

MEMORY

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Editor: This is a subject of more than casual interest to most, if not all, of us. I asked Josh if he could expand a little on the mystery of memory, what is known, and is there any hope for those of us who find it slipping away.

It seems appropriate to write about memory while there is still some left. The process of memory—the capability of recalling to mind an infinite number of ideas, facts and emotions which have been previously experienced—has fascinated and intrigued psychologists, physicians and scientists (and probably you and me even more so) since the beginning of civilization. Memory is absolutely fundamental to the development and organization of any kind of thoughtful life. It is the basis of learning, language, writing, mathematics, arts and general awareness. It is absolutely essential to independent living. Even the most primitive activity is impossible without memory.

It is customary to measure the power of memory by the ability to recall names (at convenient times, or ever) and where belongings are placed. These accomplishments are minor compared with the more subtle but far more important feats and necessities of memory. Every aspect of life depends on memory—who we are—where we live—how to get there—to whom we are married and to whom we are not—when to go to the bathroom and where it is. What is beauty and what is not—what is edible or what is not and how to eat it or not.

One would think, as important as memory is, that it would be staunch, stable, dependable and constant. Far from it! Memory is faint-hearted, whimsical. Important data are gone at important moments, later to be suddenly retrieved, irrelevantly and unexpectedly. I meet a friendly acquaintance—we exchange greetings—a brief conversation. I cannot remember his name though I know where he lives, his wife's name, how many children he has. These items are not stored in the same part of my brain with his name. Later at lunch: 'George'—no last name, still different storage area. At bedtime: 'Abbott'—George Abbott, puzzling, exasperating and frustrating delay, but miraculous that recall can and does ever occur.

I go into the next room with a definite purpose. I arrive—what is the purpose? I retrace my steps to start over again—the purpose becomes quite clear.

To make matters more confusing, there are several kinds of memory—transient, short term and long term. I awaken having had a vivid interesting dream. By the time I get to the bathroom, the dream has vanished. I can't even recall what it was all about. But, if I immediately tell it to my wife in all its mixed-up detail, I can remember it from then on easily. I look up a telephone number. The line is busy. In ten minutes, I have to look up the number again. But I can remember my own number forever. Memory is not a science. It seems to be some kind of art.

Short term memory turns up in another example. In high school a huge contest was held. All 400 boys in the school were expected to read Dickens' "Nicholas Nickelby" and take an examination on it. I studied hard for a few days, took the test and won the prize: a ten volume set of Dickens' works. Shortly thereafter, I was only able to remember fragments of the story. A couple of weeks later I could recall nothing. On the other hand even now, I can remember Lincoln's Gettysburg address, the 23rd psalm, the charge of the Light Brigade, the Highwayman, practically every detail of Treasure island, Kidnapped, etc., etc. What is the difference? I crammed Nicholas Nickelby. I worked on it briefly and intensively and never looked at it again. In order to learn something almost permanently, repetition of the learning process must take place. This is called facilitation. What happens in the process of facilitation? It is not at all well known. Several researchers claim to have identified permanent changes developing in the neurological pathways of the trained snail. These findings have not been substantiated in higher forms of life. Modern sophisticated imaging techniques have, however, demonstrated complicated transient chemical reactions intracerebrally while a subject is memorizing difficult material. It is encouraging to know that the complexity of the chemical reactions in the brain of a healthy seventy-five year old are favorably comparable to the activity in the brain of a twenty-five year old. It has been well shown that the more demands one makes of one's brain, the more the brain continues to respond. Some kind of

chemical build-up or increasing chemical availability must be present in the process of memory facilitation and storage. Various chemicals have been found to be briefly helpful in improving impaired memory, but nothing promising has turned up.

An interesting phenomenon related to subconscious memory is demonstrated by the conditioned reflex described by Pavlov. Pavlov showed that if a dog is served meat, he salivates. If at the same time the meat is served, a bell is rung (and this is repeated several times), when the bell is rung later without the meat, the dog salivates. This can be carried a step further. This time the bell is rung (no meat) the dog salivates and a bright light is turned on. After this association of events is repeated several times, the dog will salivate only when the bright light is turned on. (This must puzzle him, if he thinks about it). This is the type of deeply embedded memory which probably affects our own lives. When I eat blueberries, I immediately recall the beautiful meadow where I picked them as a child. The capability of remembering can be acutely destroyed without a trace, i.e. the lost weekend of the alcoholic (who may seem to be acting normally but can remember nothing) or post-traumatically (the survivor of the Diana crash), though sometimes some memory will return. And yet loss of consciousness with normal sleep or a general anesthetic does not affect memory. Progressive inhibition of memory may occur with long term alcohol abuse, and in the presence of poorly understood intracerebral pathological changes.

There seems to be no specific spot where the capability of memory is located in the brain. It is scattered through the same areas where are cognition, sensation and motor pathways. There are, however, some clues regarding the pathways by which new material can be learned.

Let me give you an extraordinary example of the tricks of memory. The young man had received a penetrating wound to the brain. The following is quoted from a book relating to learning and memory. "The patient was a young man in his twenties. He was introduced to me by his friend, 'This is Wayne Wickelgren.' The young man replied 'Wickelgren, that's a German name isn't it?' I said 'no.' Then he said 'Irish?' Again I said 'no'. Then he said 'Scandinavian?' and I answered 'yes'. I talked with him for perhaps five minutes, and then I had to leave to make a telephone call. When I returned everyone was standing in approximately the same locations as before. His friend, realizing that his friend would have no knowledge of having met me before, reintroduced me to him. After she said 'This is Wayne Wickelgren,' he proceeded to say, 'That's a German name isn't it?' I replied 'no.' Then he said 'Irish?' I said 'no' and he said 'Scandinavian?'—exactly the same series of questions he had asked me the first time he met me. The patient could learn no new material, i.e. that he had seen me before and had conversed with me. He was perfectly aware of and in complete control of his past experience. Thus he could carry on a perfectly normal conversation and lead a seemingly normal life.

Another patient lost a large part of his brain due to infection. As a result he has no memory of recent events, but he can converse reasonably normally—up to a point. The experts think he has lost essential "convergence zones", mental switching stations that provide access to the information and relate it to other relevant data. Many of us think our switching stations are the worse for wear.

As long as we stay clear of intracerebral pathological processes, that is to say, brain damage from injury, disease or abuse, we can keep the neurological pathways in the brain polished and active by frequent use.