammals, comprises 85% of our brain and is 30 million years old. This part increased greatly 3 million years ago when humans emerged. Thus fundamental changes occurred by adding new systems on top of old one and in modifying old systems. Oncology recapitulates phylogeny or each phylum in its embryonal development has repeated what occurred in its evolutionary stages in embryonal life, e.g. the fish stage with gill slits that are useless for the human embryo who gets noruishment from the mother. Our brain also goes through a sequence of development: Neural Chasis, R-Complex, Limbic System and Neocortex. Either the old function is required as well as the new or the old system cannot be by-passed and still have survival. During our long childhood a human gradually learns to ignore the impulses and influences coming from the lower brain complexes. The R-Complex is responsible for sex drive, aggressive behavior and establishing social hierachies. The Limbic

System generates strong love emotions, includes the pituitary gland, endocrine control, controls basic body functions. As we will see later, deep memory centers in the hippocampus is a part of the Limbic System.

The Neocortex, composed in our brain of the frontal, parietal temporal and occipital lobes has neural connections with the sub 1/2 cortical brain. But the transition to Humanity began when neocortical activity began and in human developement today this can be picked up by an EEg in the developing fetus. Abstractions such as language, reading writing and math arise from neocortical function. But some lower life froms show neocortical quality even though, (such as bees), they have no neocortex appear for they can communicate information about food location, this is an enigma,

The way in which these complex structures are connected are by a microscopic network of nerve fibers that can conduct an electric current. Bassically, there are two kinds of cells: neurons or nerve cells, of which there are some 100 billion, and glia, which outnumber the neurons by a ratio of 10 to 1. Neurons, which are the functional units of the brain are connected to each other by means of long filaments, or dendrites and form the body s nerve network. These cells receive sensory impulses, process the myriad bits of information pouring into the brain each moment, and transmit the brain s messages out to the various parts of the body, causing such reactions as the contracting and relaxing of muscles.

It has long been known that these messages are transmitted electrically. More recent research has shown that communication between the neurons is also chemical in nature. Neurons have bulbous endings called synapses. These secrete chemicals that cross the submicroscopic gaps between the individual cells, lock onto special sites on the the dendrites of neighboring cells and cause these cells to release chemicals of their own. That action allows the passage of current from one cell to another. Although some of these ehemical reactions take as little as one-millionth of a second, the actual current flow is slower than an electric current because as many as 100,000 neurons may be involved in transmission. We can be thankful that such a simple action as stepping back to avoid being hit by an oncoming car occurs in less that a second of such

brain activity:

All messages to the brain are composed of patterns of dots which are very complicated. Meaning must be related to the timing of signals because stimuli have various firing rates. And only certain patterns of dots receive attention. For example a frog only notices objects moving toward it, ignoring all other activities. The key to the code which nerves send to the brain is not understood and how the brain translates special sense organ messages is also unknown. Perception becomes experience and experience is coded in memory in the form of a change in certain protein molecules which becomes the gauge for reference for everything we do. Many researchers feel that memories are stored and recalled by a combination of macro-molecules or large molecules that probably differ considerably from one individual to another. Involuntary acts such as the blinking of the eyes when they are dry and even the migration of birds are probably laid down in hereditary material of the cells, perhaps in DNA-RNA completes. Lower animals can t change this very much but higher aninals can change it to fit a new situation and in this way a new thing is incoded and learned. The way in which our body developes an immune response to invading organesmis is an example. There is a parallel between memory and immunology. Actually one may enhance his learning ability and increase cholinesterase activity by exercising the brain with difficult learning.

There is no specific learning center in the brain. A memory trace of fixed code laid down on the side of the brain receiving the sensory stimulation. Connecting fibers establish a sort of carbon copy of the trace on the other brain side also. A crucial factor in the learning process is protein syntheses- the creation of complex molecules.

Although the cortex is involved with memory, it does not act like a computer s memory bank in which each bit of information is stored in a single electronic cell. Memory it has been found, is delocalized or spread throughout the cortex, and perhaps throughout the neocortex. Some 50 X 109 bits of information can be

stored in our brain. Experiments and observations now support a three-level theory of memory. The lowest level is short-term memory, which lasts no more than a few seconds. Every moment of life, hundreds of sensory impressions flow into the human brain and are promptly forgotten. At the next level is medium-term memory ,which lasts from a few minutes to a few hours and enables man to remember something like a telephone number just long enough to dial it or to cram for an examination or to remember bridge rules long enough to play for an evening. At the highest level is long-term memory, which is coded material that has been sifted out of all the impressions and information entering the brain and preserved because of its importance, usefulness or vividness. No energy is expended in the discarding of a temporary trace but a change has taken place at cell level. New memories are always destroyed more easily that permament traces. Forgetfulness may be a blocking of pathways that lead to storage files. It usually takes an hour for memories to be deposited in a permanent file.

Brains and computers use a mechanism called servo-mechanism. The brain operates in such a way that it regulates present performance according to what happened before. The thinking part of the brain sets the goal and triggers the mechanism into action. It instructs parts of the body to feed back information to the brain. This is done automatically. In a computer as to the quality of the product that is desired etc.

Recall mechanics can be very complex. A common experience is that we know something is in the long-term memory bank--a word, a name, a face, or an experience but we cannot recall it. No matter how hard we try, the memory resists retrieval. But if we think sideways or let it rest for a bit or recall some slightly related or peripheral item, the long-term bank releases the information. It could be that in thinking along the periphery, there is found an association to the memory trace by a different neural pathway. Not a very efficient brain-engineering feat. If we associate something we have read with seeing (writing it down), hearing (saying it aloud), or relating it to something we know, we will remember it quite well. It may mean that we are recording the item in a part of the brain that remembers sounds and images but not thoughts and that other areas record thoughts

and verbal experiences. Or it may mean that repetition over a certain circuit with different senses in association was needed to give a more permanent memory. The more memory is used the less is erased. Somehow the imprint of the synoptic relay is more forciably imprinted when it is reviewed. (overlearning) The act of functioning creates and perfects the function.

So far in our thinking we have really only considered the brain mechanism and the complex system of bringing information into it and of course the responses from it that result in action. But the most sophisticated computer cannot make completely new decisions, cannot make new memory records, has no sense of humor, cannot thrill to a scene of beauty, or sense love or any emotion or indeed feel the sense of competition or of achievement. All of these are functions of the mind and characteristics of a human. The mind in contact to the brain directs and watches but has no memory of its own. We do not know how the mind operates. There is no evidence of neuronal activity. No electrical stimulation can activate the mind,,and no area of the brain has been found that through stimulation can activate the mind. However, the area of consciousness in the higher brain stem seems to corresponds with that of the mind. When this mechanism goes off as in sleep it switches the mind off. It could do this by removing the supply of energy to the mind from the brain. It would appear that there has to be a second fundamental element and a second supply of energy for the mind to act. The mind and the brain work together for the mind vanishes whenever the brain doesn't work. The mind makes its impact on the brain; the mind acts on it and in turn must be acted on by the highest brain mechanism. Yet, they are semi-independent. Could chemical action in nerve cells in a specific area of the brain, produce a second form of energy that could initiate mind activity? The mind could be the action of a specialized mechanism of the brain.

It would seem that part of this specialized action has to do with the reaction time going on within the brain, on which its functioning depends. This reaction time is the factor that determines our subjective experience of time. It appears to be a crucial element for programming the information received from the outside

world for memory reception, storage, evaluation and for the functioning of intelligence and the making of decisions. The source of man's time sense is one unique electrical process which contains the secret of life. Time is a complicated item. No one really knows what it is. It has always been equated by the stars of the time of man and this could be called external time. But there is also internal time--the time of plants, the time in chemical reactions, radioactive changes, wave propagation and the time elements that goes on inside of atoms. The essence of the word time is that it is an attempt to evaluate a change. The biological age of a plant has nothing to do with the number of times the Earth goes about the sun. Why not use 100,000 beats of a heart per day instead of 24 hours in a day? Do nerve cells of our brain invent time after perceiving motion and space through our sense organs? The association of space and time originates in childhood but in the first 5-7 years of life the notion of time is not yet in operation. But at 8-10-years of age the child becomes capable of retrospection. The time idea becomes established as a function of what was done during the interval. A growing child has a perceptual notion of time; an adult has a conceptional notion. The adult accepts the irreversibility of events but also thanks to his memory, the reversibility of his thoughts. The concept of time is a subjective thing--a human invention. Subjectively, the notion of time is essentially tied to memory, and to a certain extent, parallel to its acuity. When conscious memory disappears, the notion of time disappears with it, as in sleep, (lost 2 days when drunk) intoxicated, trauma etc. And anything that attenuates memory, alters the sense of time, e.g. sickness. Between external time and internal time there exists a connection--activity. The appearance of the course of time gradually accelerates with the passing of years. A year in a child of 4 is 25% of his life but a year in a man of 70 is 1/70th of his life. Long before either intellect of memory exists, the first sensation of time lie in periodical recurrences of hunger and thirst. Suffering is probably the second sensation of time and pleasure the third, in the satisfaction of the meal. The repetition of suffering and pleasure conditions the newborn to a

time cycle just as Pavlov did with his hounds. Our involuntary reflexes such as breathing do not reach conscious level, because in the evolution cycle they were not thwarted or retarded. In the delay between the reflex tendency to act and the act itself there is a crucial moment of suspence and indetermination that includes judgement and the appreciation of the nature of interior time. This delay is fundamental to the brain development to the intellect to judgement because of the connection which the delay establishes between the time of expectation and the distance of satisfaction. Internal time is the interval spent in (space gone over) in cortical imagination. At the moment of action, there is an integration of internal time with external time of the object. Every perception as it is recorded is conceived in time. The trace becomes localized, schematized in memory, ready to come to light again in image and action which then involves a new time and trace. But to make a trace or reproduce a memory or to make an electornic tape, an electrical current must flow, man must fix his attention. When awake, man can associate a reproduced memory with a temporal component but when unconscious or in sleep, the reproduced spacial image is stripped of ~~a temporal~~ character. It is thought that the time involved is the retarding factor that is introduced in the electrical flow and this creates psychological time and memory is born. Thoughts are closely related to memory unique to man, born of the functioning of the brain and is the spiritual quality of a person. Each individual's personality or his individuality--depends on a privacy due to the inaccessability of the internal signals to anyone but the individual himself. We have a dual source of information--from the inside and from the outside world.

There is no question that with aging, memory becomes more difficult and forgetfulness more common. Both of these represent failures of storage rather than that of retrieving. Aging can involve a descreased blood supply causing the occurrence of degenerative plaques and abnormalities in the hippocampus and the cerebral cortex. There would then be greater difficulty in accessing new material into the long-term memory bank. At a neuron level, it could be that there is a limit to the number of replications that such cells can undergo during a lifetime.

With aging there is just an inadequate numbers of new young neurons; accordingly fewer numbers of connecting fibers, fewer synapses, more gaps and less coding as well as decoding so that retaining and utilizing information suffers. Besides impulsses have been shown to travel more slowly in the aged, it is a fact the older people cannot make new protein as well; again memory suffers. A decrease in cerebral protein synthesis may also take place because of less learning. If learning is not practiced, that function will suffer and memory traces will be less acute.

It has been shown that choline acetyl transferase which is needed for the manufacturing of acetylcholine decreases with age. This would result in impairment of memory storage and widespread disorder of general cognitive function. A viral disease called Altzeimer's Disease resulting in rapid mental deterioration, also shows a decrease in this enzyme. Pathologically, there has been seen clear-cut destruction between the areas of short and long-term memory areas in aged individuals who had memory problems.

And of course, at the time a message was given, if the recipient was not perceiving, then his internal time mechanism would not be in operation, his mind would not be receptive and no incoding would occur. An everday example of this is when your wife tells you to be certain to do something you have no interest in doing and you let it go out the other ear.

A given moment of time appears to become smaller and smaller as the life cycle progresses. The individual sees himself using up his remaining hours of life at an increasingly rapid pace. His perception of time is inversely proportional to the length of time he has lived, for each succeeding hour is a maller fraction of his total life experience. Another aspect of man'spperception of time involves the portion of life to which time is anchored. In middle age, this shifts from early life--that is, how long he already has lived--to the amount of time remaining until the end of life. The sift, in time, this time reference, perception anchorage occurs as a person realizes that his peers are beginning to look and act older, gradually emphasizing to him that his own life is finite. As before

1 year at age 4 is 25% of his life but 1 year at age 70 is 1/70th of his life. I think too in reference to internal time, if we fill every moment of our waking hours with activities whatever they may be, we tend to blot out external stimuli and thinking related to this so that not much has entered the memory bank and internal time has had little opportunity to have any effect. Since there has been no integration with external time there is no reference connection and psychological time appears to go quicker just as in sleep.

After all this, I think that all we can do to forestall the inevitable aging of the mental processes and perhaps slow down the passing of time a little bit, is the following:

1. Make certain before you are coneeived that all of your progenitors had all their marbles until they died, could recite the Gettysburg address as well as name the participants in last year's and this year's super bowl.

2. Take time out daily to think about your relationsip to your job, your family, your friends and your God.

3. Keep your mind active with some learning problem or with a goal that requires some new learning requirement. Force your mind to work.

4. Stay in as good a physical condition as you can.

5. If possible, don't be born a Dutchman where there is great possiblity that you may have your brain in your ass.

Joke about ethnic brain:

Wealthy individual had brain pretty well destroyed in an auto accident and so family scouts all over world for best avaiable brain for a transplant.

Russian brain	4,000
Australian brain	5,000
Chinese brain	7,000
German brain	10,000
Dutch brain	20,000

Why dutch brain so much more valuable, never been used.

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