



Theology of Neurology: General Details about Memory & Recall; Short- & Long-Term Memory; Memory: The Brain's Electrochemical Filing System

6. **General Details about Memory and Recall**
- 1) Remember the various terms we have noted that describe what the Bible calls a “wheel-track”: (1) Memory Store, (2) Memory Trace, (3) Engram, and (4) Cognitive Map.
 - 2) The biblical words for wheel-track are, in the Hebrew, (1) *ma'gal*, and (2) *derek* and, in the Greek, τροχία, *trocia*, all of which are usually translated into the English as “path” or “way.”
 - 3) Further, each language uses its term to idiomatically define a person's vision (or, worldview), way of life, or lifestyle.
 - 4) The thing which establishes one's worldview, way of life, or lifestyle is the accumulation within his memory of beliefs, philosophies, ideas, thoughts, opinions, convictions, attitudes, and values.
 - 5) The presence of these things in one's memory is constantly recalled to one's conscious mind due to certain stimuli.
 - 6) Stimuli exciting recall may be external and usually involve the senses, i.e., sight, sound, touch, taste, or smell.
 - 7) These senses may excite internal stimuli for recall and often involve the emotions which originate in the limbic system.
 - 8) Once senses bring something to the conscious mind by means of recall, often what occurs next is a rush of emotions which react to what memory places into the conscious mind.
 - 9) No one can execute sophisticated problem-solving unless there are wide wheel-tracks which are habitually applied under stress.
 - 10) The more these wheel-tracks are used the less thought goes into submitting to their behavior patterns.
 - 11) With each succeeding episode, the further down the road you go toward facilitating a path of least resistance.
 - 12) Facilitation of establishment or Bible principles causes the believer under pressure to choose wheel-tracks of righteousness in problem-solving and decision-making. Facilitation of human viewpoint and evil causes the believer under pressure to choose wheel-tracks of wickedness.
 - 13) The former situation describes a person who is a vessel of honor who exhibits the attributes of virtue, integrity, rectitude, and probity.
 - 14) The latter case describes a person who is a vessel of dishonor who exhibits attributes typical of chronic carnality, advanced reversionism, and tragic flaws of character.
 - 15) With this general description of how memory and behavior coordinate, let's now turn our attention to how this occurs in the electrochemical transmission system originating in the neurons of the brain.



7. **Short- & Long-Term Memory**

- 1) Your memory contains vocabulary, language and physical skills, facts, life experiences, people, places, and things.
- 2) These memories are chemically coded and retained in the brain by means of countless synaptic connections.
- 3) Learning and memory are different. Learning refers to the *acquisition* of information while memory is the *preservation* of that information that makes future *recall* possible.
- 4) The mind can store visual images in short-term memory for a few seconds. This is called *iconic memory* from the Greek word **εἰκών, eikōn**, meaning image.
- 5) James illustrates iconic memory by a negative believer who acquires academic understanding of a biblical subject but doesn't make the faith transfer to long-term memory.

James 1:23 - If anyone is a hearer of the word [**short-term memory**] and not a doer [**long-term memory**] he is like a man who looks at his natural face in a mirror;

v. 24 - for once he has looked at himself and gone away [**iconic memory**], he has immediately forgotten what kind of person he was.

v. 25 - But one who looks intently at the perfect law of liberty [**Bible doctrine**], and abides by it [**recall and application from long-term memory**], not having become a forgetful hearer [**short-term memory**] but an effectual doer [**execution from a wheel-track of righteousness**], this man shall be blessed in what he does.

- 6) Short-term memory is lost due to lack of repetition. It must be rehearsed and repeated in order to transfer it to long-term memory.
- 7) The brain is designed so as not to retain every piece of information ever taken in. Otherwise it would be crammed with a lot of useless minutia.
- 8) But what is useless minutia to one person is considered important knowledge to another, thus volition is left free to decide what is to be forgotten or retained in long-term memory.
- 9) Therefore, all information comes into the brain on a short-term basis and is lost unless it is retained through memorization into long-term status.
- 10) Information which is considered useless is lost within 10 seconds.
- 11) With practice, new information and skills are stored in long-term memory on a permanent basis.
- 12) Dr. Karl Lashley, a pioneer in brain research at Johns Hopkins University in the late 1920s, named the long-term memory traces "engrams." This term is defined by:

Encyclopaedia Britannica, 15th ed., s.v. "engram":

In neurophysiology, a change in the neural tissue that accounts for the phenomenon of memory; a memory trace.

Webster's Ninth New Collegiate Dictionary:



A change in neural tissue accounting for persistence in memory.

American Heritage Dictionary of the English Language:

A persistent protoplasmic alteration occurring on stimulation of living neural tissue accounting for memory.

Oxford English Dictionary:

A permanent change in the nucleus of a cell due to stimulus.

- 13) The process which brings about these changes in the brain's neurons is learning.
- 14) Knowledge that is transferred into long-term memory causes permanent electrochemical changes in the brain's neurons creating an engram—the neurologist's term for what the Bible calls a wheel-track.

8. **Memory: The Brain's Electrochemical Filing System**

- 1) If memory storage requires alterations in the biochemical structure of neurons, then it follows that when memories are formed, something must be changed within the brain.
- 2) Virtually all biochemical processes demand energy and energy in the brain comes from burning glucose.
- 3) Learning initially produces a brief change in the status of synaptic membrane proteins. But this is only short-term.
- 4) Although this stage may be necessary if long-term memory is to later occur, it can't be *the* biochemical change that remains permanent.

Rose, Stephen. *The Making of Memory*. (New York: Anchor Books, 1992), 253:

Something more permanent is required, something that will in some way produce some lasting remodeling of the synapses. It is this remodeling which must require the synthesis of new proteins. (See Romans 12:2)

- 5) A definition for "synthesis" is necessary for those of us who did not do well in chemistry: When two or more elements are combined to form a new compound, this is called synthesis, in this case, new proteins.
- 6) Proteins are synthesized on the basis of information provided by the DNA, that is, the genes present in the cell's nucleus.
- 7) When an engram is to be created, the DNA must be activated in some way, so as to switch on relevant genes which, in turn, produce the new proteins which then make the new memory trace.