

46. Here are some principles that describe how this “renewing of your mind” takes place:

- (1) The brain is part of the body of corruption made up of a number of components:
  - a. Dendrite:** extends from the neuron which receives information from other neurons. (p. 445)
  - b. Neuron:** specialized cell for integration and transmission of information. (p. 448)
  - c. Axon:** elongated fiber extending from the neuron by which information is transmitted from the neuron to the terminal endings. (p. 444)
  - d. Synapse:** the communication point between the axon terminal of one neuron and the dendrite of another neuron. (p. 451)
  - e. Synaptic Cleft:** the tiny space between communicating neurons at a synapse. (p. 452)
  - f. Memory:** Your memory store includes your vocabulary and knowledge of language, all the facts you have learned, your memories of your own life experiences and people you have known, all the skills you have learned. *Learning* refers to the acquisition of information or skills, and *memory* refers to the expression of information or skills. (pp. 333–34)
  
- (2) **Categories of Memory:** There are nine categories of memory but two of them are pertinent to our study.
  - (1) **Short-Term Memory:** A memory lasting about 10 seconds with a limited capacity of  $7 \pm 2$  items. Information can be maintained by conscious rehearsal. (p. 451)

**(2) Long-Term Memory:** Long-term, well-learned memories are permanent. This must mean a permanent change of some kind in neurons. Everything we know about how neurons function says that the changes must occur at synapses, the points of interconnections among neurons. There are two broad classes of possibilities, structural changes and functional changes. Overwhelming evidence shows that experience results in structural changes at synapses. This is particularly true for experience early in life. William Greenough and his associates at the University of Illinois have developed strong evidence in many experiments that a wide variety of early experiences causes an increase in the extent of dendritic branching in principal (output) neurons. (p. 381)

- (3) **Speech and Language:** Human language permits communication about *anything*. The key lies in the fact that the units of meaning (morphemes or words) can be strung together in different ways according to rules, to communicate different meanings. The most elemental component of language is the phoneme, the smallest possible sound distinguishing one word from another. All languages are based on various combinations of about 90 phonemes. English uses 40 and other languages have from 15 to 40 of these basic phonemes or sounds. *Morphemes* are combinations of phonemes into elementary units of meaning, usually words. English has more than 100,000 morphemes, which arranged in various ways yield the million-word English vocabulary. A typical educated adult has a vocabulary of about 40,000 words; an exceptional individual might have a 100,000-word vocabulary. Finally, words can be combined into sentences according to rules called *syntax*. Finally, the most complex aspect of language is *semantics*, the way language expresses meaning.

All languages, from English to obscure dialects, have the same degree of complexity and similar general properties. It is though humans came into the world equipped with a well-elaborated, complex, and biologically determined language system. In short, it would seem that we may have speech and language centers in the brain that are in some ways predetermined or preprogrammed. (pp. 390–91)<sup>1</sup>

47. Thompson's conclusion that "we may have speech and language centers in the brain that are in some ways predetermined or preprogrammed" gets very close to science coming into contact with God. It is evident that the human species is the only creature with whom God seeks to communicate.
48. The brain consists of millions of neurons and billions of dendrite and synaptic firings that comprise what each of us thinks and what we think is contained in this divinely designed organ.

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<sup>1</sup> Richard F. Thompson, *The Brain: A Neuroscience Primer*, 2d ed. (New York: W. H. Freeman and Co., 1993), 333–34, 381, 390–91, 444, 445, 448, 451, 452.