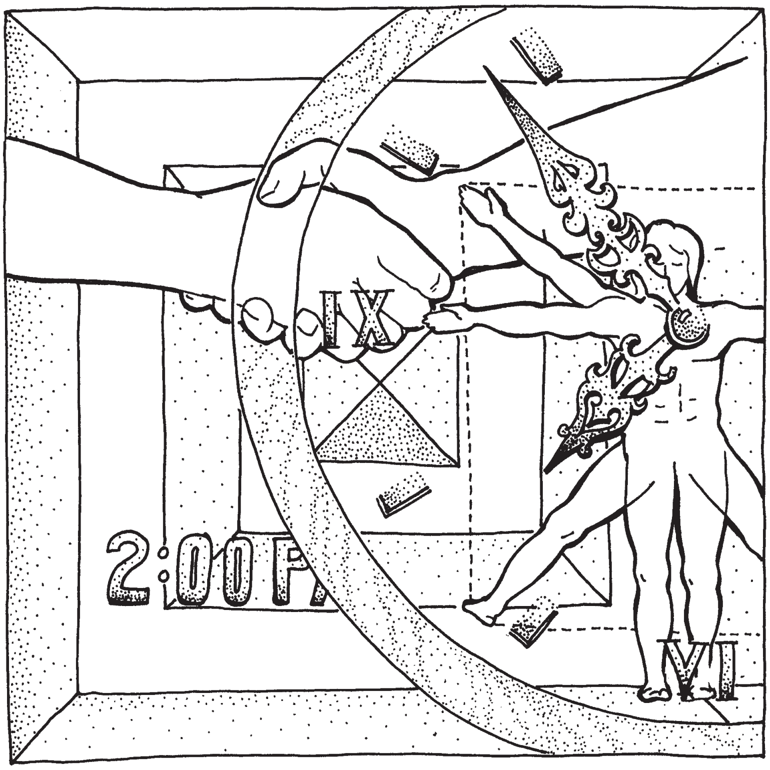
CONTENTS

CHAPTER 1

PHYSIOLOGY AND PHILOSOPHY



Edelman's model of our brain as a rich, layered, messy, unplanned jungle ecosystem is especially intriguing…because it suggests that a junglelike brain might thrive best in a junglelike classroom that includes many sensory, cultural, and problem layers that are closely related to the real-world environment in which we live—the environment that best stimulates the neural networks that are genetically tuned to it.

—Robert Sylwester 1995, 23

The Brain's Structure and Functions

Because of the complexity of the brain's physiology, it is logical to assume its functioning is at least as complex. The brain has a myriad of interconnecting systems made for figuring out complexities. Current neuroscientific research appears to reveal that many of the traditional assumptions about how people learn, which were largely based on behaviouralist theory, are faulty. As more is understood from research about how humans learn, it will become increasingly possible to discover better methods of facilitating learning (see chapter 4).

All attempts to summarise how the brain works fall short of both the complexity and the magnificence of how the brain is structured and how it functions. Any such effort will oversimplify the intricacies of the brain. However, it's important for teachers to be aware of the basic physiology of the brain in order to understand what neuroscience has to say.

There are three major regions of the brain: the brain stem (at the base), the limbic system (above that), and neocortex mushrooming out at the top. (see Figure 1.1 The Human Brain: Top to Bottom.)

The **brain stem** (sometimes called the reptilian brain) is considered to be the oldest part of the brain from an evolutionary standpoint. It follows then that much of the processing of basic survival instincts (respiration, digestion, and the "fight or flight" response) begins here.

The **limbic system**, once thought to be the exclusive repository of emotion, is now known to process not only emotional response but a number of highly cognitive functions including memory. Therefore, the connection between emotion and learning is great.

The **neocortex** (sometimes called the cerebral cortex or neurocortex) is believed by researchers to have grown out of the limbic system at some time in human evolution. Though not exclusively, the neurocortex is where higher-order and abstract thinking are processed and sensory input is comprehended (Goleman 1995). It attaches feeling and value to stimuli it receives. When students learn, it is the structure and chemistry of the nerve cells residing in the neurocortex that are changed (D'Archengelo 1998). Brain-compatible education is about making the connections that bring about actual changes in the brain's physiology. Ultimately, brain compatibility is acknowledging the way the brain processes stimuli and then designing activities, lessons, and units that complement and work with these processes.

The Human Brain: Top to Bottom

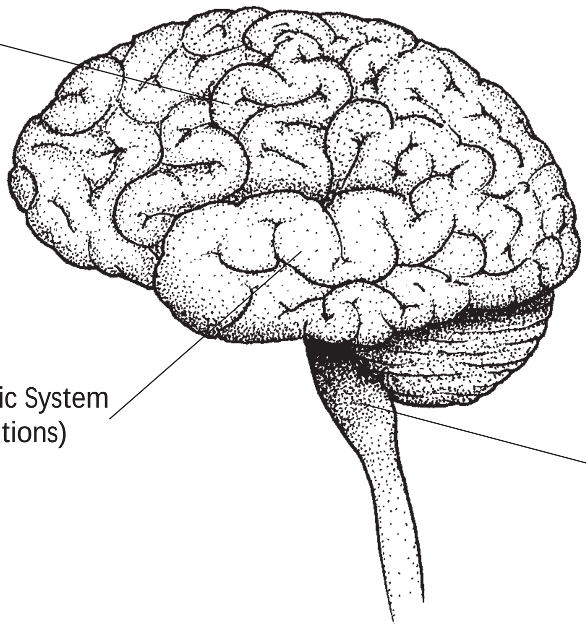


Figure 1.1

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Memory

The brain makes use of several kinds of memory systems. For the purpose of this discussion, two kinds of memory systems are highlighted: taxon and locale. Taxon memories are most clearly related to sheer rote memorisation. Spelling words, multiplication tables, countries and their capitals, and the bones of the hand are all examples of items that require sheer memorisation and thus the function of the taxon memory system (Caine and Caine 1991).

Locale memories, on the other hand, are connected to events or happenings. Usually they are associated with emotions, relationships, and connections to other material. Locale memories can be thought of as configurations of information, or mental maps, which have the capacity to withdraw material deposited in the taxon memory. Getting information into taxon memory is an arduous task, however. Getting information into locale memory can be much less taxing on the brain (Sylwester 1995). In other words, the big picture of something is more related to the locale memory, which uses the intricate pieces, parts, or elements of the picture stored in taxon memory.