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THE HUMAN NERVOUS SYSTEM: EVIDENCE OF INTELLIGENT DESIGN [PART II]

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[EDITORS' NOTE: Part I of this two-part series appeared in the August issue. Part II follows below, and continues, without introductory comments, where the first article ends.]

SOMATIC NERVOUS SYSTEM

The somatic nervous system innervates skeletal muscles and regulates activities that are under conscious control. Movements such as lifting the arms, bending the fingers, or even chewing food are included in this system. In the 2004 annual "Somatics" issue of *AHP* [Association for Humanistic Psychology] *Perspective*, Charles Badenhop suggested that humans are the proud owners of four brains—each brain evolving and functioning differently from the previous one. He deemed the first brain to be the somatic/enteric nervous system brain. He noted: "This brain came first in evolution and existed in very early organisms hundreds of millions of years ago" (2004, p. 13). Does Badenhop give any explanation of how or why the somatic nervous system evolved? No! He just "matter-of-factly" declares it to be true, and proceeds with his four-brain theory. But Badenhop is not alone in his lack of details regarding the evolution of the somatic nervous system.

A quick search of the National Library of Medicine reveals a deafening silence with respect to the mechanics of the somatic nervous system. Medem, one of the premier online physician/patient communication networks, suggested:

> The human nervous system has evolved into an extremely complex network of specialized fibers, capable of a broad range of function.... During its evolution, the nervous system developed three main structural levels, each capable of performing different functions.... The two major divisions of the efferent nervous system are the somatic nervous system and the autonomic nervous system which controls the activities of the myocardium and the vascular smooth muscles (see "Overview of...," n.d.).

Again, scientists recognize the existence and complexity of the somatic nervous system, but they offer no indication as to where it actually came from. Even Richard Dawkins, the famous atheist currently leading the charge for evolution theory, remains eerily quiet as to the origin and alleged evolutionary steps which led to the somatic nervous system. Evolutionists need to be reminded that anatomical descriptions and physiological information are not the equivalent of evolutionary origins. It is one thing to acknowledge and describe a particular system. It is something entirely different to demonstrate how that system came into existence from non-living material.

One primary difference between the somatic and the autonomic nervous systems is that the cell bodies (where the nucleus is located) of somatic motor neurons are located **within** the central nervous system. Additionally, the somatic motor nervous system is monosynaptic—that is, it uses only a single neuron to go from the spinal cord or brain to the effectors (Kandel, et al., 1991, p. 762). On the other hand, the autonomic system uses two neurons to communicate nerve signals. Another major difference between somatic and autonomic nerves is the mechanism that inhibits or blocks motor output. Somatic motor neurons are considered to be excitatory, whereas autonomic nerves are primarily inhibitory. Yet, these two systems work **together** to produce desired results. As Kandel and colleagues, observed:

> Thus, relaxation of a skeletal muscle is achieved not by inhibiting the muscle directly but by inhibiting the motor neurons in the spinal cord that excite the muscle. In contrast, autonomic targets typically receive direct inhibitory inputs. The ability of the autonomic nervous system to excite and inhibit targets directly, combined with the anatomical arrangement of effector neurons in the interconnected autonomic ganglia, permits the system to respond to environmental demands in a concerted fashion (1991, p. 763).

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Table 1

Target Organ	Sympathetic	Parasympathetic
Heart	Increases heart rate	Decreases heart rate
Iris of the Eye	Dilates pupil	Constricts pupil
Lungs	Bronchodilator	Bronchoconstrictor
Salivary Glands	Inhibits secretion	Stimulates secretion
Digestive Tract	Inhibits activity	Stimulates activity

Nerves responding in a "concerted fashion" do not sound like a product that arose out of some lifeless primordial soup.

AUTONOMIC NERVOUS SYSTEM

The autonomic nervous system innervates primarily involuntary structures such as smooth muscle lining the vessels and digestive system, as well as organs and glands. All of the motor neurons within the autonomic system are located **outside** of the central nervous system. The autonomic nervous system is disynaptic, with one synapse taking place in a peripheral autonomic ganglion, and the other taking place at the target organ. The autonomic system is generally divided into two parts—the sympathetic and parasympathetic nervous systems. [NOTE: Some texts add a third division—the enteric nervous system. This system is a meshwork of neurons that innervate the gastrointestinal tract, pancreas, and gall bladder, and is routinely placed into the other two designations.] **These two divisions of the autonomic nervous system have their cell bodies in totally different regions; yet, both divisions innervate primarily the same target organs, producing antagonistic effects in order to maintain homeostasis.** For instance, one increases the heart rate, while the other decreases it (see Table 1 above). The absence of one of these systems would be equivalent to owning an automobile with a gas pedal but no brake pedal—or a brake pedal but no gas pedal. This antagonistic action again brings to mind the previous phrase that characterizes a system as responding in a "concerted fashion." Was this by chance or design? Compared to the Design Theory, the premise of Neo-Darwinian "chance" is feeble in explaining this complex action.

Again, the organization of these two separate systems must not be overlooked. Consider the following details:

Sympathetic Division of the Autonomic Nervous System

The nerve cells that compose this division help prepare the body for "fight or flight" situations (see Table 1). For instance, should you unexpectedly encounter a grizzly bear, you would not be worried about digesting your lunch or taking a nap. At that moment in time, you would want all of your available energy and resources to be diverted to your legs, heart, lungs, etc. in an effort to help you elude the bear. The sympathetic nerves are responsible for that coordinated action. These nerves originate in the lateral horn of spinal cord segments T1-L2 (the first thoracic vertebra down to the second lumbar vertebra). Most of these nerves synapse in ganglia far away from their target organ, and thus have long post-ganglionic fibers which travel to the target organ. The ability to "fight or flight" is important, but once the threat is gone the body must be able to return to normal. Thus, the parasympathetic division is also a vital component.

Parasympathetic Division of the Autonomic Nervous System

The easiest way to remember the function of the parasympathetic division is by the phrase "rest and digest." These nerve cells automatically bring the body back to its normal state. Whereas the sympathetic nerves come primarily from the middle of the spinal cord, the parasympathetic nerves originate from the brain and the lateral horn of lower spinal cord segments, S2-S4 (the second sacral vertebra down to the fourth). Unlike the sympathetic division, the parasympathetic nerves have relatively short postganglionic fibers, because the ganglia in which they synapse are usually in or very close to the target organs. Also unlike the sympathetic nerves, these nerves do not innervate the skin, but rather the head and viscera in the body trunk. Both of these systems, working in conjunction, are necessary in the human body.

TYPES OF NEURONS

All of this activity, whether autonomic or somatic, is carried out by individual nerve cells. Discussing the complexity of the cell, Michael Behe observed: "The 'simplest' self-sufficient, replicating cell has the capacity to produce thousands of different proteins and other molecules, at different times and under variable conditions" (1996, p. 46). But consider that the nervous system, unlike organs such as the liver or heart, also includes specialized nerve receptor cells—such as those in the eye, nose, tongue, or skin—which are responsible for converting environmental stimuli into nerve signals that reach the brain where they are then acted on. The human body contains the following nerve receptor cells:

1. Mechanoreceptors—detect touch, sound, motion, and arterial blood pressure
2. Thermoreceptors—detect temperature
3. Nociceptors—detect pain and tissue injury
4. Electromagnetic receptors—detect light
5. Chemoreceptors—detect arterial oxygen, blood carbon dioxide, flavor, odor, blood glucose, amino acids, and fatty acids

The complexity of these specialized cells can only be appreciated when one considers the spectrum of functions that must be carried out. Sensory information, memory, and learning are all carried out within the nervous system. And yet, this complex arrangement of nerve cells allows for the simultaneous integration of thousands

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of nervous signals. For instance, while sitting in a nice restaurant, the human nervous system can simultaneously detect new odors, taste the main entrée, hear and carry-out a conversation with someone at the same table, sense whether the temperature is too warm or cold, move the fork to acquire another bite of food—all the while neurons within the body are working hard to maintain homeostasis.

Most cells of the body give some indication of their overall function (see Kuffler and Nicholls, 1976). For instance, liver cells or muscle cells indicate their own function. But this is not true for the nervous system. As Joseph LeDoux remarked, cells of the brain "participate in myriad activities, from seeing and hearing to thinking and feeling, from awareness of self to the incomprehension of infinity" (2002, p. 39). In order to carry out these Herculean tasks, the human brain has been estimated to contain **10 trillion nerve cells** (see "Neurons Release...," 2001) and possess **240 trillion synapses** in the cerebral cortex (Koch, 1999, p. 87). Among these neurons there are believed to be at least **10,000 different types** of neurons that share many common features (Kandel, et al., 1991, p. 18). Consider the mathematical probability of this many precise connections resulting from pure happenstance. Are we to believe that each of these different types of neurons is a product of evolution? On the contrary, each of the 240 trillion synapses occurs at a **precise** location between **specific** neurons—complex design pointing to a Designer.

Additionally, evolutionists must explain from what cell type neurons originally evolved. There are no cells that one could point to that would be considered a transitional cell that is on its way to conducting nerve signals. Furthermore, we know today that nerve cells which share similar properties can produce **different actions** due to varied connectivity within the body. The nervous system has (1) sensory neurons in precise locations which send signals to (2) interneurons located within the brain, which then send messages to (3) motor neurons within muscles and glands. The placement of these neurons was not the result of some cosmological accident. Rather, they were purposefully arranged. The realization that these neurons communicate through synaptic junctions to one another all over the body makes a modern telephone system appear antiquated. And yet, evolutionists would have us to believe that there is no conscious design in this multifaceted network!

Nerve Cell

There are two distinct classes of cells within the nervous system: nerve cells and glial cells (Kandel, et al., 1991, p. 19). To grasp the complexity of individual nerve cells it is important to understand their morphology.

Nerve cells are the active signaling cells that most people envisage when they consider the nervous system. These are the cells involved in transmitting information. While the nervous system consists of many different types and sizes of neurons, all nerve cells share a basic configuration. Each one commonly possesses a cell body, dendrites, axons, and presynaptic terminals. These basic components help nerve cells to conduct the electric signal (often referred to as an action potential) to a neighboring nerve cell, as well as producing proteins and keeping the individual cell alive. It is important to understand that each nerve cell is an independent cell, not interconnected with other nerve cells. Every time a nerve signal is sent, it must cross a small junction (known as the synapse or synaptic cleft) that lies between each cell. The synaptic cleft between neurons covers only 20-40 nanometers (Kandel, et al., 2000, p. 176). In light of evolution, does it make sense that living cells would "evolve" this gap, which requires the production of a variety of neurotransmitters, followed by the evolution of a transportation system that can correctly collect specific neurotransmitters into vesicles? Further, is it plausible to the rational mind that the vesicles then transport their cargo to the synaptic cleft where a recognition system correctly determines when the neurotransmitters should be dumped into the cleft? At the outset, intelligent design of these components is the only logical answer.

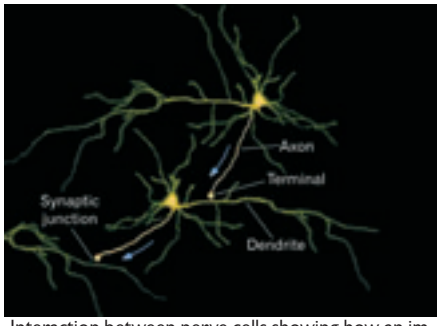
In 1889, German anatomist Wilhelm Gottfried von Walder-Hartz correctly pointed out that the dendritic extensions approached other cells, but did not actually contact them (Asimov, 1994, p. 446). The placement of each cell is not haphazard or accidental. Rather, neurons connect with one another in a specific fashion. As Kandel, et al. observed: "Nerve cells do not connect indiscriminately to one another to form random networks; rather each cell makes specific connections at precise and specialized points of synaptic contacts—with *some* postsynaptic target cells but not with others" (1991, p. 20, italics in orig.) How is it that these cells learned to "discriminate" connections and make "specific connections at precise and specialized points of contact"? A typical neuron has two ends, one where the messages are received (the dendrites and the cell body itself), and one where messages are perpetuated. The axon is the sending portion of the cell and in some cases can be several feet long! (see "Nerve Signaling," 2003).

Consider the following simplified analogy of a single nerve cell. If one were to picture a large oak tree and imagine it as a typical nerve cell, the branches would be the multi-branched dendrites that act as the receiving part of the cell. Once input is received on a particular branch, it then travels down to the top of the trunk where all the branches come together. This region would be considered the cell body, which houses the nucleus, and where most cellular proteins are manufactured. From there, if the action potential (discussed in more detail later) is generated in that cell, the signal is sent down the axon (the trunk of the tree). The roots of the tree would be the axon terminal, where the signal is then transmitted on to the next nerve cell using neurotransmitters. Next consider the roots of other trees purposefully touching the branches of that tree in a precise fashion. Also imagine the roots of the original tree trying to link up with not only branches, but tiny, specific points on the branches of thousands of other trees. Sound complex and orchestrated? Of course—because it is!

Further, nerve cells vary in size, shape, and specific function. They range anywhere from 4 microns (a granule cell) to almost 100 microns (a motor neuron in the spinal cord). In order to appreciate better the size of neurons, examine a new five dollar bill. On the side that displays the image of Abraham Lincoln there are three oval lines (an inner, middle, and outer line) that surround his picture. At the bottom of the middle line the words "The United States of America" are written in very small font. The "o" in the word "of" is oblong and about 15 x 30 microns, or about the size of a fairly large neuron.

In addition to varying in size, nerve cells also vary in the number of connections they make with other nerve cells. For instance, a spinal motor cell, whose dendrites are moderate in both number and extent, receives about 10,000 contacts—2,000 on the cell body and 8,000 on the dendrites. The larger dendritic tree of the Purkinje cell of the cerebellum **receives approximately 150,000 contacts!** (Kandel, et al., 1991, p. 22, emp. added). While neurons may possess hundreds of dendritic branches, they will only possess one axon. The axons are commonly covered by a lipid layer known as the myelin sheath. Interestingly, axons do not possess ribosomes and cannot manufacture proteins, and thus the neuron has a complex transportation center that moves synaptic proteins from the cell body to the synaptic junction. Given that these tiny messenger cells must build and possess a complex transportation system, as well as building and maintaining multifaceted sodium and potassium pumps, one begins to realize the gargantuan dilemma for evolutionists.

Neurons can be classified into three different groups. **Sensory neurons** commonly have a long dendrite and a short axon. They primarily carry messages from sensory receptors (i.e., skin) to the central nervous



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Interaction between nerve cells showing how an impulse is transferred.

system. **Motor neurons** typically have long axons and short dendrites. Their primary function is to transmit messages from the central nervous system back to the muscles or effectors. **Interneurons** are found within the central nervous system and conduct signals between neurons. Each type of neuron contains specific neurotransmitters, special ion channels, membrane transport mechanisms, and/or receptors for neurotransmitters (Kandel, et al., 1991, p. 47).

Glial Cells

Nerve cells are surrounded by a supporting network composed of glial cells (from the Greek *glia*, meaning glue). Glial cells are present in small numbers before birth, but the majority of these cells are derived after birth. There are 10-50 times more glial cells than neurons (Kandel, et al., 1991, p. 22). If nerve cells serve as the active signaling cells, glial cells are the glue that holds everything together and helps maintain proper function of the entire system. For instance, the mylein sheath not only insulates the neuron, but also helps to speed up transmission of the nerve signal. Within the nervous system, myelin is produced by specialized glial cells known as Schwann cells which surround the axon. Schwann cells are believed to serve as nutritive, supportive, and service facilities for neurons. Spaced along the Schwann cells are gaps known as the node of Ranvier (named after neuroanatomist Louis Antoine Ranvier) which help to speed up signal transduction as well as generate nerve signals. These gaps are not random, but rather are deliberately situated to help the brain communicate to distant regions of the body (e.g., toes) in just a few thousandths of a second. Once again, an honest examination would cause one to conclude that these gaps are **purposefully** arranged. In an abstract titled: "Evolution of Myelin Proteins," Gould, et al. observed:

> The myelinated nervous system arose in a common ancestor of all modern-day gnathostomes (jawed animals). Modern-day agnathans (jawless animals, i.e., lamprey and hagfish) have nervous systems that contain large axons surrounded by glial cells, but no mylein. In order for myelination to evolve, both neurons and axons had to **simultaneously develop appropriate communication pathways**. Pathways from large axons were **designed** not only to attract glial cells, but also to induce them to form myelin internodes of appropriate size for the axon. The associating glial cells in turn need to signal neurons/axons to target ion channels and other proteins to specialized regions called nodes of Ranvier. The accumulation of ion channels at nodes of Ranvier is an **essential** feature of rapid saltatory nerve conduction (2004, p. 168, parenthetical items in orig., emp. added).

Evolutionists have yet to demonstrate a transitional glial cell. Gould, et al. recognize that the development of myelin would require both neurons and axons to "simultaneously develop appropriate communication pathways." Has this simultaneous development ever been recorded in nature? Additionally, how does a "communication pathway" evolve? Scientists recognize that without glial cells, the nervous system would not be as effective. They function in the following manner:

1. They serve as supporting elements, providing firmness and structure to the brain. They also separate and occasionally insulate groups of neurons from each other.
2. Two types of glial cells, the oligodendrocyte in the central nervous system and the related Schwann cell in the peripheral nervous system, form myelin, the insulating sheath that covers most large axons.
3. Some glial cells are scavengers, removing debris after injury or neuronal death.
4. Glial cells buffer the potassium ion concentration in the extracellular space, and some take up and remove chemical transmitters released by neurons during synaptic transmission.
5. During development, certain classes of glial cells guide the migration of neurons and direct the outgrowth of axons.
6. Certain glial cells induce formation of the impermeable tight junctions in endothelial cells that line the capillaries and venules of the brain, causing the lining of these vessels to create the "blood-brain barrier."
7. There is suggestive evidence that some glial cells have nutritive functions for nerve cells, although this has been difficult to demonstrate conclusively (Kandel, et al., 1991, p. 22).

Are myelin and glial cells essential to the human nervous system? Just ask someone suffering from multiple sclerosis (MS). This condition is suspected to be caused by a viral infection where myelin in the central nervous system is attacked in an autoimmune response. A second group of demyelinating diseases are degenerative diseases identified as leukodystrophies. In 2001, D.R. Cotter and colleagues presented a paper titled "Glial Cell Abnormalities in Major Psychiatric Disorders: The Evidence and Implications" in *Brain Research Bulletin*, acknowledging that glial cell loss may be responsible for many different pathological changes and disorders (p. 585). So, are myelin and glial cells a critical component of the human nervous system? Yes! Can evolution explain their existence? No.

THE NERVE IMPULSE AND ACTION POTENTIALS

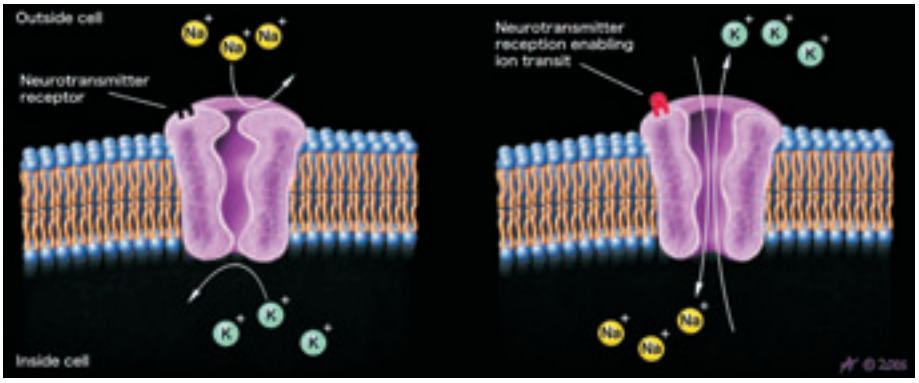
A nerve cell is useless unless it can perform its task of conducting a nerve signal down itself, and then pass it along to a neighboring neuron. Once a stimulus reaches the dendritic branch of a nerve cell, there must be a mechanism to propel that signal down the nerve cell itself. More than two-hundred years ago Italian scientist Luigi Galvani discovered that nerve impulses inside a neuron possess an electrical component (see Boring, 1950). This electrical component is commonly referred to as an **action potential**. The first published record of an action potential measured with an intracellular electrode occurred in the giant squid axon in 1939 (see Hodgkin and Huxley). Today nerve cells can be identified by their specific electrical activity, and scientists have successfully recorded data from neurons in living humans.

Neurons have an electrical potential across their cell membranes. Cellular membranes of neurons possess thousands of channels (also referred to as gates) that allow specific ions to pass through. For instance, the density of sodium channels in the giant squid axon is 300 per micron^2 (see Hille, 1984, p. 210). One must ask, exactly how did these gates arise? And how are they able to function so quickly and seamlessly? Normally, most of the gates are closed. Having channels that allow the cell to leak certain ions would not always be beneficial. Why did these ion-specific channels originate in the first place? [In addition, it should be noted that nerve cells also have a different type of gate between the nucleus and the cytoplasm to allow newly manufactured proteins to exit the nucleus.] Is one to assume that a rogue protein in the cell's membrane somehow evolved into a gated channel? As Michael Behe observed: "This is like asking if wooden beams in a wall could be transformed, step by Darwinian step, small mutation by small mutation, into a door with a scanner" (1996, p. 111). Yet, those channels are indispensable to the formation of action potentials.

In 1970, Bertil Hille was able to verify the role of sodium and potassium currents

in action potentials (Hille, 1970). The initial stage of an action potential results when sodium gates open wide, allowing positively charged sodium ions to flow inside the cell membrane. This flow of sodium ions requires specific proteins within the neuron, known as sodium-potassium pumps, purposefully to open the sodium channels, allowing the positively charged sodium ions inside the cell. The typical number of sodium pumps in a neuron is approximately 1,000 pumps/micron^2 (Willis and Grossman, 1981, p. 36). Opening the sodium channels causes the inside of the cell temporarily to possess an electrical charge that is more positive than the outside. (This event is known as depolarization). At the same time, potassium is pumped outside the cell in an effort to repolarize the cell. The combined depolarization and repolarization is referred to as an action potential. This continuous wave of sodium flooding in, followed by potassium flowing out, is self-propagating, i.e., once it has started, the next point (or node) along the membrane will follow soon thereafter. These continue down the neuron, aided by the myelin sheaths and nodes of Ranvier. At each "node" point there are 1,000 to 2,000 voltage-gated sodium channels per micron^2 (Nolte, 1999, p. 163). Interestingly, between nodes there are only 25 voltage-gated sodium channels per micron^2 (p. 163). Can evolution explain not only how the nodes of Ranvier originated, but also how these channels evolved, and then clustered around each node in order to propagate nerve signals? Any explanation that excludes intelligent design is doomed to failure.

Neurons have specific threshold levels that must be reached before an action potential will occur. If the stimulus is not of adequate strength to reach this threshold level, then the action potential will not cause the neuron to transmit a nerve impulse. Thus, nerves are commonly considered to follow an "all-or-none" principle, meaning the stimulus produces an impulse or it does not. In considering the domino analogy, the first domino in the line must receive a big enough push in order to fall down and thus knock over the second domino. If the threshold is not reached on the first one, none of the dominoes will fall. But all of this activity simply gets the information down the neuron itself. At some point, it must be passed to a neighboring neuron so that it can continue farther down the line.



Gated ion channel in a closed state before the chemical neurotransmitter is received.

Chemically gated ion channel opened after the neurotransmitter is attached to receptor site.

SYNAPSE

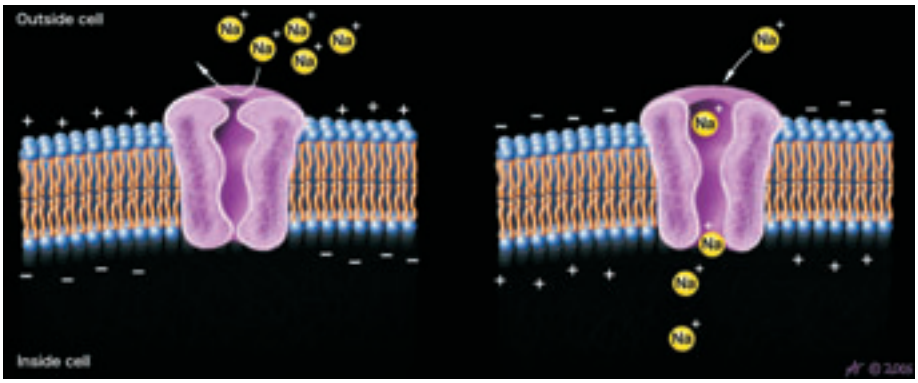
Nerve cells convey information both chemically and electronically. The electrical component occurs within the nerve cell itself (as discussed earlier), as an electrical charge is propagated down the axon. The chemical signaling occurs at the junction between neurons, called the synapse. It has been estimated that the number of synapses in the cortex is 0.15 quadrillion (see Pakkenberg and Gundersen, 1997, p. 312), with a "typical" neuron possessing 1,000 to 10,000 synapses. In this section, we will look briefly at what occurs at the synaptic cleft.

The primary way nerve cells communicate with one another, and the way nerve signals are conducted from one part of the body to another, is by the use of neurotransmitters. At the axon terminal there are vesicles that contain various neurotransmitters. When an action potential arrives at the end of the axon (at the axon terminal), vesicles release specific neurotransmitters into the small gap between the two cells. It is believed that each synaptic vesicle contains 5,000 molecules of neurotransmitter (Kandel, et al., 2000, p. 277). Stephen Rothman observed: "A vesicle is any membrane-enclosed structure found in a cell that acts as a *vehicle* to transport molecules from one place to another. **It is the understanding that vesicles move in a directed fashion** and as a consequence move their contained substances" (2002, p. 147, italics in orig., emp. added). But moving something in "directed fashion" indicates a director, which occurs by design, not by chance.

We have already identified that numerous neurotransmitters are required for different roles at the synapse. Did each of these neurotransmitters evolve independently? Consider also that these neurotransmitters are stored in synaptic vesicles until needed. But how did those vesicles get there? And how do they know when they are needed and which neurotransmitters they should carry? And precisely how do all of these vesicles get carried to the axon terminal? Michael Behe discussed this complexity when he noted: "Molecular machines haul cargo from one place in the cell to another along 'highways' made of other molecules, while still others act as cables, ropes, and pulleys to hold the cell in shape" (1996, p. 4). As Rothman explained: "[D]epending on how one breaks things down, the basic model (excluding various alternative transport routes) proposes that eukaryotic (nonbacterial) cells require 15 to 30 distinct or separate biological mechanisms to move protein molecules a few micrometers, about 0.0005 inches" (2002, p. 138, parenthetical items in orig.). All of this complex mechanism built into each cell, just to move proteins a few micrometers? And yet recall that some axons are three feet in length!

The complexity of this microscopic transportation system is mind-boggling. As Pryer and his colleagues admitted: "The transport of proteins between membrane-bound organelles is an immensely complex process" (1992, p. 471). Expounding on this intricacy, Behe continued:

> The function of the intracellular transport system is to carry cargo from one place to another. To do this, packages

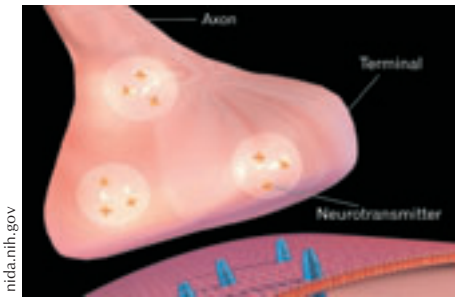


Voltage-gated ion channel in a closed state before the voltage changes.

Voltage-gated ion channel opened when cell membrane charges are reversed to allow ion transit.

must be labeled, destinations recognized, and vehicles equipped. Mechanisms must be in place to leave one enclosed area of the cell and enter a different enclosed area. The failure of the system leaves a deficit of critical supplies here, a choking surplus there (1996, p. 205).

Consider what would happen if these vesicles were delivered to the wrong place, or dumped their contents at the wrong time. Are we ready to say that nature "selected" for this multifaceted system? How many organisms had to die before the vesicles were transported properly and were able to dump their contents correctly? If the organism died, the "selection" process would have ended and no evolution would have occurred.



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Synapse

A neuron sending a signal will release neurotransmitters into the space between a neighboring nerve cell. This causes a sequence of actions that allows the signal then to be further transmitted by the second nerve cell. This process can be summarized as follows:

> Between adjacent neurons, there is a microscopic gap called the synaptic cleft. However small, the electrical signal carrying a message cannot bridge the synaptic cleft as it is. The solution to this is the synapse, an elegant way of bridging the gap chemically. The electrical impulse triggers the release of certain chemical substances into the gap. There substances are called neurotransmitters and are carried over the small synaptic cleft by diffusion. Once on the other side of the cleft, the neurotransmitters bond to certain proteins, called receptors, that are attached to the cell surface of the receiving cell. The binding of the transmitter to the receptor leads to the generation of a new electrical impulse. The gap has been bridged! ("Nerve Signaling," 2003).

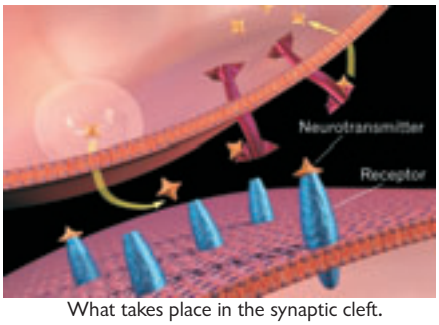
After the neurotransmitters have been dumped into the synaptic cleft, they are either taken back up and recycled in the axon terminal, or they are broken down by enzymes from supporting glial cells. All of this activity is required in order to send a nerve impulse across the synapse. And yet this complex system must be able to complete these functions in just fractions of a second! The nerve's ability to manufacture, collect, store, and deposit neurotransmitter to conduct nerve signals is light years ahead of Fed Ex's 10:00 a.m. delivery guarantee!

PLASTICITY OF THE NERVOUS SYSTEM

If all this were not enough, evolutionists must also contend with another amazing aspect of the nervous system—its ability to rewire itself. Known commonly as plasticity, this concept simply means that the nervous system is not as "hard-wired" or permanently fixed as we once believed. Research has shown that the brain is able to remodel its connections in order to adjust the organism's response to changing conditions. As Shepherd remarked:

> The inability to generate new neurons might imply that the adult nervous system is a static, "hard-wired" machine. This is far from the truth. Although new neurons cannot be generated, each neuron retains the ability to form new processes and new synaptic connections" (1994, p. 222).

Interestingly, since Shepherd's remarks were printed, additional research has even documented the ability of neurons to be generated within certain areas of the brain. These cortical rearrangements that occur are not as simple as unplugging a lamp and plugging it into another socket. The changes observed by researchers indicate that if the brain was represented by a home electrical system, then many of the wires within the walls would be pulled out, rewired to different connections and different rooms, new outlets would appear, and some would even carry different voltages. Due to the colossal connectivity that takes place within the brain, any "rewiring" is, by its very nature, going to have an effect on several areas. Shepherd noted:



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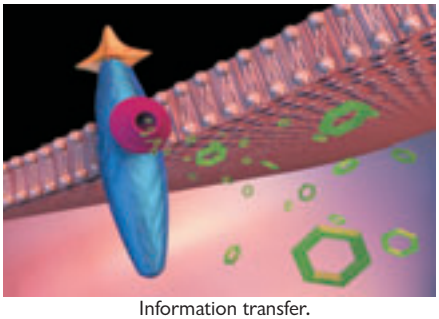
What takes place in the synaptic cleft.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Information transfer.

> These rearrangements have several interesting and important features. First, they show that thalamic inputs to the cortex are both **extremely precise and also significantly plastic**. Second, these changes take place over varying time scales; in some cases the shifts in representations are slow, developing over weeks, but in other cases they may be surprisingly rapid, beginning within a day or so, or even a few hours. Third, these changes are not limited to the primary cortex (1994, p. 290, emp. added).

"Extremely precise"? That would indicate forethought and design. And just how "significantly plastic" is the brain? Consider this: doctors can remove the left hemisphere of the cortex—where speech and language centers are located—and months later these functions will be carried out by similar areas in the remaining right hemisphere. The brain rewires itself using the remaining right hemisphere. Christina Santhouse was diagnosed with Rasmussen's encephalitis and suffered from seizures more than 100 times per day. Doctors successfully removed the right side of her brain, where the disease was located, and five years later Christina was enrolled in a private high school in suburban Philadelphia! The plasticity of the brain allows the remaining half of the brain to assume functions of the lost side (see "Teen-ager with Half...," 2001).

CONCLUSION

Charles Darwin once lamented: "If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down" (1872, p. 154). When considering the complex vesicular transport system required, the ion channels necessary, and the various types of neurons and glial cells needed to deliver a nerve impulse accurately, it becomes obvious that the brain and nervous system cannot be explained simply by "successive, slight modifications." This study has only scratched the surface of the complexity and design built into the human nervous system. **An honest assessment of the nervous system reveals purposeful arrangement and irreducible complexity.** Michael Behe described a scenario of detectives finding a dead man lying crushed on the floor next to a large gray elephant. But he said the detectives overlooked the elephant, because they are trained "to get their man." Likewise, he insisted: "There is an elephant in the roomful of scientists who are trying to explain the development of life. The elephant is labeled 'intelligent design' " (1996, p. 193).

Francis Crick once noted: "Biologists must constantly keep in mind that what they see was not designed, but rather evolved" (1990, p. 138). Crick realized that a purposeful arrangement pointed toward design, and in order to negate any notion of a designer, biologists constantly need to ignore the obvious—the elephant of intelligent design. Darwin himself acknowledged as much in a conversation with the Duke of Argyll when the Duke recounted:

> In the course of that conversation I said to Mr. Darwin, with reference to some of his own remarkable works on the Fertilisation of Orchids, and upon The Earthworms, and various other observations he made of the wonderful contrivances for certain purposes in nature—I said it was impossible to look at these without seeing that they were the effect and the expression of mind. I shall never forget Mr. Darwin's answer. He looked at me very hard and said, "**Well, that often comes over me with overwhelming force**; but at other times," and he shook his head vaguely, adding, "it seems to go away" (see Darwin, 1902, p. 64, emp. added).

Given the almost unfathomable capabilities of the brain and nervous system, and the physiological construction of this complex network, we are faced with one of the strongest evidences available for the existence of a Creator. Indeed, this incredible evidence is an "overwhelming force" that cannot be explained by Darwinian evolution. Speaking of the brain and its complex components, 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, emp. added). In his book titled *The Human Body: Accident or Design?*, Wayne Jackson declared: "Man is not some fortuitous creature accidentally conceived by 'father chance' and birthed by 'mother nature.' We are the offspring of God, in Whom we live, move, and have our very existence (Acts 17:28-29)" (2000, p. 51). Indeed, we are!

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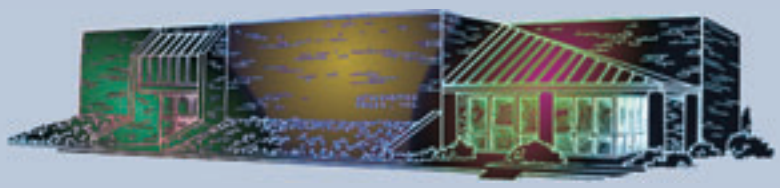
NOTE FROM THE EDITORS



A.P.—YOUR RESEARCH RESOURCE

That time of year is once again upon us—when big yellow school buses fill city streets, and excited college students assess how much "stuff" from home they can cram into a small dorm room. School is back in session. With a new school year comes new academic projects and extensive research papers. While we cannot eliminate all the painstaking and arduous hours spent on research papers, we can ease that pain by offering valuable aids and resources.

Apologetics Press has become a clearing house for individuals looking for good information in areas related to the Bible and science. Parents, students, and teachers are encouraged to take full advantage of the free resource materials available online (www.ApologeticsPress.org). Our Web site averages well over 200,000 hits per month from individuals all over the world who are seeking high quality, well-researched material. In addition, if students have questions, or cannot find what they are looking for, our professional staff is always happy to lend a helping hand. We are here to serve.

This year we anticipate a dramatic increase in debate on the creation/evolution controversy. From the President's comments supporting Intelligent Design to countless court cases, people are questioning evolutionary dogma. Simply put, the theory has not lived up to its oft'-alleged status as "fact." Increased interest will undoubtedly stimulate more research papers and additional school projects. We trust that you will consider Apologetics Press your #1 source for information.

Commenting on the current environment that students are facing in today's classroom, Utah Senator D. Chris Buttars observed:

> The argument over classroom discussion of evolution vs. divine design is just the latest attack on everything that would mention a belief in God. If you talk against Darwinian evolution in the classroom, you immediately incur the rage of those who don't want God discussed in any way, shape or form. These vehement critics claim that there are mountains of scientific proof that man evolved from some lower species also related to apes. But in this tremendous effort to support Charles Darwin's theory of evolution, in all these "mountains of information," there has not been any scientific fossil evidence linking apes to man (2005).

Consider the following even bolder declaration by Buttars:

> The trouble with the "missing link" is that **it is still missing!** In fact, the whole fossil chain that could link apes to man **is also missing!** The theory of evolution, which states that man evolved from some other species, has **more holes in it than a crocheted bathtub.** I realize that is a dramatic statement, so to be clear, let me restate: **There is zero scientific fossil evidence** that demonstrates organic evolutionary linkage between primates and man (emp. added).

Buttars is absolutely correct! It is our hope and prayer that young people all over our nation will discover this truth for themselves. We stand ready to do all we can to ensure that future generations learn the truth: they were created in the image and likeness of God. We are committed to producing quality materials for all ages to that end. In fact, in the very near future we will be announcing a brand-new children's science book, co-authored by Kyle Butt and Eric Lyons, titled *Truth Be Told*. This valuable resource will be available for teachers and parents to aid in their quest to instruct students concerning their origin. The time has come for our children to learn that the reason the missing link is still missing is because it never existed in the first place!

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