The Origin of the Brain and Mind

Brad Harrub and Bert Thompson*

Abstract

The human brain—arguably the most complex matter in the Universe—performs thousands of unusual and unique mental functions. Within that three pounds of grey matter, exist over 10 billion neurons containing education, memories, communication skills, emotions, likes and dislikes—yet all the while that same three pounds of matter continues to regulate bodily functions. Many have denounced the Cartesian dualistic view of brain and mind, suggesting instead that all human experiences can be explained simply by the firing of neurons. According to some, there is nothing in the mind except neuronal activity. But this would mean that emotion-based responses such as tears and laughter are solely products of organic evolution—something that were "naturally selected for" in humans. Evolutionists ascribe the brain's origin to nothing more than a triune layering of various animal-stage brains. Many believe that the fossil record supports this gradual increase in brain size over eons of time as humans allegedly improved their mental faculties. However, we know today that human brains vary greatly in size, and that no evidence exists to demonstrate a relationship between brain size and intelligence. The precision, complexity, and interconnectivity of the brain indicate that it was not laid down in layers. While many questions regarding the human brain still remain, its origin cannot be explained by current evolutionary theory. The ability of the human brain to interact with the human mind clearly points to an Almighty Creator.

(Note: In this paper, SMALL CAPS indicate emphasis in original; *italics* indicate emphasis added. Words in [brackets] added by the authors.)

Introduction

On July 17, 1990, U.S. President George H.W. Bush declared that the years between 1990 and 2000 were to be designated as the "Decade of the Brain," and announced that this declaration was intended "to enhance public awareness of the benefits to be derived from brain research" through "appropriate programs, ceremonies, and activities." Millions of grant dollars were shifted toward neurobiological studies to encourage neuroscientists to try to answer some basic questions in this area. It was during this "decade of the brain" that I found myself completing my graduate degree in the neurobiology department at the University of Tennessee Medical School. Those years of in-depth study taught me a great deal about the anatomy and physiology of the brain, and about how it works within the body as a whole. But they also taught me that, as scientists, we are far from unlocking all the secrets that this incredible structure holds. In fact, scientists are not always sure how they can unlock the remaining secrets. We now possess the ability to record the activity from a single neuron located deep within the brain, but we can only speculate about the role that particular activity plays in such things as memories or emotions. The more we learn about this complex group of cells, the more we realize we do not know much about the "big picture."

I vividly recall an occasion in which those of us in one of my graduate classes were being asked to explain the molecular events that transpire when a neuron fires. The professor phrased the question something like this: "Suppose for a minute that you want to remember a phone number, what events would take place at the cellular level within the basal ganglia during that thought process?" After a lengthy discussion about calcium and sodium channels, a student in the back of the class spoke up and said, "Yeah, but where would that phone number be stored, and exactly how does the brain remember things?" The professor's answer: We don't know. Robert Ornstein and Richard Thompson summed it up well when they stated: "After thousands of scientists have studied it for centuries, the only word to describe it remains AMAZING" (1984, p. 21).

Consider this simple test. Read the following sentence: *Mom had hot apple cider ready for us on that cold snowy day*. In the seconds that were required for you to complete

* Brad Harrub, Ph.D., Bert Thompson, Ph.D., Apologetics Press, Inc. 230 Landmark Dr., Montgomery, AL 36117.

Accepted for publication: December 1, 2003

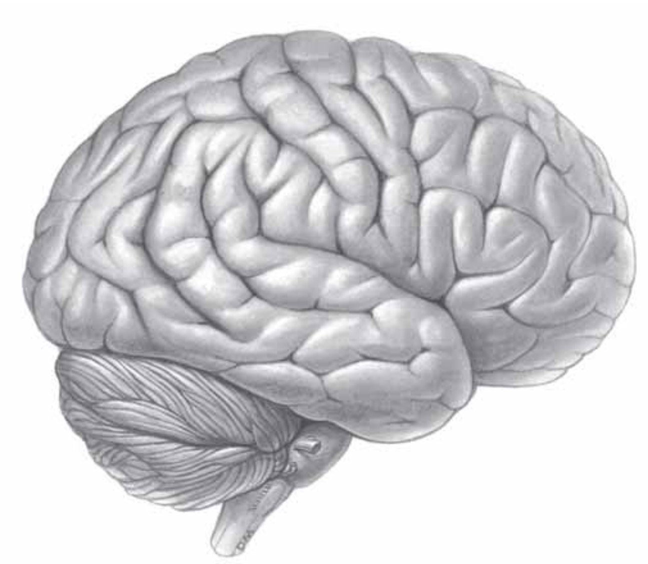


Figure 1. The human brain. LifeART image copyright (2003) Lippincott Williams & Wilkins. All rights reserved.

the sentence, your brain already had carried out a multitude of tasks. Initially, your eyes focused on the piece of paper on which the sentence was written, and then transmitted the visual stimuli chemically via your optic nerve to your brain. The brain received that chemical signal, and immediately recognized the symbols on the page as English letters. It then compiled those letters into an entire sentence (using rules that you learned long ago in elementary school), which it analyzed and comprehended. In addition, your brain also may have painted a mental image of this snowy day and your mother. You may even have found yourself suddenly craving a mug of hot apple cider. Also, during that short span, your ears reported any unusual sounds, and your nose constantly was sampling the air for new odors. All the while, your brain was keeping your body at homeostasis—that is, it signaled your heart to beat and your lungs to respire, it measured hormone levels in your blood stream (and made adjustments as needed), and relayed any pain or sensation that you might be feeling during those few short seconds. And all of this is merely the proverbial "tip of the iceberg." The brain, and the nerves associated with it, carry out countless physiological functions, most of which we understand at only a very basic level. Again, truth be told, we have yet to understand exactly how this unique organ can perform all of these functions simultaneously and with such marvelous precision.

And therein lies the enigma surrounding the brain. How can we take three pounds of matter, and in that small space cram all of our education, memories, communication skills, emotions, likes, and dislikes—yet, all the while it is those same three pounds of matter that keep our heart beating, cause our lungs to respire, and give us a detailed internal map of the position of our arms or legs? How is it that a certain smell instantaneously can carry us back to a period in our childhood, offering us crystal clear images of that particular time in our life? Exactly how is it that we can distinguish between a banana and an orange, just by using our nose? What chemical reactions occur to tell us which one is an orange? *Where* is that memory stored, and how long will that memory *remain* stored? What part of our brain controls our emotions? Where do we hold feelings such as love and hate? How is it that the sound of one voice can bring tears of joy, while sounds from another can cause our blood pressure to begin to climb? In fact, why is it that humans love at all?

As vexing as these questions are, they are even more troubling for individuals who espouse that the brain arrived here by Darwinian mechanisms. Evolutionists would like us to believe that the brain is nothing more than an advanced computer—it receives input (via the senses), and after the input makes its way through various neuronal circuits, output is the end result. Input equals output. Ornstein and Thompson speculated: "What exists as only a few extra cells in the head of the earthworm, handling information about taste and light, has evolved in us humans into the incredibly complex and sophisticated structure of the human brain" (1984, p. 22). These sentiments no doubt are shared by thousands of individuals who stand in utter awe of the brain, yet who chalk up its existence to pure happenstance. Is the brain merely the product of evolution, or were humans created differently than animals?

History of the Brain

The earliest known reference to the brain anywhere in human records was written on papyrus in the seventeenth century B.C. (see Breasted, 1930). According to James Breasted, the individual who translated and published the contents of that document, the word "brain" occurs only eight times in Egyptian history, six of them on the pages of the Smith Papyrus describing the symptoms, diagnosis, and prognosis of two patients suffering from compound fractures of the skull. The organ that we commonly refer to as the brain has not always held a revered status in the eyes of men. In fact, the brain was given little importance by ancient Egyptians who believed that it cooled the body and did little else. As these skilled preservers of the dead prepared bodies for mummification, they excised the brain through the nose with a wire loop and discarded it. Often, the brain simply was pitched into the sand (primary attention was given to the heart, which they considered the most important organ of the body). The classical Greeks, to whom we owe so many ideas, also were divided over whether the heart or the brain served as the seat of one's intellect. The famed Hippocratic writers rightly believed the brain to be the dominant location for things like intelligence and passion. Plato also taught that the brain was the supreme organ of the body, assigning to it such things as emotions, passions of the heart, and even appetites of the belly. Aristotle, a student of Plato, contended on the other hand that the heart was the center of thought and sensation, believing that the brain worked as a refrigerator to cool the heart (which is ironic, now that we know the brain generates the most heat!). And so, the debate continued for centuries.

At the time the Old Testament was translated into Greek (finished sometime during the second century B.C.), the majority of people adhered to Aristotle's viewpoint, and believed that the heart was the center of understanding. The Scriptures are replete with references to man's intellect and emotions as residing in "the heart"—what we now refer to as "the mind." The King James Version lists 830 occurrences of the word heart in over 762 verses. Just a short period after Christ walked this Earth, a philosopher by the name of Galen (A.D. 130–200) realized Aristotle's mistake, and noted that the "power of sensations and of movement flows from the brain" and that "what is rational in the soul has its existence there" (as quoted in Fincher, 1984, p. 13). He went on to question: "Why is the brain capable of cooling the heart, and why is the heart not rather capable of heating the brain which is placed above it, since all heat tends to rise? And why does the brain send to the heart only an imperceptible nerve while all the sensory organs draw a large part of their substance from the brain?" Unfortunately, however, early human anatomy was based on a combination of animal dissections and fertile imagination, which only perpetuated the confusion, allowing Shakespeare (1546–1616) to have Portia question, "Tell me, where is fancy bred, Or in the heart or in the head?"

Great discoveries about human physiology and the structure of the human brain were made during the Renaissance Period. Leonardo da Vinci discovered that he could pour wax into the ventricles (open spaces) of an ox brain, and then strip away the flesh after it had cooled. The hardened wax model that resulted, represented the true shape of the cavities that had remained clandestine within the brain for millennia. In the nineteenth century, the debate over the brain/mind erupted into a furor, led by these famous words:

"What is mind?" —— "No matter."
"What is matter?" —— "Never mind."

Eventually, anatomy revealed the truth, and cardiocentric believers found themselves jarred by the fact that during embryonic formation, nerves developed directly from the brain, while blood vessels developed independently from the heart. Further human dissections firmly established that the heart was more or less a pump, while the brain held all of the intricate secrets of consciousness and the senses, including emotions such as love. However, some theories die hard. For instance, we challenge you to find a Valentine's card with a picture of a **brain** with an arrow going through it. While we know that the heart is not the center of our emotions, many people still make references such as "you always will hold a special place in my heart."

Thus, after years of deliberating and conjecture, the cerebral cortex began to be viewed as more than a mere radiator for the heart. Paradoxically, before men even speculated on its higher functions, part of the answers already had been recorded: "…It is to be conceived that the motor force, or the nerves themselves, take their origin from the brain, where fantasy is located" (see Fincher, p. 16). French mathematician René Descartes, who was born in France in 1596, made this fitting declaration. During his lifetime, a series of biological discoveries rocked the scientific world, and stimulated Descartes to probe the brain. He was devoutly religious, and his philosophy was a bold attempt to reconcile scientific methods while remaining true to his faith in God. Descartes was the one who penned those famous words, "*cogito ergo sum*" ("I think, therefore I am"). Accordingly, Descartes defined thinking as the whole range

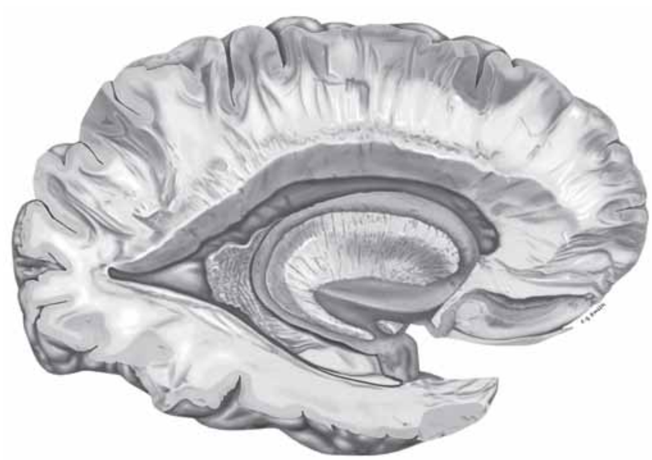


Figure 2. Cerebral hemisphere dissection showing the cortex. LifeART image copyright (2003) Lippincott Williams & Wilkins. All rights reserved.

of conscious mental processes—intellectual thoughts, feeling, will, and sensations. He was of the firm opinion that the mind always was at work, even during periods of sleep. Based on his work, Descartes made a complete and total division between mind and body—one far more drastic than Plato's. Descartes' work was very important because it established "a modern philosophical basis for the belief that a human being lives a dual existence involving a spiritual soul and a body" (Elbert, 2000, p. 217). However, he believed that the body and soul interacted at a particular place, and he unfortunately felt obligated to try to determine that place. Due to the insufficient knowledge of Descartes' day, he concluded that the interaction took place in the pea-sized pineal gland—a structure that we now know is an endocrine glad that manufactures and secretes melatonin in accordance with our circadian rhythms.

The Evolution of the Brain

If you were to walk into a neuroanatomy class at a major medical school, you very likely would find more than fifty white porcelain buckets—each filled with preservative fluids and containing a brain that had been collected from a donor cadaver. The first thing you would notice as you examined the physical mass of the brain probably would be the various convolutions and wrinkles (known as sulci) that cover the entire surface. Had the brain not been soaking for weeks in a fixative such as formaldehyde, you would be able to see that the brain itself is extremely soft, with almost a custard-like consistency. Upon cutting the brain in half, you would observe what appear to be striations in various areas, and you would find various hollow ventricles that normally are bathed in cerebrospinal fluid. Hidden within this gray and white tissue is the most intricately wired communication network in the world.

Those three pounds of "matter" represent literally billions of interconnected nerve cells and millions of protective glial cells—which, according to evolutionists, arose by the effects of time, natural law, and chance from nonliving matter. The brain has been estimated to contain 100 billion (10^{11}) neurons (Kandel, 1991, p. 18), each a living unit within itself. While most neurons share similar properties, they can be classified into "perhaps as many as 10,000 different types" (p. 18). Over 100 thousand billion electrical connections are estimated to be present throughout the human brain, which has been said to be more than "all the electrical connections in all the electrical appliances in the world." In describing this awesome organ, R.L. Wysong wrote:

> The human brain weighs about three pounds, contains ten billion neurons with approximately 25,000 synapses (connections) per neuron. Each neuron is made up of 10,000,000,000 macromolecules. The human mind can store almost limitless amounts of information (a potential millions of times greater than the 10^{15} bits of information gathered in a lifetime), compare facts, weigh information against memory, judgment and conscience and formulate a decision in a fraction of a second (1976, p. 340, parenthetical item in orig.).

The brain, arguably, is the most unique organ in the entire body—not merely because of its physical make-up, but because of *what* it does and *how* it does it. As evolutionist George Bartelmez put it many years ago: "Only a single fundamental organ has undergone great specialization in the genus *Homo*. This is the brain" (1926, p. 454). Today, from an evolutionary perspective, that assessment still is viewed as correct. As Johanson and Edgar noted seventy years later: "This change in both size and shape represents one of the most remarkable morphological shifts that has been observed in the evolutionary history of any mammal, for it entailed both an enhanced cranial capacity and a radical reorganization of brain proportions" (1996, p. 83).

We believe that the brain deserves a great deal more respect than evolutionists are willing to afford it. The late evolutionist Isaac Asimov characterized the human brain as "the most complex and orderly arrangement of matter in the universe" (1970, p. 10). When Paul Davies, professor of mathematics and physics at the Universe of Adelaide, referred to it as "the most developed and complex system known to science" (1992, 14[5]:4), he did not overstate the case. Nuland wrote in regard to the human brain:

> Though the three pounds represent a mere 2 percent of the body weight of a 150-pound person, the quartful of brain is so metabolically active that it uses 20 percent of the oxygen we take in through out lungs. To supply this much oxygen requires a very high flow of blood. Fully 15 percent of the blood propelled into the aorta with each contraction of the left ventricle is transported directly to the brain. Not only does the brain demand a large proportion of the body's oxygen and blood but it also begins its life requiring an equivalent share, or even more, of its genes. Of the total of about 50,000 to 100,000 genes in *Homo sapiens*, some 30,000 code for one or another aspect of the brain. Clearly, a huge amount of genetic information is required to operate the human brain…. From all of this emerges the brain's overarching responsibility—it is the chief means by which the body's activities are coordinated and governed (1997, pp. 328, 346).

Since Nuland's statement was made, the human genome project has been completed, and the latest estimates the entire human genome are approximately 30,000 genes. However, the point should not be lost that a great percentage of those genes code for "one or another aspect of the brain." James Trefil addressed the brain's complexity when he wrote:

> The brain is a physical system. *It contains about 100 billion interconnected neurons—about as many neurons as there are stars in the Milky Way galaxy*…. In the end, by mechanisms we still haven't worked out (but we will do so!), these signals are converted, by neurons in different parts of the brain, into the final signals that produce images or smells or sounds… (1996, pp. 217–218, parenthetical item in orig.).

Notice Trefil's admission that the brain works "by mechanisms we still haven't worked out." Ian Tattersall, in his book, *Becoming Human*, wrote in a similar fashion in describing the brain's marvelous sophistication—while admitting that "there's a huge amount that we don't know."

> [T]he brain is an extremely power-hungry mechanism that, because of its size, monopolizes some 20 percent of our entire energy intake…. But the matter doesn't rest there, for sheer brain size is far from the full story. *The organization—the structure—of our brains is also unique, and it is this that appears to hold the ultimate key to our remarkable cognitive powers*. There's a huge amount, of course, that we don't know about how the brain works and especially about how a mass of chemical and electrical signals can give rise to such complex effects as cognition and consciousness (1998, pp. 69, 70).

The point in Dr. Tattersall's last sentence is well taken. There is a "*huge amount that we don't know*"—including (among other things) how "a mass of chemical and electrical signals can give rise to such complex effects as cognition and consciousness." [Pardon us if we are a bit skeptical of Trefil's exuberant suggestion, "but we will do so!" On this topic, we agree wholeheartedly with Robert Jastrow of NASA, who admitted: "Is it possible that man, with his remarkable powers of intellect and spirit, has been formed from the dust of the earth by chance alone? It is hard to accept the evolution of the human eye as a product of chance; it is even harder to accept the evolution of human intelligence as the product of random disruptions in the brain cells of our ancestors.… Among the organs of the human body, none is more difficult than the brain to explain by evolution. The powers that reside in the brain make man a different animal from all other animals" (1981, pp. 98–99,104).] Tattersall suggested: "Little as we understand the highly complex workings of our brains in producing consciousness, it is clear that there is a 'whole brain' effect in the production of our prized awareness" (2002, p. 73). But, the "whole brain" idea does not get us very far, as Daniel Dennett admitted in *Consciousness Explained*.

> [T]he trouble with brains, it seems, is that when you look in them, you discover that THERE'S NOBODY HOME. No part of the brain is the thinker that does the thinking or the feeler that does the feeling, and the whole brain appears to be no better a candidate for that very special role (1991, p. 29).

Yet in spite of the fact that when we look at the brain, "there's nobody home," and in spite of the fact that "neuroscience is said to be awash with data about what the brain does, but virtually devoid of theories about how it works" (Lewin, 1992, p. 163), there are some things we *do* know.

> The brain, although being THE MOST COMPLEX STRUCTURE EXISTING ON EARTH—AND PERHAPS IN THE UNIVERSE—is a well-defined object: it is a material entity located inside the skull, which may be visualized, touched and handled. It is composed of chemical substances, enzymes and hormones which may be measured and analyzed. Its architecture is characterized by neuronal cells, pathways and synapses. Its functioning depends on neurons, which consume oxygen, exchanging chemical substance through their membranes, and maintaining states of electrical polarization interrupted by brief periods of depolarization (Cardoso, 1997/1998).

> The brain is a helmet-shaped mass of gray and white tissue about the size of a grapefruit, one to two quarts in volume, and on average weighing three pounds (Einstein's brain, for example, was 2.75 pounds). Its surface is wrinkled like that of a cleaning sponge, and its consistency is custardlike, firm enough to keep from puddling on the floor the brain case, soft enough to be scooped out with a spoon…. *The human genome database accumulated to 1995 reveals that the brain's structure is prescribed by at least 3,195 distinctive genes, 50 percent more than for any other organ or tissue*… (Wilson, 1998, p. 97, parenthetical item in orig.).

> Some overall descriptions of the properties of the human brain are instructive. For instance, *10 billion neurons are packed into the brain, each of which, on average, has a thousand links with other neurons, resulting in more than sixty thousand miles of writing. Connectivity on that scale is beyond comprehension*, but undoubtedly it is fundamental to the brain's ability to generate cognition. Although individual events in an electronic compute happen a million times faster than in the brain, *its massive connectivity and simultaneous mode of activity allows biology to outstrip technology for speed*. For instance, the faster computer clocks up a billion or so operations a second, which pales to insignificance beside the 100 billion operations that occur in the brain of a fly at rest…. To say that the brain is a computer is a truism, because, unques-

> tionably, what goes on in there is computation. But so far, no man-made computer matches the human brain, either in capacity or design…. Can a computer think? And, ultimately, can a computer generate a level of consciousness… (Lewin, 1992, pp. 160,163,).

> The human brain's increase in neurons is due to its greater size, not to greater density, since humans have only about 1.25 as many neurons per cubic centimeter as chimpanzees do. There are approximately 146,000 neurons per square millimeter of cortical surface. The human brain has an area of about 2,200 square centimeters and about 30 billion neurons (more than assumed until quite recently). The chimpanzee and the gorilla have brains of about 500 square centimeters, and with about 6 billion neurons (Ornstein, 1991, p. 63, parenthetical item in orig.).

Can anyone—after reading descriptions (and admissions!) such as these—really believe that the human brain is "only another organ," as Michael Lemonick claimed in *Time* magazine (2003a, 161[3]:66)? Not without denying the obvious! In the January 16, 1997 issue of *Nature*, Sir Francis Crick's close collaborator, Christof Koch, wrote: "The latest work on information processing and storage at *the single cell (neuron) level reveals previously unimagined complexity and dynamism*" (385:207, parenthetical item in orig.). His concluding remarks were: "As always, we are left with a feeling of awe for the amazing complexity found in Nature" (385:210). Amazing complexity indeed!

A case in point is British evolutionist Richard Dawkins. In the preface to his book, *The Blind Watchmaker*, he discussed the brain's incredible complexity and "apparent design," and the problem posed by both.

> The computer on which I am writing these words has an information storage capacity of about 64 kilobytes (one byte is used to hold each character of text). The computer was consciously designed and deliberately manufactured. The brain with which you are understanding my words is an array of some ten million kiloneurones. Many of these billions of nerve cells have each more than a thousand "electric wires" connecting them to other neurons. Moreover, at the molecular genetic level, every single one of more than a trillion cells in the body contains about a thousand times as much precisely coded digital information as my entire computer. *The complexity of living organisms is matched by the elegant efficiency of their apparent design. If anyone doesn't agree that this amount of complex design cries out for an explanation, I give up* (1986, p. ix).

But, after having described the brain's immense complexity and "apparent" design, and after being just about ready to "give up," he reconsidered, and wrote:

> No, on second thought I don't give up, because one of my aims in the book is to convey something of the sheer wonder of biological complexity to those whose eyes have not been opened to it. But having built up the mystery, my other main aim is to remove it again by explaining the solution (p. ix).

He then spent the remainder of the book informing the reader (using, of all things, well-designed computer programs) that the design in nature is merely "apparent," not "real."

But, the question lingers: How did natural selection produce the human brain? Basically, there are two views within the evolutionary camp. Some, like MIT's Steven Pinker, believe that the brain can be broken down into individual components, each of which evolved for specific purposes (see Morris, 2001, p. 208). To quote Pinker:

> The mind, I claim, is not a single organ but a system of organs, which we can think of as psychological faculties or mental modules…. The word "module" brings to mind detachable, snap-in components, and that is misleading. Mental modules are not likely to be visible to the naked eye as circumscribed territories on the surface of the brain, like the flank steak and the rump roast on a supermarket cow display. A mental module probably looks more like roadkill, sprawling messily over the bulges and crevasses of the brain (1997a, pp. 27,30).

Others, having been heavily influenced by a theory set forth by the late paleontologist, Stephen Jay Gould, and his close friend, population geneticist Richard Lewontin, take a different approach. These two Harvard professors advocated the view that the brain evolved for its own set of reasons, and that certain human traits then followed that had nothing whatsoever to do with natural selection. According to Gould:

> …[T]he brain got big by natural selection for a small set of reasons having to do with what is good about brains on the African savannas. But by virtue of that computational power, *the brain can do thousands of things that have nothing to do with why natural selection made it big in the first place*…. Natural selection didn't build our brains to write or to read, that's for sure, because we didn't do those things for so long (1995).

Since written language is allegedly a relatively recent evolutionary invention, then it could not be an ability that evolved during ancestral times as hominids roamed the savannas of Africa. Gould's point, then, is that the ability to read and write must be a by-product of the way the brain itself is constructed. Indeed, says Gould, it would be easy to construct quite a large list of human intellectual abilities that could not have been shaped by natural selection. Such a list might include such things as the ability to learn higher mathematics, to understand complicated games like chess, to play a violin, and perhaps even to form linguistic constructions.

In addition to reading and writing, Dr. Gould cited consciousness as a "quirky accident" that was simply a fortuitous, unexpected by-product of the brain having evolved and gotten bigger. A brief history lesson is in order.

In 1978, the Royal Society of London sponsored a symposium on the subject of "adaptation." Dr. Lewontin had been invited to attend, but he does not care much for airplanes. He asked his friend Dr. Gould to co-author the paper with him, and then to present it at the British Symposium. The paper was titled "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme" (see Gould and Lewontin, 1979), and became famous practically overnight. [Note: When Gould and Lewontin referred to the "Panglossian paradigm" in the title of their paper, they were alluding to the ideas espoused by Dr. Pangloss in Voltaire's famous novel, *Candide*. In his novel, Voltaire satirized the beliefs of the eminent German philosopher Gottfried Wilhelm von Leibniz, who maintained that this was "the best of all possible worlds." According to Dr. Pangloss, in this best of all words, everything existed for a purpose. For example, in explaining to Candide why he had contracted syphilis, Dr. Pangloss said: "It is indispensable in this best of all possible worlds. For if Columbus, when visiting the West Indies, had not caught this disease, which poisons the source of generation, which frequently even hinders generation, and is clearly opposed to the great end of Nature, we should have neither chocolate nor cochineal" (see Morris, 2001, p. 85).]

The Gould/Lewontin paper (which was published a year later in 1979) began with a description of the central dome of St. Mark's Church (*San Marco* in Italian), located in Venice. The dome is supported by two distinct arches, which meet at right angles. The arches divided the dome into four tapering, triangular spaces. As Gould and Lewontin noted, these spaces are an unavoidable by-product of mounting a dome on two rounded arches; the arches could not divine the inner surface of the dome in any other way.

Figure 3. The spandrels of San Marco. Image courtesy of Alan Humm.

These spaces are known as spandrels. [The term spandrel actually was misapplied by Gould and Lewontin. As it turns out, the correct term is "pendentive," as several authors have pointed out; see Houston, 1990, pp. 498–509; Dennett, 1995, pp. 271–275; Ruse, 2001b, p. 236).] In the spandrels, artisans painted mosaics of the four biblical evangelists (Matthew, Mark, Luke, and John) and mosaic images representing the Tigris, Euphrates, Nile, and Indus rivers. Gould and Lewontin pointed out that the spandrels were not created by the architect for any specific purpose. On the contrary, they were "non-adaptive side effects"; the spandrels *had* to be there. They were not created for the *purpose* of housing mosaics; they were decorated because there were *empty spaces* to be filled.

According to Gould and Lewontin, a similar phenomenon occurs during the course of evolution. Organisms, they suggested, possess numerous traits that were not molded by natural selection. The traits exist because they are by-products of something else (see Schwartz, 1999). This does not mean that these traits are not useful. Once a spandrel exists, natural selection supposedly was able to modify it in some way to make it useful, just as the architects of San Marco found that the triangular spaces (spandrels) could be used for decorative mosaics. Spandrels often turned out to be useful when adapted for some purpose, but, as Gould and Lewontin noted, the spandrels originally evolved for secondary purposes. They therefore could not be attributed directly to natural selection.

Three years later, Gould and Yale University paleontologist Elisabeth Vrba invented the term "exaptation" to define and illuminate the role played by spandrels. What, exactly, is an exaptation? Gould explained: "…[W]hat shall we call structures that contribute to fitness but evolved for other reasons and were later co-opted for their current role? They have no name at present, and [Elisabeth] Vrba and I suggest that they be called 'exaptations'" (1984, p. 66; for Vrba reference, see Gould and Vrba, 1982). Thus, exaptations are spandrels that organisms have adapted for some useful purpose. In a 1997 article he authored for the

New York Review of Books ("Evolution: The Pleasures of Pluralism"), Gould wrote: "Natural selection made the human brain big, but most of our mental properties and potentials may be spandrels—that is, nonadaptive side consequences of building a device with such structural complexity" (1997, 44[11]:52).

From an evolutionary viewpoint, the "extraordinary increase in the human brain size was *the fastest evolutionary transformation known*" (Ornstein, 1991, p. 35). On some levels, it might make sense that the larger the brain, the more intelligent the animal. However, we now know that brain size does not determine intelligence. The tiny mouse lemur (*Microebus murinus*) has a brain that represents three percent of its overall body weight, whereas the human brain accounts for only two percent, and yet this tiny mouse cannot talk or make complex tools. Simply put, brain size does not determine intelligence. Tattersall put it this way:

> *We know remarkably little about the actual sequence of events in human brain enlargement over time. Even less do we understand the effects of these events*…. Intuitively, from a human vantage point, it's hard to avoid the conclusion that, somehow, brain expansion is intrinsically a good thing—though perhaps the contemplation of the extreme rarity of this phenomenon in nature should make us think again…. *[A]s it turns out, the concept of a gradual increase in brain size over the eons is actually rather problematic. For a start, this idea strongly implies that every ounce of extra brain matter is equivalent in intelligence production to every other brain ounce—which is clearly not the case* (2002, pp. 67,68).

No evidence exists that demonstrates a relationship between brain size and intelligence within any given species. The human brain, for example, is known to have a range in volume from less than 1,000 to more than 2,000 cubic centimeters. In fact, some of the most intelligent people in history had small brains.

Yet, evolutionists often classify hominid fossils largely according to brain size (see the chart in Pinker, 1997a, pp. 198–199)! They assume that the human brain started out in primates as a relatively small organ, and then evolved through time to the size we now see it. Peter Wilson commented on this in his book, *Man the Promising Primate*:

> We distinguish hominid fossils from other primate remains partly by the relative size of the braincase. As we move from *Australopithecus africanus* to *Homo habilis*, *Homo erectus*, and finally *Homo sapiens*, we have a creature whose probable brain size increases from 400 cubic centimeters to 1,500 cubic centimeters. That brain is housed in a cranium that becomes more and more vaulted, loses its ridges and crests, and shows more and more evidence of a forehead and backhead (1980, p. 45).

Gould, however, concluded one of the chapters in his book, *Ever Since Darwin*, by asking:

> But *why* did such a large brain evolve in a group of small, primitive, tree-dwelling mammals, more similar to rats and shrews than to mammals conventionally judged as more advanced? And with this provocative query I end, for *we simply do not know the answer to one of the most important questions we can ask* (1977, p. 191).

Growing a bigger brain is not quite as straightforward as it first might appear. It is not simply a matter of "putting on weight" like one does with his or her body. Every neuron that is "added" must be of the right kind (excitatory or inhibitory), must possess the right neurotransmitters, and must be "interconnected" with literally thousands of other neurons. Harvard's Ernst Mayr correctly remarked: "The unique character of our brain seems to lie in the existence of many (perhaps as many as forty) different types of neurons, some perhaps specifically human" (2001, p. 252, parenthetical item in orig.).

Also, a rich supply of oxygenated blood must be present, which would entail allowing additional blood vessels to reach these new neurons. Additionally, our brains require a tremendous amount of energy. As an example, a newborn's brain consumes 60% of the energy that the baby produces (Gibbons, 1998, p. 1345), while adults devote only 20% of their cardiac output to this organ (which only accounts for two percent of our body weight—Van De Graaf and Fox, 1989, p. 438). So the question then becomes, if humans (and their brains) evolved, why would nature "select" for a larger brain that is more energy consuming? Michael Ruse realized the hurdle in "evolving" brains when he stated: "When we developed brains, they are so expensive to produce that one needs really big ones or their benefits do not outweigh their costs" (2001a, p. 70). Furthermore, the question must be asked: Where does the energy come from in the first place? It would make sense that supporting a "bigger" brain would require a higher energy consumption, yet a human's basal metabolic rate is no higher than that of a large sheep, which has a brain one-fifth as large. As Gibbons noted: "Humans are apparently getting enough energy to feed their brains without increasing their overall energy intake, so it must be coming from some other source" (1998, p. 1345). But exactly what that source is, remains to be determined.

Researchers have long known that an animal's body size plays a critical role in brain size (see Gibbons, 1998, p. 1345). Whales and elephants compensate for their large brains by an increased size in other organs that can provide energy (e.g., larger heart and lungs provide more oxygen). But humans do not follow this rule. In the context of simian primates, for example, the human brain is approximately "three times larger than the value predicted for an 'average' monkey or ape with our body size" (Jones, et al., 1999, p. 116). If evolutionists are correct, then the human brain has tripled in size since "Lucy" walked the Earth, yet our bodies have yet to even double. According to primatologist Robert D. Martin, humans "have the largest brain size relative to body size among placental mammals" (as quoted in Gibbons, p. 1345). Yet, as Mayr has admitted:

> *What is perhaps most astonishing is the fact that the human brain seems not have changed one single bit since the first appearance of Homo sapiens, some 150,000 years ago.* The cultural rise of the human species from primitive hunter-gatherer to agriculture and city civilizations took place without an appreciable increase in brain size. It seems that in an enlarged, more complex society, a bigger brain is no longer rewarded with a reproductive advantage (2001, p. 25).

One question that evolutionists admittedly have difficulty answering is why "other animals" have not similarly "evolved" larger brains. If humans were able to somehow surmount all of the physiological and energy-related obstacles standing in the way of growing larger brains, why have reptiles, birds, or fish not followed suit? Exactly how is our brain different from those of animals? Was it forced to grow larger and "rewire" as we climbed out of trees and changed our diets? Hardly! Evolutionists admit that "our brain is unusually large" and that "its internal wiring shows only subtle differences from other mammals" (Jones et al., 1999, p. 107). But if the wiring is essentially the same, and if we know of animals that have larger brains, then what accounts for the vast differences we see between human intelligence and animal intelligence?

Equally important, of course (at least from the human vantage point) is the question: What caused the tremendous increase in *human* brain size? Scientists admit that no one knows. Johanson and Edgar wrote: "*We cannot answer exactly why we evolved our large brains*" (1996, p. 80). Ornstein admitted:

> *We look at whether the human mind is, in part, an accident. Its evolution turns around a central question: Why is our brain so big?* Why have a brain capable of not only chess when there was no game, but of building guided missiles when there was no metal or chemistry or writing? For the brain (which is the most "costly" neural material in the body) ballooned up radically 2 million years ago, and the "usual suspects" for this expansion don't seem to have primary responsibility. It was not language, it was not tools, it was not bipedalism alone. *The brain seems to have increased in size before all the organized societies, cooperation, and language would have had any call for such a development.*
>
> *This is the central mystery of the mind*: It is difficult to see why we are so advanced relative to our nearest ancestors. We aren't just a slightly better chimp, and it's difficult, on reflection, to figure out why. This gigantic cortex has given us our adaptability as well as the extra capacity to adapt to the heights of the Himalayas, the Sahara Desert, the wilds of Borneo, even to central London….
>
> Life challenges alone were probably not enough to inspire the astonishing rapidity of brain growth. *There must have been another reason*…. This development occurred well before organized society or language and long before technology. It is an amazing spurt in growth in the most complicated structure in all biology (1991, pp. 8,37, parenthetical item in orig.).

But was it the brain's size alone that allowed these "nonadaptive side consequences"? Apparently not, as Johanson and Edgar went on to note.

> In absolute size, the human brain breaks no records. Elephant brains exceed ours by a factor of four, and some whale brains are even bigger…. Monkeys, apes, and humans possess the biggest brains relative to body weight of any terrestrial mammal. So, part of the answer is that the human brain is just a highly elaborated ape brain. Yet this is still something different, something unique, about the size of the human brain. Our brain is three times larger than the predicted size for a hypothetical non-human primate of average body size…. *But size isn't everything.* Our brain also differs significantly from those of apes in the proportion of various parts…. The human brain is a sponge that soaks up sensations and observations, and it is a masterful organ for storing, retrieving, and processing a wide range of detailed and complicated information…. So, *size alone does not explain our unusual mental abilities.* What counts is what's inside the package and how it is all arranged… (p. 80).

Earlier, we quoted Ian Tattersall, who ended his assessment of the brain with these words: "There's a huge amount, of course, that we do not know about how the brain works and especially about how a mass of chemical and electrical signals can give rise to such complex effects as cognition and consciousness" (1998, p. 70). We also quoted Richard Morris, who lamented:

> Scientific knowledge of the brain is woefully incomplete. *Scientists do not know how the brain acquires and stores information, how it produces feelings of pleasure and pain, or how it creates consciousness. The functioning of the human brain is a profound mystery* (2001, p. 200).

We could not have said it better ourselves. Evolutionists do not know how the brain evolved. Nor do they have much understanding about how the brain acquires and stores information, in spite of decades of intensive research. Ernst Mayr admitted: "The synapses, for instance, apparently play an important role in memory retention, but how they do so is almost entirely unknown" (2001, p. 252). Similarly, evolutionists do not know how the brain creates consciousness. Yet the leading candidate to serve as a potential evolutionary explanation for the mind (and then, ultimately, consciousness) is, perhaps somewhat conspicuously, the brain. Some (like Pinker and his colleagues) believe that the brain evolved its specific regions with a purpose (if you will pardon the pun) "in mind." Others, like Gould and his followers, believe that, to quote Ornstein, "structures that evolved for one purpose later changed their function" and gave rise to consciousness (1991, p. 33). Not much agreement here, to be sure.

But there is one place where a consensus *does* exist. Monroe Strickberger, in his textbook, *Evolution*, put it like this: "[A]lthough we do not yet know the precise relationship between the matter of the brain (neurons, synapses, and so on) and the thoughts and feelings it produces, *that such a relationship exists is no mystery*" (2000, p. 56, parenthetical item in orig.). *That* a relationship between brain, mind, and consciousness exists may be "no mystery." But *why* and *how* that relationship exists, certainly *is*!

Perhaps it is because of the mystery that surrounds the various functions and attributes of the brain that, as our knowledge of the brain has multiplied in what sometimes seems to be almost a geometric progression, it has becoming increasingly popular to "downplay" the extreme complexity of the brain itself—no doubt in the hope that the general populace will begin to think like this: "Well, if the once-impenetrable fortress of humanity that is the human brain has now been breached and explained by science, we have answered the most basic issue: evolution's major problem is solved!" Attempts to minimize the brain's amazing abilities have become rather commonplace. Consider just one example.

In an article on mind/body problems titled "The Power of Mood" that he authored for the January 20, 2003 issue of *Time* magazine, Michael D. Lemonick commented:

> *The brain, after all, is only another organ*, and it operates on the same biochemical principles as the thyroid or the spleen. What we experience as feelings, good or bad, are at the cellular level no more than a complex interaction of chemicals and electrical activity (2003a, p. 66).

In the introductory article ("Your Mind, Your Body") he wrote to accompany the feature articles in that same issue of *Time*, he suggested:

> *Mind and body, psychologists and neurologists now agree, aren't that different.* The brain is just another organ, albeit more intricate than the rest.... Scientists are also learning something else. Not only is the mind like the rest of the body, but the well-being of one is intimately intertwined with that of the other. *This makes sense because they share the same systems*—nervous, circulatory, endocrine and immune (2003b, p. 63).

Russell Stannard, in his volume, *The God Experiment: Can Science Prove the Existence of God?*, wrote:

> It is a widely held assumption that nothing goes on in the brain that is markedly different from what happens in inanimate matter. Although the processes occurring in the brain are undoubtedly more intricate because of the extreme complexity of the physical structure, *they are nevertheless all to be held accountable for—in principle—through the operation of the well-established laws of nature* (2000, p. 45).

Tufts University philosopher Daniel Dennett, in an interview on this very subject, said matter-of-factly: "The mind is somehow nothing but a physical phenomenon. *In short, the mind is the brain*..." (as quoted in Lewin, 1992, p. 157). Sherwin Nuland, in *The Wisdom of the Body*, took the same approach.

> *The mind is a man-made concept*, a way to categorize and contemplate the manifestations of certain physical and chemical actions that occur chiefly in the brain. It is a product of anatomic development and physiologic functioning. What we call the mind is an activity, made up of a totality of the innumerable constituent activities of which it is composed, brought to awareness by the brain. The brain is the chief organ of the mind, but not its only one. In a sense, every cell and molecule in the body is a part of the mind, and every organ contributes to it. *The living body and its mind are one—the mind is a property of the body* (1997, p. 349).

In *The Astonishing Hypothesis*, Francis Crick even went so far as to suggest that it soon may be possible to identify specific neurons in the brain that cause consciousness. He asserted that, eventually, all mind processes, including consciousness, will be explicable as nothing more than the firing of neurons—i.e., in terms of interactions between atoms and molecules (1994, pp. 3,259). Steven Pinker is on record as stating: "*Nothing in the mind exists except as neural activity*" (1997b). B.A. Farrel announced bluntly: "A human being is a modulator of pulse frequencies, and nothing more" (as quoted in Allan, 1989, p. 63). Or, as Jerome Elbert put it: "I DO maintain that 'mental events can be reduced to brain events'" (2000, p. 265). He then predicted:

> Science will probably succeed in describing how our consciousness arises from natural processes. It will probably explain how thinking, reasoning, emotions, motivations, and intuition function as a result of the activity of the brain, and as a result of the brain interacting with the

> rest of the body and the outside world (p. 268).

Think with us for a moment, however, about the implications of what you have just read. Beliefs have consequences! If: (a) "what we experience as feelings, good or bad, are at the cellular level no more than a complex interaction of chemicals and electrical activity"; (b) "mind and body…aren't that different"; (c) "the mind is a property of the body" and "mind is a man-made concept"; (d) "nothing in the mind exists except as neural activity," *what does all of this mean*?

Let Steven Pinker explain. He believes (as noted above) that "nothing in the mind exists except as neural activity." Would it surprise you to learn, then, that in a *New York Times* article, Pinker suggested that women who murder their newborn babies may not be either mad or evil, but simply unconsciously obeying "primeval instincts to sacrifice their children for the good of the tribe"? (see Blanchard, 2000, p. 382). In his fascinating book, *Does God Believe in Atheists?*, John Blanchard addressed Dr. Pinker's suggestion: "This is the logical outworking of materialism, BUT IF REDUCING THE BRAIN'S ACTIVITY TO ELECTRICAL IMPULSES CAN SANCTION MURDER, WHAT CAN IT CONDEMN?" (p. 382)

What indeed? Atheistic philosopher Michael Ruse admitted that if evolution is accepted as true, then "*morality is no more…than an adaptation*, and as such has the same status as such things as teeth and eyes and noses" (1995, p. 241). But if, as Ruse went on to say, "morality is a creation of the genes" (p. 290), then by what criterion, or group of criteria, do humans make moral decisions? Reichenbach and Anderson commented on this very issue when they wrote:

> Reductionism, however, threatens the very concept of the person. Where persons' actions and beliefs are ultimately explainable in terms of unpredictable neural firings and chemical transfers, those acts and beliefs are no longer the purposeful product of human choice…. *This means that reductionism is particularly disastrous for morality, not to mention our concept of personhood itself* (1995, p. 279).

And what place is there for the famed human possession, "free will"? Are we merely products of our environment? Does input truly equal output? Nancey Murphy recognized the quandary of losing our free will and reducing the brain to little more than matter.

> First, if mental effects can be reduced to brain events, and the brain events are governed by the laws of neurology (and ultimately by the laws of physics), then in what sense can we say that humans have free will? Are not their intendings and willings simply a product of blind physical forces, and thus are not their willed actions merely the product of the blind forces? (1998, p. 131).

She went on to comment:

> Second, if mental events are simply the products of neurological causes, then what sense can we make of reasons? That is, we give reasons for judgments in all area of our intellectual lives—moral, aesthetic, scientific, mathematical. It seems utter nonsense to say that these judgments are merely the result of the blind forces of nature (p. 131).

Have we no option but to do whatever our genes have programmed us to do? In other words, how can the materialist escape from the stranglehold of determinism—the idea which suggests, as its name implies, that everything we do is "determined," and that we have, in essence, no free will. This farcical idea is exactly what Cornell professor William Provine has advocated. In 1998, during "Darwin Day" at the University of Tennessee at Knoxville, he delivered the keynote lecture titled "Evolution: Free Will and Punishment and Meaning in Life." During that lecture, he displayed a slide that stated: "Finally, free will is nonexistent." It went on to note: "Free will is the worst of all cultural inventions. Belief in free will fuels our revenge-minded culture" (see Provine, 1998).

In the now-famous text of his Compton Lectures, *Objective Knowledge: An Evolutionary Approach*, British philosopher Sir Karl Popper made the point that even if determinism *were* true, it could not be argued, since any argument is itself presumably predetermined by purely physical conditions—as would be any opposing arguments. As Popper put it:

> According to determinism, any such theories—such as, say, determinism—are held because of a certain physical structure of the holder (perhaps of his brain). Accordingly, we are deceiving ourselves (and are physically so determined as to deceive ourselves) whenever we believe that there are such things as arguments or reasons which make us accept determinism. Or in other words, physical determinism is a theory which, if it is true, is not arguable, since it must explain all our reactions, including what appear to us as beliefs based on arguments, as due to *purely physical conditions*. Purely physical conditions, including our physical environment, make us say or accept whatever we say or accept… (1972, p. 223).

In their book, *The Wonder of Being Human: Our Brain and Our Mind*, Sir John Eccles and his co-author Daniel Robinson commented on the correctness of Popper's assessment—and the absurd nature—of determinism when they observed: "This is an effective *reductio ad absurdum*" [reduction to the absurd]. They then went on to state: "This stricture applies to all of the materialist theories"

(1984, p. 38; cf. also Eccles, 1992, p. 21). Indeed, it *is* absurd. And yes, it *does* apply to "all of the materialist theories."

A good illustration of this is the life, teachings, and actions of the French novelist commonly known as the Marquis de Sade (1740–1814), who gave his name to sadism, in which a person derives sexual satisfaction from inflicting pain and humiliation on others. De Sade argued that, since everything is chemically determined, whatever is, is right. The distinguished microbiologist, Lynn Margulis, and her co-author/son Dorion Sagan, discussed this very point in their book, *What is Life?*

> The high-born Frenchman Donatien Alphonse Francois de Sade (1740–1814) keenly felt the vanishing basis for morality. *If Nature was a self-perpetuating machine and no longer a purveyor of divine authority, then it did not matter what he, as the infamous marquis de Sade, did or wrote* (1995, p. 40).

Or, as Ravi Zacharias put it: "Thinking atoms discussing morality is absurd" (1990, p. 138).

In his book, *In the Blood: God, Genes and Destiny*, Steve Jones suggested that criminal behavior was determined largely by genetic make-up (1996, pp. 207–220). In discussing Jones' book, one writer, Janet Daley, insisted that if genetics is indeed ultimately responsible for "bad" traits, it also must account for "good" ones. She observed: "If we can never be truly guilty, then we can never be truly virtuous either." Daley went on to say:

> Human beings are only capable of being moral insofar as they are free to choose how they behave. If they have no power to make real choices—if their freedom to decide how to act is severely limited by forces outside their control—then it is nonsense to make any ethical judgements about them. It would be wrong, as well, to base a judicial system on the assumption that people are free to choose how they will act. The idea of putting anyone on trial for anything at all becomes absurd (1996).

In fact, attempting to locate a "basis for morality" in the blind outworkings of nature is futile. As Ruse put it: "There is no justification for morality in the ultimate sense" (as quoted in O'Hear, 1997, p. 140). In Dave Hunt's words, "There are no morals in nature. Try to find a compassionate crow or an honest eagle—or a sympathetic hurricane" (1996, p. 41). Are those who advocate the idea that "nothing in the mind exists except as neural activity," willing to accept the consequences of their belief?

Growing Neurons

Every human begins life as a single fertilized cell. When the male and female gametes join to form the zygote that eventually will grow into the fetus, it is at that very moment that the formation of a new body begins. It is the result of a *viable* male gamete joined sexually with a *viable* female gamete, which has formed a zygote that will move through a variety of important stages.

The first step in the process—which eventually will result in the highly differentiated tissues and organs that compose the body of the neonatal child—is the initial mitotic cleavage of that primal cell, the zygote. At this point, the genetic material doubles, matching copies of the chromosomes move to opposite poles, and the cell cleaves into two daughter cells. Shortly afterwards, each of these cells divides again, forming the embryo. [In humans and animals, the term "embryo" applies to any stage after cleavage but before birth (see Rudin, 1997, p. 125).]

As the cells of the embryo continue to divide, they form a cluster of cells. These divisions are accompanied by additional changes that produce a hollow, fluid-filled cavity inside the ball, which now is a one-layer-thick grouping of cells known as a blastula. Early on the second day after fertilization, the embryo undergoes a process known as gastrulation, in which the single-layer blastula turns into a three-layered gastrula consisting of ectoderm, mesoderm, and endoderm, surrounding a cavity known as the archenteron. Each of these layers will give rise to very specific structures. For example, the ectoderm will form the outermost layer of the skin and other structures, including the sense organs, parts of the skeleton, and the nervous system. The mesoderm will form tissues associated with support, movement, transport, reproduction, and excretion (i.e., muscle, bone, cartilage, blood, heart, blood vessels, gonads, and kidneys). The endoderm will produce structures associated with breathing and digestion (including the lungs, liver, pancreas, and other digestive glands) [see Wallace, 1975, p. 187].

Within 72 hours after fertilization, the embryo will have divided a total of four times, and will consist of sixteen cells. Each cell will divide before it reaches the size of the cell that produced it; hence, the cells will become progressively smaller with each division. About twenty-two days after fertilization, the brain begins its embryonic development with the formation of the neural tube. About twenty-two days after fertilization, this hollow region begins to develop (Moore and Persaud, 1993, p. 385). The cells located within this hollow tube eventually will multiply, migrate, and become the brain and spinal cord. Once the brain is fully developed, three distinct regions can be identified: forebrain, midbrain, and hindbrain. Structures such as the cerebrum, thalamus, and hypothalamus are located within the forebrain. The midbrain is made up of the superior and inferior colliculi and the cerebral peduncles.

The hindbrain is composed primarily of the cerebellum, pons, and medulla oblongata. Literally millions of neurons are housed in each of these structures, from which radiate communicating axons to other regions to allow the entire brain the unique ability to communicate with itself (thanks to a small structure known as the corpus callosum, the left and right hemispheres of the brain possess the ability to communicate with one another).

While regions and structures within the brain have been dissected exhaustively and mapped out considerably, what can those neurological pathways tell us about *function*? Can we look at the exterior surface of the brain and determine the intellectual capabilities of an individual? Evolutionists must think so; look at the "dumb," hairy, club-carrying creatures that they portray as our ancestors. These evolutionists would like to be able to look at a fossilized skull, or even an endocranial cast, and determine what "prehuman" brains were capable of doing in the distant past. However, as Terrence Deacon admitted: "Surface morphology and underlying brain functions are not directly correlated in most cases." He went on to say, therefore, that "we must be careful when drawing functional interpretations from endocasts" (1999, p. 116).

Many materialists are adamant that the human brain has evolved through a layering process—with each "higher species" adding a new layer. Thus, as Ian Tattersall remarked in his book, *The Monkey in the Mirror*, "as far as is known, not much if anything has been 'lost' in the course of human brain evolution. Our skulls still house the descendants of structures that eons ago governed the behavior of ancient fish, of primitive mammals, and of early primates" (2002, p. 72).

According to this "triune" brain theory, the brain evolved in three stages: the reptilian brain, followed by the paloecortex, and then the neocortex. Thus, the innermost portion of our brain is said to be the reptilian brain—since evolutionists believe it to be the oldest and most primitive portion. It therefore would include structures such as the pons and medulla, and would handle many of the autonomic tasks needed for survival (e.g., breathing). According to evolutionists, this portion of our brain has remained basically unchanged by evolution, and we therefore share it with all animals that possess a backbone. The next layer is said to be the mammalian brain or the paloecortex, which is alleged to have arisen when mammals evolved from reptiles. It would include structures such as the amygdale and hypothalamus. Then, on top of this, evolutionists claim we have added another layer—the neocortex or human brain, which allows humans to handle logic. This new layer is said to "envelop" the other layers in gray matter, and amounts to 85% of the human brain mass. In his biography of Carl Sagan, William Poundstone observed that even Sagan propagated this myth. He noted: "His extended discussion of the triune brain implicitly endorses it as (at least) an interesting idea. That was what some neurologists found objectionable. 'It's dismaying for people like us,' complained Boyd Campbell of Walter Reed Army Medical Center, 'to see Sagan come and swallow all that stuff, write *The Dragon of Eden*, and get a Pulitzer Prize for it'" (1999, p. 254, parenthetical item in orig.). Dismaying indeed. As James Trefil pointed out, this way of thinking is "completely wrong:"

> Unfortunately, this understanding of the brain has led to a rather oversimplified notion of brain function in some parts of the popular press—in which the brain is seen as a set of successive overlays. At the bottom (the brain stem and diencephalons) is a kind of primitive, reptilian brain shared with all animals, with progressive overlying refinements added until we get to the cerebral cortex, which reflects the highest brain functions. In its extreme form, this view presents the idea of the brain as a kind of sedimentary structure, like the stratifications of the Grand Canyon. Each new layer adds a new function, while underlying layers stay more or less the same. This is another of those concepts that the French call a *fausse idée claire*. *It's simple, elegant, clear, and completely wrong* (1997, p. 75, parenthetical item in orig.).

And yet the textbooks still show a progression through fish, amphibians, reptiles, and mammals. This theory of how the brain evolved in layers has suffered the same fate as that of a soufflé when the oven door is slammed—it has fallen flat.

The Brain Versus a Computer

Walk into any office, hospital, or even grocery store, and you will find yourself in the presence of computers. Computers have become an integral part of everyday life—they even played a part in getting this article to you. But most intelligent individuals will agree that computers did not arrive on this planet by time, natural law, and chance. Computers are designed and manufactured, and they constantly are being improved to increase their speed and capabilities. But the computer fails miserably in comparison to the human brain. When is the last time a computer grabbed a pencil to compose a sonnet, a short story, or a poem? How many computers are capable of taking a piece of wood, fashioning it in the shape of a violin, and then sitting down to play Barber's *Adagio for Strings*. And yet evolutionists insist that the human brain—an object far more complex, and with far more capabilities than a com-

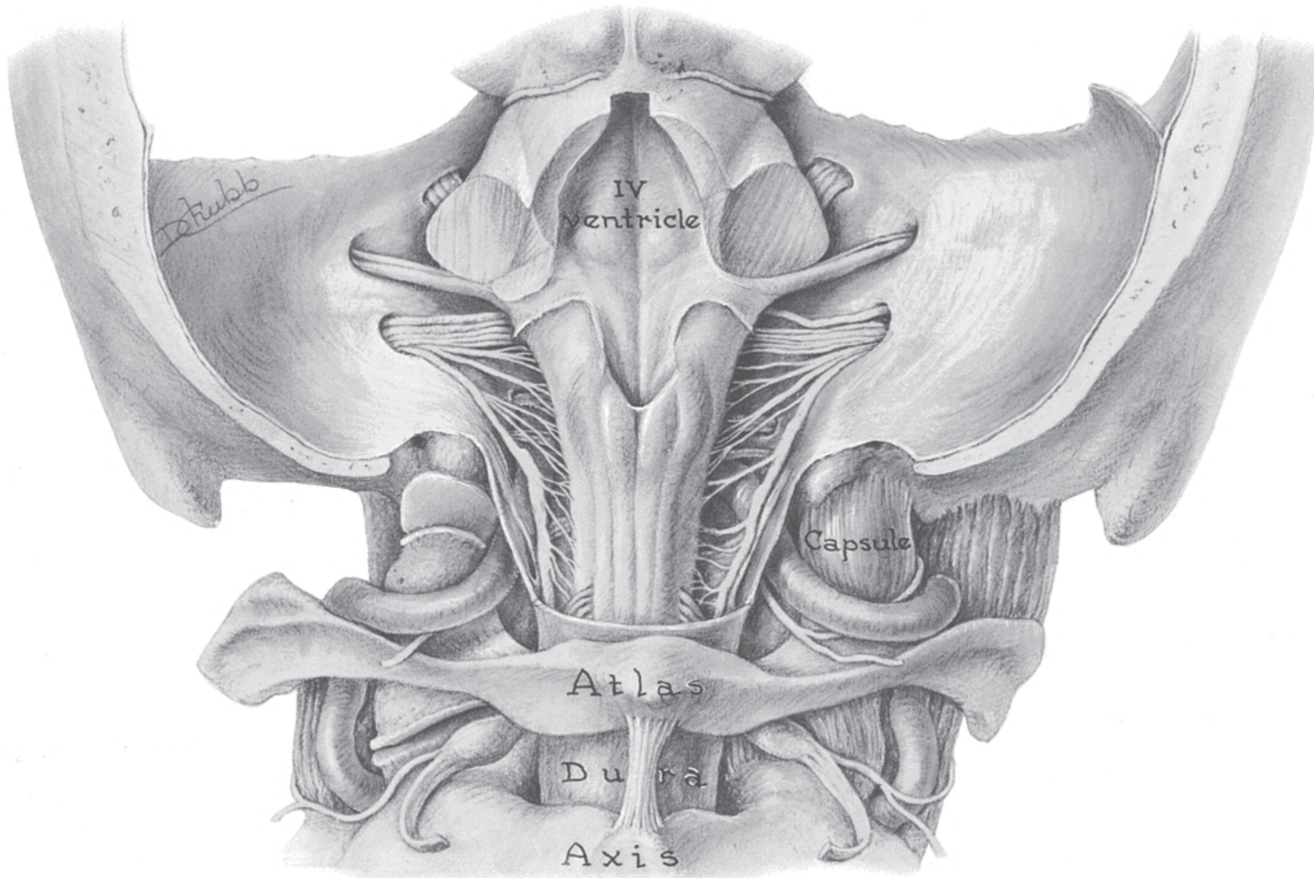


Figure 4: Posterior view of cranial nerves exiting through various foraminae. LifeART image copyright (2003) Lippincott Williams & Wilkins. All rights reserved.

puter—"evolved" in order to provide us with memories, emotions, the ability to reason, and the ability to talk. Other individuals like to "simplify" the human brain down to the level of modern-day computers. They rationalize that, like computers, the human brain can rapidly process, store, and recall bits of information. Also, some scientific investigators compare neuronal connections to the wiring found within computers. However, the inner workings of a computer always can be reduced to one thing—electronics. The basic function of computers always involves the movement of an electrical charge in a semiconductor. The brain, on the other hand, operates purely on electrochemical reactions. The transmission of nerve signals involves chemicals known as neurotransmitters. Once a neuron is caused to fire, it moves these neurotransmitters into the tiny space between itself and the neighboring neurons (at the synapse), in order to stimulate them.

Additionally we know that the human brain can reason and think—i.e., we possess self-awareness. Computers have the ability to carry out multiple tasks, and they can even carry out complex processes—but not without the programming and instruction they receive from humans. Additionally, computers do not possess the ability to reason. When asked to translate into Russian the sentence—"the spirit is willing but the flesh is weak"—one computer came up with words that meant "the vodka is fine, but the meat is tasteless" (Allan, 1989, p. 68)—which is a far cry from the original meaning. Nor are computers self-aware. In comparing a modern-day computer to the awesome power of the human brain, astrophysicist Robert Jastrow admitted: "The machine would be a prodigious artificial intelligence, but it would be only a clumsy imitation of the human brain" (1981, p. 143).

It has been estimated that if we learned something new every second of our lives, it would take three million years to exhaust the capacity of the human brain (Weiss, 1990, p. 103). Plainly put, the brain is not just an advanced computer. All those convolutions and neuronal networks are

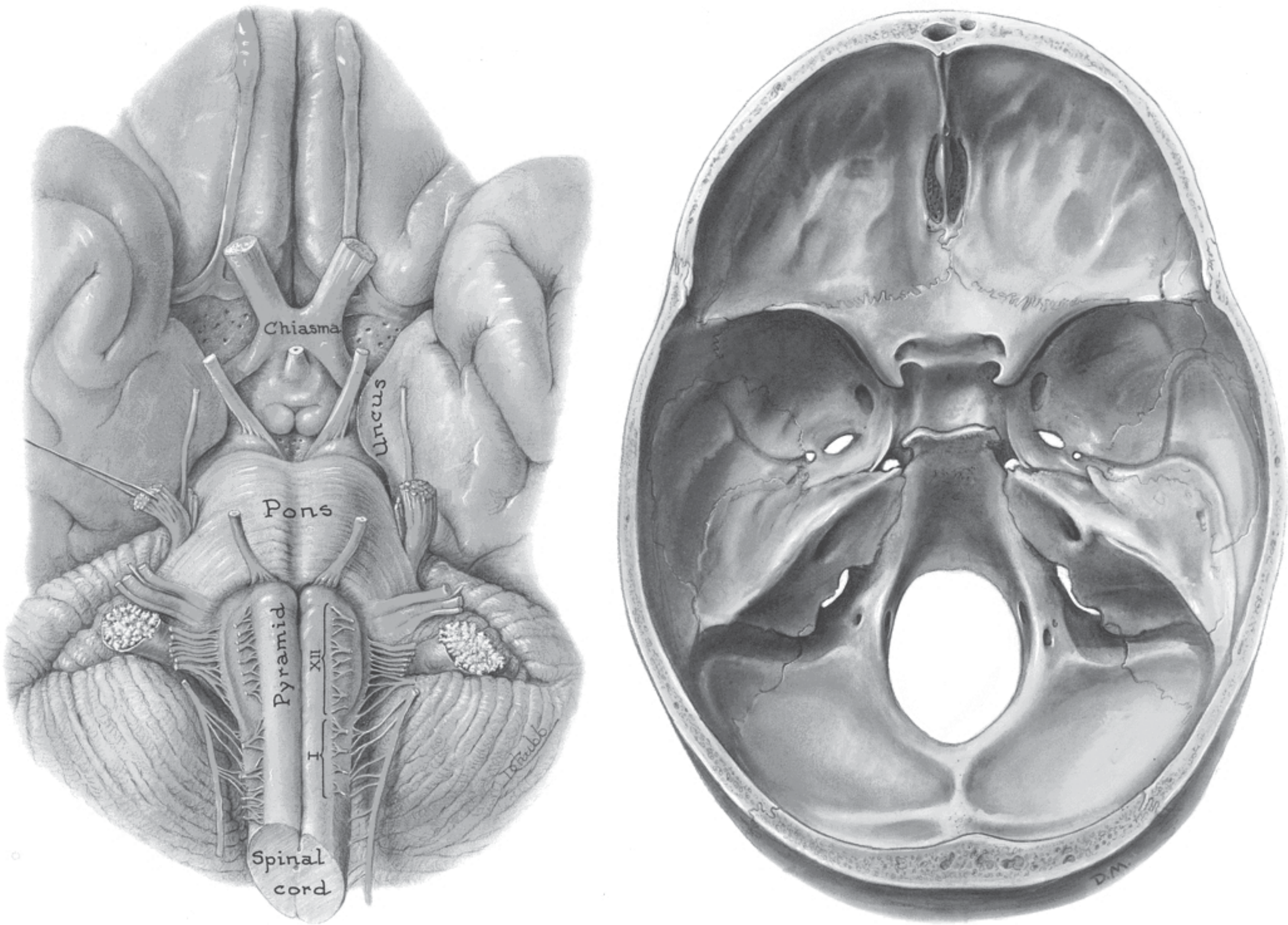


Figure 5: Superficial view of cranial nerves and the interior base of the skull demonstrating the various formina. LifeART image copyright (2003) Lippincott Williams & Wilkins. All rights reserved.

the result of an intelligent Creator. If we are able to rationalize that a computer found in the middle of the Sahara Desert did not just "happen" by random chance, then why are so many willing to believe that a far more complex human brain occurred in such a fashion?

Twelve Cranial Nerves

We all have experienced the unpleasantness of sitting in front of a doctor with our tongue outstretched, saying "Ah," while the physician gags us with a wooden tongue depressor. Interestingly, this dreadful routine, which is performed on a daily basis in clinics and doctors' offices around the world, has a purpose. By having you open your mouth, protrude your tongue, vocalize the word "Ah," and confirm an intact gag reflex, doctors are able to not only look at the back of your throat, but also to assess many of your cranial nerves. Every human is born with twelve pairs of these special nerves, each performing a different function, and each going to a different location within the body.

Unlike nerves that originate from your spinal cord, cranial nerves drop directly out of the brain and then proceed to their target organs. Recall, however, that your brain is completely encased in bone—your skull. So, exactly how do these twelve cranial nerves get to where they need to go? Quite simply, they travel through well-placed foramena or "holes." Each pair of nerves has a specific "hole" through which it descends in order to reach a target such as the eye (optic nerve) or the heart (vagus nerve). If you were to take a skull and pour water where the brain normally would be sitting, you soon would notice water coming out of several different holes. These holes allow the cranial nerves to travel from the brain to their target organs. But ask yourself this question: How did the holes get there? Did they evolve, too? Did these cranial nerves simply "evolve" out of the brain and then wait around until holes evolved in the skull? And let us not make a small issue out of these tiny holes: the brain is constantly bathed in cerebral spinal fluid, a fluid that you do not want "leaking" out of the cranium. The formation of the holes and the dural layers that prevent this "leakage" definitely point to an intelligent Creator.

Conclusion

Neuroscientists already have gone, to use the Star Trek mantra, "where no one has gone before." Scientists now possess the ability to record the neurological activity from a single neuron. Using ultra-fine microelectrodes, we can proceed down through the cortex of the brain and patch-clamp neurons in order to determine exactly what ionic changes are occurring across the neuronal membranes. We have the ability to use tracer dyes to detect where a nerve sends a specific signal. Entire maps have been made that demonstrate the neurological pathways of specific types of neurons. We have tremendous hope that new areas of research, such as neuronal stem cells and nerve growth factors, will relieve or cure some of the neurological diseases that exist today. But science is far from understanding and comprehending the complexity of the brain. In fact, the brain remains a puzzle with far more pieces missing than have been properly set in place to complete the puzzle.

Upon hearing of the death of a child, a mother will begin to weep uncontrollably. What actually caused the tears to flow down her face? Where does she hold those treasured memories of her offspring? Some scientists would have us believe that those tears are merely a product of organic evolution, and that through time, humans "naturally selected" for them. But why? Man can reason, laugh, cry, and even worship. Why would we selectively want to cry at the loss of a loved one? Or why would our fleshly "brain" go to great lengths to worship and praise something it has never seen—unless we are more than mere matter? Evolutionist Steven Pinker wrestled with this point in his book, *How the Mind Works*.

> How does religion fit into a mind that one might have thought was designed to reject the palpably not true? The common answer—that people take comfort in the thought of a benevolent Shepherd, a universal plan, or an afterlife—is unsatisfying, because it only raises the question of why a mind would evolve to find comfort in beliefs it can plainly see are false. A freezing person finds no comfort in believing he is warm; a person face-to-face with a lion is not put at ease by the conviction that it is a rabbit (1997a, pp. 554–555).

The precision and complexity of our brain, and the manner in which it is able to interact with our mind, clearly point to an Almighty Creator. How can we look at something as marvelous as the human brain—something that we have yet to unravel all the mysteries of—and suggest that it is the end product of a cosmological accident? God formed man with intelligence literally from the first day of creation. How sad is it that man is now using this God-given intelligence to eradicate any mention of a Divine Creator? Writing in the *Bulletin of Atomic Scientists*, professor Roger Sperry, a psychologist at the California Institute of Technology, observed:

> Before science, man used to think himself a free agent possessing free will. Science gives us, instead, causal determinism wherein every act is seen to follow inevitably from preceding patterns of brain excitation. Where we used to see purpose and meaning in human behavior, science now shows us a complex bio-physical machine composed entirely of material elements, all of which obey inexorably the universal laws of physics and chemistry.… I find that my own conceptual working model of the brain leads to inferences that are in direct disagreement with many of the foregoing; especially I must take issue with that whole general materialistic-reductionist conception of human nature and mind that seems to emerge from the currently prevailing objective analytic approach in the brain-behaviour sciences. When we are led to favour the implications of modern materialism in opposition to older, more idealistic values in these and related matters, *I suspect that science may have sold society and itself a somewhat questionable bill of goods* (1966, pp. 2–3)

We suspect so, too.

References

Allan, John. 1989. *The human difference*. Lion, Oxford, England.

Asimov, Isaac. 1970, In the game of energy and thermodynamics you can't even break even. *Smithsonian Institute Journal*, pp. 4–10, June.

Bartelmez, George W. 1926. Human structure and development. In Newman, H.H. (editor), *The nature and the world of man*, pp. 440–470. Garden City Publishing, Garden City, NY.

Blanchard, John. 2000. *Does God believe in atheists?* Evangelical Press, Auburn, MA.

Breasted, James Henry 1930. *The Edwin Smith surgical papyrus*. University of Chicago Press, Chicago, IL.

Cardoso, Silvia H. (1997–1998), "What is mind?," *Brain & mind*, [On-line], URL: http://www.epub.org.br/cm/n04/editori4_i.htm, No. 4, December (1997)–February (1998).

Crick, Francis. 1994. *The astonishing hypothesis: The scientific search for the soul*. Simon & Schuster, New York.

Daley, Janet. 1996. Interview in *Daily Telegraph* (London), May 1.

Davies, Paul. 1992. The mind of God. *Omni* 14[5]:4.

Dawkins, Richard. 1986. *The blind watchmaker*. W.W. Norton, New York.

Deacon, Terrence W. 1999. Impressions of ancestral brains. In Jones, Steve, Robert Martin, and David Pilbeam (editors), *Cambridge encyclopedia of human evolution*. Cambridge University Press, New York.

Dennett, Daniel C. 1991. *Consciousness explained*. Little Brown, Boston, MA.

———. (1995), *Darwin's dangerous idea*. Simon & Schuster, New York.

Eccles, John C. 1992. *The human psyche*. Routledge, London.

Eccles, John C. and Daniel N. Robinson. 1984. *The wonder of being human: our brain and our mind*. The Free Press, New York.

Elbert, Jerome W. 2000. *Are souls real?* Prometheus, Amherst, NY.

Fincher, Jack. 1984. *The human body—the brain: mystery of matter and mind*. (editor), Pinchot, Roy B. Torstar Books, New York.

Gibbons, Ann. 1998. Solving the brain's energy crisis. *Science* 280:1345–1347.

Gould, Stephen Jay. 1977. *Ever since Darwin*. W.W. Norton, New York.

———. 1984. Challenges to Neo-darwinism and their meaning for a revised view of human consciousness. *The Tanner lectures on human values*, [On-line] URL: http://www.tannerlectures.utah.edu/lectures/gould85.pdf. [NOTE: Dr. Gould presented these lectures on April 30 and May 1, 1984, at Clare Hall, Cambridge University.]

———. 1995. The pattern of life's history. [On-line] URL: http://www.edge.org/3rd_culture/gould/gould_p3.html. This essay was the second chapter in *The third culture*, (editor) Brockman, John. Simon & Schuster, New York.

———. 1997. Evolution: The pleasures of pluralism. *New York review of books* 44[11]:47–52.

Gould, Stephen Jay and Richard C. Lewontin. 1979. The spandrels of San Marco and the panglossian paradigm: a critique of the adaptationist programme. *Proceedings of the Royal Society of London* Series B 205:581–598.

Gould, Stephen Jay and Elisabeth S. Vrba (1982), Exaptation—a missing term in the science of form. *Paleobiology* 8[1]:4–15.

Houston, Alasdair. 1990. Matching, maximizing and melioration as alternative descriptions of behaviour. *From animals to animats*. (editors), Meyer, J.A. and S. Wilson. MIT Press, Cambridge, MA, pp. 498–509.

Hunt, Dave. 1996. *In defense of the faith*. Harvest House, Eugene, OR.

Jastrow, Robert. 1981. *The enchanted loom: mind in the universe*. Simon & Schuster, New York.

Johanson, Donald C. and Blake Edgar. 1996. *From Lucy to language*. Nevraumont, New York.

Jones, Steve. 1996. *In the blood: God, genes, and destiny*. Harper Collins, London.

Jones, Steve, Robert Martin, and David Pilbeam, (editors) 1999. *Cambridge encyclopedia of human evolution*. Cambridge University Press, New York.

Kandel, Eric R. 1991. Nerve cells and behavior. In Kandel, Eric R., James H. Schwartz, and Thomas M. Jessell (editors), *Principles of neural science*. Elsevier, New York.

Koch, Christof. 1997. Computation and the single neuron. *Nature* 385:207–210.

Lemonick, Michael D. 2003a. The power of mood. *Time* 161[3]:64–69.

———. 2003b. Your mind, your body. *Time* 161[3]:63.

Lewin, Roger. 1992. *Complexity: life at the edge of chaos*. Macmillan, New York.

Margulis, Lynn and Dorion Sagan. 1995. *What is Life?* University of California, Berkeley, CA.

Margulis, Lynn and Dorion Sagan. 1997. *Slanted truths: essays on Gaia, symbiosis, and evolution*. Springer-Verlag, New York.

Mayr, Ernst. 2001. *What evolution is*. Basic Books, New York.

Moore, Keith L. and T.V.N. Persaud. 1993. *The developing human*. W.B. Saunders, Philadelphia, PA.

Morris, Richard. 2001. *The Evolutionists: the struggle for Darwin's soul*. W.H. Freeman, New York.

Murphy, Nancey. 1998. Nonreductive physicalism: philosophical issues. In Brown, Warren S., Nancey Murphy, and H. N. Malony (editors), *Whatever happened to the soul?: scientific and theological portraits of human nature*. Fortress Press, Minneapolis, MN. pp. 127–148.

Nuland, Sherwin B. 1997. *The wisdom of the body*. Knopf, New York.

O'Hear, Anthony. 1997. *Beyond evolution: human nature and the limits of evolutionary explanation*. Oxford University Press, New York.

Ornstein, Robert. 1991. *The evolution of consciousness*. Prentice Hall Press, New York.

Ornstein, Robert and Richard F. Thompson. 1984. *The amazing brain*. Houghton Mifflin, Boston, MA.

Pinker, Steven. 1997a. *How the mind works*. W.W. Norton, New York.

———. 1997b. "Interview," *Sunday Telegraph*. London.

Popper, Karl R. 1972. *Objective knowledge: an evolutionary approach*. Oxford University Press, Oxford, England.

Poundstone, William. 1999. *Carl Sagan: a life in the cosmos*. Henry Holt, New York.

Provine, William. 1998. Evolution: free will and punishment and meaning in life. [On-line] URL: http://fp.bio.utk.edu/darwin/1998/slides_view/default.html.

Reichenbach, Bruce and V. Elving Anderson. 1995. *On behalf of God*. Eerdmans, Grand Rapids, MI.

Rudin, Norah. 1997. *Dictionary of modern biology*. Barrons, Hauppauge, NY.

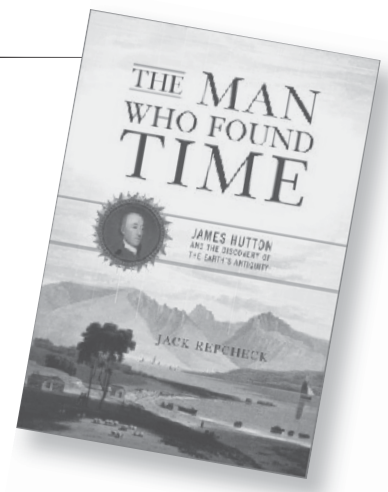
Ruse, Michael. 1995. *Evolutionary naturalism*. Routledge,

London.
———. 2001a. *Can a Darwinian be a Christian?* Cambridge University Press, New York.
———. 2001b. *The evolution wars*. Rutgers University Press, New Brunswick, NJ.
Schwartz, James. 1999. Oh my Darwin! Who's the fittest evolutionary thinker of them all? [On-line] URL: http://www.arn.org/docs2/news/ohmydarwin1199.htm.
Sperry, Roger W. 1966. Mind, brain, and humanist values. *Bulletin of the atomic scientists*. September.
Stannard, Russell. 2000. *The God experiment: can science prove the existence of God?* Paulist Press, Mahway, NJ.
Strickberger, Monroe W. 2000. *Evolution*. Jones and Bartlett, Boston, MA.
Tattersall, Ian. 1998. *Becoming human*. Harcourt Brace, San Diego, CA.
———. 2002. *The Monkey in the mirror: essays on the science of what makes us human*. Harcourt, New York.
Trefil, James. 1996. *101 Things you don't know about science and no one else does either*. Houghton Mifflin, Boston, MA.
———. 1997. *Are we unique? A scientist explores the unparalleled intelligence of the human mind*. John Wiley & Sons, New York.
Van De Graaf, M. Kent and Stuart Ira Fox. 1989. *Concepts of human anatomy and physiology*. William C. Brown, Dubuque, IA.
Wallace, Robert A. 1975. *Biology: the world of life*. Goodyear, Pacific Palisades, CA.
Weiss, Joseph. 1990. Unconscious mental functioning. *Scientific American* 262[3]:103–109.
Wilson, Edward O. 1998. *Consilience*. Knopf, New York.
Wilson, Peter J. 1980. *Man, the promising primate*. Yale University Press, New Haven, CT.
Wysong, R.L. 1976. *The creation-evolution controversy*. Inquiry Press, Midland, MI.
Zacharias, Ravi. 1990. *A shattered visage*. Baker, Grand Rapids, MI.

[Authors' Note: This article is an abbreviated discussion of this topic. A more complete treatment may be found in: Harrub, Brad and Bert Thompson. 2003. *The truth about human origins*. Apologetics Press, Montgomery, AL.]

Book Review

The Man Who Found Time by Jack Repcheck
Perseus Publishing, Cambridge, MA. 2003. $26.00



This is the story of Scottish James Hutton (1726–1797) who along with Charles Lyell (1797–1875) and Charles Darwin (1809–1882) helped overthrow in the minds of many the belief in a biblically-based, young Earth creation. Repcheck's thorough review of the historical aspects of the controversy is well worth reading. He shows how gradually through time bits and pieces of the Creation story were cast aside. The reasons were manifold. Some were clearly due to faulty theology of the Church at the time – the Earth is the center of the universe, hence all the heavenly bodies revolve around it, the Genesis "kinds" are the same as the modern-day biological classification of "species," etc. On the other hand, Hutton's idea of an ancient Earth with "no vestige of a beginning—no prospect of an end" was squarely founded upon his personal observations of slow erosion rates. This idea begot the huge assumption of slow geologic rates throughout the entire Earth's history. Divine intervention was not allowed. Hence, it was impossible to conceive of the Earth as being young, in spite of it being so pictured in biblical genealogies.

While more modern geology thought admits that catastrophes did, in fact, occur during geologic history, the over-all belief in an ancient Earth still prevails. Indeed, with the discovery of radioisotopes about a hundred years after Hutton's death, the scientific community is confident that Hutton's over-all idea of an ancient Earth is sound. Obviously, this is the reason for young earth creationists to continue searching for possible ways in which radioactive decay rates may have been much higher in the geologic past, thus giving misleading, ancient dates based upon the assumption of uniform decay rates.

Robert Gentet
305 Cloudmont Dr., San Antonio, TX 78239