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Neuroscience and Education: The Importance of a Christian Understanding of Human Persons

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Abstract

The increased research in the neurosciences has affected the discipline of education in numerous ways, with publications translating this research into classroom practices. A caution is given to Christian educators to carefully reflect upon how this research influences our view of human persons and what difference this view makes in the teaching and learning process. The purpose of this paper is (1) to examine some of the ways that neuroscience is speaking into the discipline of education, particularly in understanding the capabilities and processes of the learner; (2) to develop an awareness of how this affects our understanding of persons; and (3) to establish the necessity for the preparation of future educators with a distinctly Christian perspective of the human constitution.

Neuroscience and Education: The Importance of a Christian Understanding of Human Persons

Laura A. Barwegen

Abstract

The increased research in the neurosciences has affected the discipline of education in numerous ways, with publications translating this research into classroom practices. A caution is given to Christian educators to carefully reflect upon how this research influences our view of human persons and what difference this view makes in the teaching and learning process. The purpose of this paper is (1) to examine some of the ways that neuroscience is speaking into the discipline of education, particularly in understanding the capabilities and processes of the learner; (2) to develop an awareness of how this affects our understanding of persons; and (3) to establish the necessity for the preparation of future educators with a distinctly Christian perspective of the human constitution.

If we want to be biblical in our thinking, we will have to work hard to rescue the good name of science from the smears it has picked up in this area, and to restore a positive view of it as a pathway to marvelous and potentially invaluable gifts of God, in which he means men to rejoice with thanksgiving. (MacKay, 1974, p. 47)

Therefore, I urge you, brothers, in view of God's mercy, to offer your bodies as living sacrifices, holy and pleasing to God – this is your spiritual act of worship. Do not conform any longer to the pattern of this world, but be transformed by the renewing of your mind. Then you will be able to test and approve what God's will is – his good, pleasing and perfect will. (Romans 12:2)

How is *learning* defined? I ask this question on one of my exams for my sophomore level *Learning and Development* course, for defining the concepts of teaching and learning are at the core of the discipline of education. Because they have been studying a variety of theories of learning and development, students answer the question from the

various perspectives of a cognitive theorist, socioculturalist, and a behaviorist, among others. One definition states that learning is a response to being placed in a state of disequilibrium where an individual must adapt either through assimilation of the new experience to the already established mental framework, or schema, or through accommodation, where the mental schemas are altered to fit the new experience. Both of these processing choices will lead the individual back into a state of equilibrium (Piaget, 1953).

Another response is that learning does not occur in isolation but instead occurs as a result of being in community. Through the medium of language, the individual communicates with others within the community and works in partnership with an older, wiser mentor who guides the apprentice through the learning process. The mentor uses scaffolds when necessary and insures that the task is neither too easy nor too hard for the individual to complete, but is within a zone of proximal development wherein the individual can learn with the assistance of the mentor (Vygotsky, 1978).

A third response is that learning can only be defined by outward behaviors and any attempt to define it otherwise is just conjecture. These outward behaviors are conditioned through systems of rewards and punishers: rewards increase the likelihood that a behavior will recur and punishers decrease that likelihood. Learners become conditioned, then, to make choices that drive them to more rewards and fewer punishers (Skinner, 1984). Although learning is more complex than the simplistic explanations provided above, these present the skeletal frameworks for the variety of ways that learning can be defined. While defining the concepts of teaching and learning are foundational in education, another explanatory framework for learning has arisen recently, and it is

derived from the discipline of biology, namely neuroscience.

Neuroscience, broadly defined, is a branch of the life sciences that deals with the anatomy, physiology, biochemistry, or molecular biology of nerves and nervous tissue and especially their relation to behavior and learning (Bear, Connors, & Paradiso, 2001). This neuroscientific definition of learning has little to do with the human drive to maintain equilibrium, gain the knowledge of the social culture, or receive rewards and avoid punishers; this definition includes the biological connections of neurons, and how they are established and pruned away throughout the life of the individual. Drives to maintain equilibrium, gain knowledge of the social culture, and avoid punishers can all be reasons for the neural connections, but the study of neuroscience examines more closely the biological relationships between physical brain structures and the behavioral, attitudinal, and/or cognitive outcomes. In the discipline of education, Robert Sylwester (1995, 2003), Eric Jensen (1998), and David Sousa (2001, 2007) are translating current neuroscientific research into classroom practices. Each of these educational researchers believes that neuroscience will become central to the preparation of future teachers, and will play a significant role in the teaching and learning process (Sylwester, 2007).

The purpose of this paper is (1) to examine some of the ways that neuroscience is speaking into the discipline of education, particularly in understanding the capabilities and processes of the learner; (2) to develop an awareness of how this affects our understanding of persons; and (3) to establish the necessity for the preparation of future educators with a distinctly Christian perspective of the human constitution.

Neuroscience and Education

Research and theory in cognitive neuroscience has produced insights into how the development of the brain, especially the cerebral cortex, relates to thinking and learning (Fischer & Rose, 1998; Thatcher, 1994). The physical matter that resides within the skull, referred to as the “brain” and the mental attributes of beliefs, perceptions, thoughts, desires, etc., referred to as the “mind” have been recently demonstrated to have strong

correlations: electrical and chemical neuronal events of the brain have been scientifically correlated with the mental events associated with the *mind*. The key philosophical – and increasingly practical – question is to what degree are the two correlated, whether these phenomena are identical, at least partially distinct, or related in some other way.. Is there a cause/effect relationship?

One question in the general education sector that has existed for decades is whether boys and girls learn in similar or different ways. Neuroscience is providing key evidence for educators to gain insight into this question. For example, neuroscientists are uncovering anatomical, chemical, and functional differences between the brains of men and women, implicating regions involved in language, memory, emotion, vision, hearing and navigation. Human brain imaging evidence has begun to reveal a sex-related hemispheric lateralization of amygdala function with respect to memory for emotionally arousing material. For example, in both a glucose PET investigation (Cahill, Haier, White, Fallon, Kilpatrick, Lawrence, Potkin, & Alkire, 2001) and an fMRI investigation (Canli, Desmond, Zhao, & Gabrieli., 2002), activity of the right, but not the left, hemisphere amygdala related significantly to long-term incidental memory for arousing material in men but not in women, whereas activity of the left, but not right, hemisphere amygdala related significantly to memory for arousing material in women but not in men (Cahill, Uncapher, Kilpatrick, Alkire & Turner, 2004).

In a recent report in *Scientific American*, Larry Cahill described additional differences between the sexes that are attributable to the physical structure of the brain: increased serotonin production in males, decreasing the likelihood of depression, and reaction to short-term stress, which increases the density of dendritic “spines” in hippocampal neurons in males, but decreases them in females. Because the hippocampus is involved in learning and memory, the results raise the possibility that short-term stress induces cerebral changes that facilitate learning in males but reduce it in females (Cahill, 2005). In translating the biological research into education, Michael Gurian identified ways that teachers can organize the classroom and the curriculum to enhance learning for both sexes, which included allowing more movement around the classroom, varying the levels

of short-term stress, utilizing a variety of teaching methods that incorporate both verbal instructions and responses and practices that are more experiential and kinesthetic (Gurian & Stevens, 2004).

In addition to identifying ways in which the brain functions to enable learning, neuroscience is also contributing to understanding what happens when learning doesn't occur in the typical fashion. Understanding atypical and typical functioning requires going beyond simplistic brain-behavior correspondences to analyzing how brain functioning relates to the ways children learn and grow. Neurological functions that break down or fail to develop as expected afford researchers and practitioners a unique opportunity to learn about the ways in which the brain and mind organize themselves over time, such as the ways that children functionally compensate for their neurological deficits (Fischer, Immordino-Yang & Waber, 2007). The identification of these functional breakdowns provides feedback into the discipline of education and issues of educational policy and practice. How are learning disorders defined and identified, neuropsychologically? What neuropsychological strengths might be used to compensate for and remediate these weaknesses? Two disorders which have proven problematic in the discipline of education and have received recent neuropsychological attention are dyslexia and attention deficit hyperactivity disorder.

Neuropsychologically, a learning disorder might be defined as an atypical pattern of behavior attributed to either a lack of function to specific neural sites, either through lesions or physical abnormalities, or to a lack and/or slow speed of connections among neural networks. Being able to clearly identify, then, the physical anomalies associated with the atypical behavior can lead to treatment or development of compensatory avenues of learning and behavior. One such disorder which has plagued students and is currently being addressed by the shared knowledge base between neurology and education is dyslexia. Researchers have traditionally defined dyslexia as inaccurate and/or slow, effortful reading that typically originates with weakness in the phonological processing of language (Lundberg, Olofsson, & Wall, 1980; MacDonald & Cornwall, 1995; Elbro Borstrom, & Petersen, 1998; Shaywitz, Fletcher, Holahan, Shneider, Marchione, Stuebing,

Francis, Pugh, & Shaywitz, 1999; Castles and Coltheart, 2004). Shaywitz (1998) cites evidence of brain abnormalities in dyslexia, and the underlying neurological cause appears at this time to be reduced activity in the lower parietotemporal cortex.

Dyslexia may represent the first example of a learning disability whereby a possible pathway may link the observed behavior to an underlying neurological substrate that has a neurodevelopmental history beginning with an abnormal gene. Similar efforts are being made to link other cognitive disorders of development to a molecular pathway involved in brain development. The objective is to disclose a developmental brain pathway leading to a brain that has a particular structure and physiology, a set of perceptual, cognitive, and metacognitive associations, and a behavior explained by these cognitive structures and processes (Galaburda, 2005). In translating neuropsychological research to the discipline of education, the Scientific Learning Corporation has designed a computer program, FastForward, which slows down and digitally enhances speech sounds for the struggling reader as well as develops adaptive schedules for a range of critical reading skills, including phonemic awareness, fluency, vocabulary, comprehension, decoding, and syntax. A study out of Stanford in 2003 cited scientific learning reading-based software as significant in enhancing reading ability (Temple, Deutsch, Poldrack, Miller, Tallal, Merzenich, & Gabrieli, 2003). Software to enhance reading ability in adults is currently in development.

Another area in the K-12 classroom where neuroscientific research is contributing to a fuller understanding is attention deficit/hyperactivity disorder (AD/HD). AD/HD is a neurobiologically-based developmental disability estimated to affect between 3-5% of the school age population (Professional Group for Attention and Related Disorders, 1991). No one knows exactly what causes AD/HD. Scientific evidence suggests that the disorder is genetically transmitted in many cases and results from a chemical imbalance or deficiency in certain neurotransmitters, which are chemicals that help the brain regulate behavior. In addition, a landmark study conducted by the National Institute of Mental Health showed that the rate at which the brain uses glucose, its main energy source, is lower

in subjects with AD/HD than in subjects without AD/HD (Zametkin, Mordahl, Gross, King, Semple, Rumsey, Hamburger, & Cohen, 1990). Additional research has implicated the ventrolateral prefrontal cortex as the site of decreased neuronal activation in individuals diagnosed with AD/HD. Notwithstanding the compelling evidence of frontostriatal abnormalities in ADHD, the precise nature of the pathophysiology has remained elusive. Stimulants, such as Ritalin, activate the anterior cingulate cortex, which has been implicated for its ability to inhibit other functioning and increase the level of focus and attention an individual can provide to a given task.

However, a high-tech, non-pharmacological approach called neurofeedback therapy may be a safer and longer-lasting treatment that helps patients regulate slower, electrical theta waves in the brain and faster beta waves. Electrical brain mapping techniques have demonstrated that individuals diagnosed with AD/HD have a preponderance of slower, theta brain waves, and a decreasing activity of faster, beta waves (Butnik, 2005). The aim of neurofeedback is to provide participants with realtime feedback on the activity of their brain, usually through a video display. A system of rewards and punishers enable individuals to learn when the beta wave usage is increasing. Participants, then, learn the conscious control of their own brain wave activity. After 20-60 treatments, many patients can learn to regulate their own brain's activities to remain in the more focused and attentive beta wave state simply by recognizing how it "feels" when the brain is active in this way (Dorn, 2000).

These are just two ways in which neuropsychology and education are beginning to overlap. One of the more significant developments on the horizon is that of mirror neurons. The initial discovery of mirror neurons actually occurred 15 years ago by an Italian neuroscientist, Giacomo Rizzolatti and his team of Italian neuroscientists, who were studying monkey brain systems that regulate intentional hand movements. They discovered that neurons in the premotor areas of the cortex that prime movement sequences (such as to grasp an object or to break open a peanut) activate milliseconds before the movement occurs, but also when the monkey simply observes someone else making that same movement sequence (Sylwester, 2007). After the

initial monkey research, neuroscientists used neuroimaging technologies to study mirror neurons in humans. These studies have already resulted in fascinating discoveries that are changing how we view many aspects of human life. These elements include the development of articulate speech; the underlying mechanisms of empathy; maladies such as autism; the broad appeal of observing others who are engaged in sports, dance, or musical performance; and the effects of electronic media on behavior. Mirror neurons are also providing windows into how we view ethics and morality because they allow us to infer goal-directed intentions from the behavior of others. In a 2000 article published in *Edge*, noted neuroscientist V.S. Ramachandran stated

The discovery of mirror neurons in the frontal lobes of monkeys, and their potential relevance to human brain evolution — which I speculate on in this essay — is the single most important "unreported" (or at least, unpublicized) story of the decade. I predict that mirror neurons will do for psychology what DNA did for biology: they will provide a unifying framework and help explain a host of mental abilities that have hitherto remained mysterious and inaccessible to experiments (Ramachandran, 2000, Paragraph 1).

Sylwester speculates that the future of the discipline of teaching and learning will be built on this foundation of what we are discovering about mirror neurons and neuroplasticity (2007). Mirror neurons provide the biological connection to teaching strategies such as modeling and guided participation, as well as more abstract concepts such as moral behavior and decision making. In an article for the American Association for School Administrators, Sylwester lists the seven developing brain systems and processes that he thought would impact educational policy and practice within the next 10 years — mirror neurons, neuroplasticity, emotion and attention, hemispheric specialization, the arts and humanities, intelligence, and consciousness (Sylwester, 2007). As a case in point, at a recent conference entitled *Learning and the Brain*, Blackwell Publishers introduced the first professional, peer-reviewed journal targeted at this intersection between education and neuropsychology entitled *Mind, Brain, and Education*, with the first issue published in March 2007. With the increased use of available

technologies, such as PET and fMRI, our knowledge of the connections between the physical structure of the brain and the functioning of the mind will continue to increase.

As more and more of our attitudes, behaviors, and thinking processes become attributable to neurological functions, and the integration between education and neuropsychology increases, it begs the questions: *Will the discipline of education become a subset of neuropsychology (i.e. the study of the neuropsychology of learning)? Is there anything else of the person that should be developed or attended to in this process of teaching and learning or is all subsumed in the chemical and electrical exchanges and impulses of the brain and if we just attend to that, all else will fall into place? Is the anatomical structure of the brain fully responsible for defining who we are as people or is there something else? Finally, for those of us who prepare future teachers at Christian colleges and universities, what difference does it make here, amidst these questions, that Jesus Christ is Lord?*

Neuroscience, Education, and the Imago Dei

Although neuroscience began as a biological discipline, it now includes the disciplines of psychology, education, philosophy, and theology. Questions not only about how we as humans learn but also questions about how we as humans are defined in relationship to ourselves, our fellow humans, and God are raised through these scientific discoveries. A key question for educators is whether the advancement in neurosciences is so closely paralleling advances in education, at least the teaching and learning process of the institution of education, as to appear redundant. Along with the translation of how advances in neuroscience reveal the learning process comes the claim that human beings are simply a compilation of the physical aspects of body and brain, and the functionalities that these enable one to do. The underlying conviction that is communicated is that as teachers our work is to influence and alter the neurological structures of another's mind which in turn neglects deeper questions of human nature and the Christian view of the nature of the person that extends beyond the temporal. This strikes at the core of education: the amalgamation of teaching and learning of human persons. Without a right understanding of what constitutes *human persons*, the fusion between teaching and learning

becomes confusion, the role of the teacher becomes limited, and the purpose of a Christian department of education and the preparation of future teachers becomes lost.

Traditional Substance Dualism

For most people – Christians and non-Christians alike – the reigning unarticulated belief is that the soul is present whether consciously or subconsciously, regardless of the physical state of the person. The body, or material being, is a separate substance from the soul, or spiritual, being. The true person resides within the body and is contained, as in a jar of clay (II Cor. 4:7), until finally at death the Christian soul is released from its chains to an eternal, non-physical existence to be in fellowship with God and His Christ. Most people believe that the body and the soul are separate entities, and Christians rely upon Scripture to support this. One of the strongest arguments is to be found in Philippians 1:21-24: “For to me, to live is Christ and to die is gain. If I am to go on living in the body, this will mean fruitful labor for me. Yet what shall I choose? I do not know! I am torn between the two: I desire to depart and be with Christ, which is better by far; but it is more necessary for you that I remain in the body.”

Another argument cites the apparent dichotomous nature of the two substances. In addition to the divisibility of the spiritual substance of the person from the physical substance is the indivisibility of the spiritual as compared to the divisibility of the physical, which further supports their being distinct one from another. The mind cannot be broken down into any other component parts that together create the mind; it is whole. In addition, the mind is present at every point that the physical faculties can extend. When the mind is affected, it also affects the body. The opposite, however, does not hold true. The body can be broken down into component parts, and these parts are not present at every place where the mind exists. (For example, my foot is not present in my thinking about finishing this paper, but wherever my foot is, there my mind is as well, albeit most often in my subconscious through what is called *proprioception*.)

Preparing future teachers, and serving as teachers ourselves, using this perspective of the dualistic, or dichotomistic, constitution of human persons calls us to attend to the physical development and

instruction of the human person, including the brain as a physical organ, as well as attention to the development of the spiritual substance of the person. However, our awareness of these two entities as separate substances affects the different by which we attend to these tasks. In fact, because the spiritual is what continues to live on in eternity, it is this development to which Christian educators have attended most closely, sometimes at the expense of the intellectual, and this is a caution to Christian educators who hold this view.

This traditional view of human persons has recently come under question because of the advances in neuroscience. As stated earlier, an increasing number of characteristics that had traditionally been ascribed to the spiritual substance of the dualistic nature are actually being found to be rooted in the physical functioning of chemical and electrical reactions in the brain. Because of this, the following questions have been raised:

if the mind/soul and the physical/body are truly different substances, how do they interact with one another?

for Christians, how does a nonphysical spiritual God in the person of the Holy Spirit interact with the physical human brain? and

how do we interpret accumulating research studies that demonstrate the spiritual and psychological effects of localized, physical damage to specific areas of the brain?

In addition to the implications for neurology and psychology, these questions also have implications for educators as we make decisions about the curriculum and the pedagogy in our classes. Examples of how these questions are entering into the mainstream of educational thought are the presentations at education conferences. At the February 2007 *Learning and the Brain* conference, noted cognitive psychologist Michael Gazzaniga posited that the brain determines the mind and the brain is a physical entity. His a priori assumption is that the physical world is determined, so therefore, our brains must also be determined. If our brains are determined, and the brain is the necessary and sufficient organ that enables the mind, then we are left with the question: Are the thoughts that arise from our minds also determined? (Gazzaniga, personal communication, 2007; Gazzaniga, 2005). At this

same conference, Daniel Siegel defined mind as “an embodied and relational *process* that regulates the flow of energy and information” (personal communication, 2007). Gazzaniga iterated these conceptions of brain and mind into other key ethical questions such as stem cell research, abortion, and euthanasia, each of which delves into the definition of what it means to be a human person. Obviously, this line of thinking would greatly influence our conception of the educational system as a whole, our view of the human persons we are teaching, and our belief in the teacher’s ability to influence the lives of children and youth and in what ways.

Monistic Views of the Human Constitution

To address these questions of interaction, as well as to take into consideration neurological research, a different view of the human constitution is growing in popularity among Christians and non-Christians, as evidenced by Gazzaniga’s comments above. Monistic perspectives of the human constitution have mounted, attempting to provide an explanatory framework for current neuropsychological discoveries in ways that a dualistic view appears to fall short. A monistic perspective states that humans are constituted of only one element and it is physical, or material. This complex material substance generates the abilities, thoughts, states, personality, values, goals, will, etc., that we have come to know as humans. As such, any deficiencies or idiosyncrasies or even diseases that are expressed through these mental states can be addressed and/or resolved through the physical. Therefore, the conclusion of monism is that there are no mental states; there are only brain states. This position has been labeled *eliminative materialism*, *reductive physicalism*, or *ontological reductionism* (Corcoran, 2005). All thoughts, perceptions, goals, and values can be reduced to the firing of neurons and the connections established between them. In his recently published autobiography, Nobel prize-winner in the category of physics and/or medicine, Eric Kandel describes his discovery of the process of learning and memory, which is indicative of the research which supports the monistic position. His research with the *Aplysiastail*, chosen because of its large and comparatively small number of neurons, established physical evidence for neural connections that are made, reinforced, and networked in the processes called “learning and

memory” (Kandel, 2006). Kandel reports the chemical exchanges between neurons communicate what we interpret as information and the important role of proteins in bonding a connection between these neurons that increases the likelihood that these neural pathways will be used again the next time these same, or similar, stimuli are present. In addition to “learning,” Kandel also described the biological, neuronal explanations for habituation and extinction of behaviors, mental states, and thought patterns (Kandel, 2006).

These fairly recent rapid advances in the study of the human brain within neuroscience, neuropsychology, and clinical neurology are making it increasingly hard to find a realm of human thought, action, or experience that is not the product of, or very strongly influenced by, the activity of identifiable neural systems (Brown, 2004). Research in neuroscience raises the possibility that the concept of a separate, immaterial soul is unnecessary with respect to understanding human life and experience, and monism offers an alternative to body/soul dualism that accommodates a greater resonance and harmony between theology and neuroscience.

Unlike educators who hold a traditional dualistic perspective of the human constitution, a reductive physicalist approach is not concerned about the eternal nature of the soul as a separate entity from the brain because there is no such thing. The educative concern here is with ensuring the normal functioning of neuronal activity which includes, but is not limited to, speed of neurotransmission, activation of appropriate neural sites, and proper connection and associations of neurons and neural networks. Increased usage and availability of recent technologies, such as PET scans and fMRIs over time lend themselves to be used as scientific assessment methodologies to determine whether a gain in students’ cognitive processes has occurred and is within the “acceptable” or “normal” range. Educators would identify and agree upon premium brain functioning, and this premium brain functioning could, then, be objectively measured and in an ideal world be synonymous with “student achievement.”

When particular circuits in the brain (i.e. interconnected neurons, groups of neurons, and clusters of groups of neurons that form specific pathways and systems of the brain) are activated,

various mental pathways are constructed. The brain creates a “neural map” or “neural net profile” – a specific pattern of neural firing in particular regions – that serves to create a “mental image,” such as a sensory image or the linguistic representation of a concept or object. The term “representation” is sometimes used to refer to a neural map or to a mental image that serves as a symbol for something. At this point in the history of science, as noted neurologist Antonio Damasio states, we do not yet know exactly how the brain “map” creates the “image” (1999). Cognitive neuroscientists generally agree, however, that it is the particular clusters of neurons firing in a specific pattern that, somehow, creates the experience of mind (Siegel, 1999). Andrew Brulle, colleague of mine, and I joke around about the old idiom, “Boys and girls, let’s put on our thinking caps,” and wonder if a day will come when students actually will wear a headpiece in the classroom to monitor brain activity, which would be displayed on the instructor’s computer to help him/her determine which students are more actively engaged in learning.

Monism has typically been associated with *reductive or eliminative materialism* and *determinism*, both of which are difficult to reconcile with the Christian faith, and which may be antithetical to the Christian faith. In his book titled *The Astonishing Hypothesis: The Scientific Search for the Soul*, Nobel prize winner Francis Crick states that “all our thoughts, behaviors, and feelings are the result of chemical and electrical activity in the brain and related neural structures” (Crick, 1994). Crick’s premise continues to be advanced by current neuroscientists, such as Antonio Damasio (1994, 1999, 2003), Stephen Pinker (1997, 2002), and Richard Dawkins (1989, 1996, 2006), all working to persuade us that we are nothing more than the results of chemical and electrical activity within the brain.

For example, in response to Harvard’s Committee on General Education suggestion that students take courses under a “Reason and Faith” requirement, Stephen Pinker stated that this was a scandal. “Universities are about reason, pure and simple,” he trumpeted. “Faith—believing something without good reasons to do so—has no place in anything but a religious institution, and our society has no shortage of these. Imagine if we had a requirement

for ‘Astronomy and Astrology’ or ‘Psychology and Parapsychology.’” To give such significance to religion “is to give it far too much prominence.” After all, religious belief “is an American anachronism, I think, in an era in which the rest of the West is moving beyond it.”

In the recent New York Times bestseller, *The God Delusion*, Dawkins states that the premise of his text is to dispel the God Hypothesis that “there exists a superhuman, supernatural intelligence who deliberately designed and created the universe and everything in it, including us” (p. 31) and propose instead an alternative: “any creative intelligence, of sufficient complexity to design anything, comes into existence only as the end product of an extended process of gradual evolution” (2006, p. 31). In his book, Dawkins uses scientific research in neurology to support his theory that God was created by humans and not vice versa, and then claim that this belief is destructive to a civil society.

Historically, Christian reaction to this claim has been to defend the Christian faith by stating that science did not have all of the answers and that God is to be found among the gaps in our knowledge, with the naïve belief that these gaps would never be completely filled in. Because research in the neurosciences was uncovering data about the material substance, some Christians believed that the realm of science was restricted to the physical and therefore would not cross over into the cognitive, psychological, or spiritual. Francis Bacon, for instance, insisted that what he called the ‘providential ordering of nature’ was all due to God, however successful we might be in tracing the patterns of physical causes in each case.

Noted scientist Donald MacKay warned against attempting to defend a substance dualist perspective on the basis of the gaps in discovery (1974). Part of MacKay’s reasoning was that the defense of the Christian faith should not be grounded in a *lack of evidence* but instead should engage scientific evidence from the Book of Nature and compare this with what is found in the Book of Revelation, the Holy Scriptures. This lack of intellectual engagement has also been noted by Mark Noll in *The Scandal of the Evangelical Mind* (1995). This call to intellectual engagement of the Christian faith with the world is also shared by contemporary scientists, such as John Polkinghorne and Francis Collins.

A different monistic perspective, *nonreductive physicalism*, claims that humans are only one substance, which is physical. However, this nonreductive physicalism distances itself from eliminative materialism by stating that mental events do exist; they are just dependent upon lower level brain activities, thereby creating a hierarchy between mental and physical activities (Struthers, 2005). In *Whatever Happened to the Soul? Scientific and Theological Portraits of Human Nature*, Brown, Murphy, and Malony explore the possibility of maintaining, within both science and Christian theology, a particular version of monism: *nonreductive physicalism*. This position admits the biological nature of humans (physicalism), but the “nonreductive” qualifier contends that conscious decisions and will are real phenomena that are effective in exerting a top-down (or whole-part) causal influence on the neurophysiological processes of the brain.

Accepting this position of nonreductive physicalism, the “soul” is a feature of physical existence, not an additional immaterial essence. Humans *are* bodies – they do not *have* bodies; they *are* souls – they do not *have* souls. It should be made clear, however, that the standpoint of nonreductive physicalism does not deny the theological position of a Biblical distinction between the material world and a nonmaterial Creator or God, which is a different kind of material/ nonmaterial dualism. Rather, nonreductive physicalism suggests that *human persons* are creatures that are cradled within the corporeal world. The line that separates the material and the immaterial does not divide the human person into parts.

Nonreductive physicalism, however, is not without its critics. One criticism is that with any form of physicalism, causal reductionism is inevitable. In his article entitled “The Myth of Nonreductive Materialism,” Jaegwon Kim (1994) argued that mental properties will turn out to be reducible to physical properties unless one countenances some sort of downward causation. But if top-down processes are demonstrated, the downward efficacy of the mental would suggest an ontological status for the mental that verges on dualism.

Nancy Murphy, a noted proponent of nonreductive physicalism, responded to this critique by suggesting that Kim’s conclusion is inevitable only

within his definition of how the mental might supervene over the physical. In proposing a limited understanding of possibilities of such supervenience, Murphy claimed that Kim ignored the hierarchy of complexity in biological systems, including the fact that patterns of information that exist only within larger systems have top-down influence on more microscopic entities (1999). The main argument here being one of interaction between an immaterial, spiritual Being and a physical, material person or soul.

Another concern about the monistic view of the human constitution is expressed by Donald MacKay in his term “nothing *buttery*” (1974). This phrase pares down positions which begin with the phrase, “all of this is *nothing but . . .*” He stated that “nothing-*buttery*, or ontological reductionism, is characterized by the notion that by reducing any phenomenon to its components you not only explain it, but explain it away” (MacKay, 1974, p. 43). MacKay continues by commenting that

[O]ur problem is not that we take too high a view of God but that we take too low of one. If God creates the whole of our drama – its past, its present, and its future – it is not at all surprising if when we study man’s past scientifically we find it a coherent whole at the levels of biology and physics. The phrase “nothing but”, though, is ambiguous. . . . [N]obody objects to the claim that an advertising sign is “nothing but” lamps on a board unless the claimant imagines that on this account he has debunked it. Another example is considering that a *No Smoking* sign was *nothing but* ink on a page. If he claims that it has no claim on his attention as a message, he is talking nonsense. The phrase “nothing but” all too often betokens an attempt to obscure the point of a situation that makes an inconvenient claim. Christians as such have no justification in Scripture for postulating any sort of barrier to the progress of brain science. (p. 43-44)

Although Murphy and other nonreductive physicalists claim that they are avoiding this pitfall through the admission of a supernatural force interacting with the physical functioning of the brain, which, in turn, determines the nature of the human being, they ultimately leave the personhood of the human dependent upon nothing but the physical functioning of the matter within the skull.

Finally, one other difficulty with the monistic position has been addressed by John W. Cooper in *Body, Soul, and Life Everlasting* (1989). The problem lies with the intermediate state, or what happens to the person when the body dies. In Cooper’s carefully wrought argument, he analyzes both the strict substance dualist position, as well as the monistic position, in any of its forms – including ontological reductionism and nonreductive physicalism. The problem, as he states it, is that if one is a monist, one must believe that the body and the person cease to exist – in any form – at the time of death, and that there is no assurance of personal identity in the resurrection, for with a new resurrection body, there is no guarantee that the personal identity of the new physical body is that of the old person in the old, unregenerate body (1989). If one is a strict monist, with regard to the resurrection, any reworking of the physical material must also entail a change in the person, since the person is a result of the physical functioning of the brain/body. Therefore, the monistic position is in contradiction of an intermediate state and is questionable with regard to a resurrected person. Scriptural evidence, however, tells us that we will be resurrected with Christ (1 Cor 15), that Paul desired to be with Christ which meant to be apart from the body (Phil. 1:21-24), and that the Saints are under the altar in Heaven in some type of recognizable form, eagerly awaiting the final judgment and rule of Christ on earth (Rev 6:9-11).

A Christian educator who holds a monistic perspective of the person would place greater emphasis upon the physical brain structure and changes that occur in the process of learning, inclusive of cognitive, emotional, psychological, and other types of learning that occur within the school day and beyond. The so-called “spiritual” emphasis would be either greatly reduced or nonexistent because the soul is not defined as a separate entity to be developed and shaped but instead is inherent in the biological functioning of the brain. Therefore, when the brain is physically altered as a result of learning, the spiritual is automatically influenced and changed. There is no need for separate attendance because there is only one nature (*monistic*) as opposed to two (*dualistic*).

Holistic Dualism

A third view of the human constitution, proposed by John Cooper, must be considered, one which values

the scientific discoveries of our age but does not bow down to them, and honors the inerrant Word: holistic dualism. Cooper's conclusion is that the monistic position is untenable because its voice contradicts what we are told in Scripture and does not admit an intermediate state or recognize that the human person lives on in any form after the death of the body (1989). He also does not support a strict substance dualist position because of the identified interconnectedness between our body and our person.

He arrives at the conclusion that one must be a dualist, in some form, if one believes in the resurrection and a continued personal existence with Christ throughout eternity. However, this continuation of personal existence, or "soul" if you will, is not the same as our existence in our temporal state, but a minimal type of existence, which allows for our personhood to continue beyond the death of our bodies but not to have the full functionality until the resurrection, when we will be given new bodies and retain full and enhanced functionality. Cooper states that the biblical view of human nature is both holistic – emphasizing the religious, phenomenological, and functional integration of life – and dualistic – asserting that persons are held in existence without fleshly bodies until the resurrection (1989).

This position of holistic dualism is also asserted by philosopher C. Stephen Evans, who names it "minimal dualism" (1981). He clarifies a distinction between substance and function and between "separate" and "separable:"

"Separable" is a possibility word: hence this distinction involves the difference between what is the case, and what could be the case. Two things which are separate in some manner or other exist independently, though of course they may be interdependent in any number of ways. Two things which are separable do not necessarily exist independently. However, they are still "different" in the sense that they *could* exist separately in some sense of the word "could." . . . Minimal dualism is the claim that human souls (understood as selves or persons rather than as parts of persons or selves) and human bodies are related in the following way: *the soul is functionally separate from the body, but as a substance, it is only separable.* (Evans, 1981, p. 314).

If the view of the Christian educator is that of a substance dualist, emergent dualist, or nonreductive physicalist, the consideration of mental events that are not deterministic in nature but are controlled by forces that are either a substance separate from the physical, or have a causal relationship with the physical, will in turn allow for the view of a whole person and a bigger picture of the eternal significance of that person. It is important that Christian colleges and universities present these perspectives to our candidates as we prepare them to become educators with a Christocentric worldview, not one that denies science or intellect but one that values the Truth of Scripture and Christ.

Preparing Teachers with a Christian Perspective on Learners

As Christian educators, then, we are at a crossroads: the dualist position, which emphasizes the separate, eternal soul of the person from her body, would support a focus upon the necessity of teaching individuals for the purpose of Life beyond the temporal, which is far more important than the brief temporal existence here on earth, yet it appears to be in conflict with much of what is being discovered by the scientific community. The monistic perspective, which identifies the physical processes of the brain as defining personhood, provides reasoning and explanation for the scientific findings, with the nonreductive physicalist position providing space for a supernatural influence which is outside of the physicalist functions. However, neither the strict monistic nor the nonreductive physicalist position accounts for an intermediate state of the person and the promise of the resurrection of the individual, but the holistic dualism position does.

For the Christian educator, thinking carefully and clearly through these arguments is vital, especially for those who prepare Christians to teach in whatever field they are called: public or private schools, missionary schools, international schools, or any variety of schooling options available today or designed in the future. The work that we do influences the knitting together of the person and the development of identity, and in looking at this through a holistic dualism perspective, the learning that occurs in our bodies affects the spiritual nature of the learners as well. It is this personal identity which is formed that will live with Christ through a

resurrected body. Therefore, experiences play an important role, with educators playing a significant part in child and adolescent development. According to David Jones in Malcolm Jeeves' *From Cells to Souls – and Beyond: The Changing Nature of Human Persons*, “the organization of the brain is as much dependent upon soft wiring (influenced by the environment) as upon hard wiring (built in genetically). As the brain develops, the final form of its synaptic connections and neural networks depends as much upon the environment as upon what is laid down genetically. In other words, the environmental influences are not mere afterthoughts or unimportant peripheral add-ons; they are essential for the final form of any brain” (p. 26).

In her chapter on psychology and the brain-mind debate, Van Leeuwen states that “in the intermediate state, persons continue to function as selves without their earthly bodies; at the resurrection, Scripture implies, they will be *more* than their earthly bodies – “glorified bodies,” in fact” (1985, p. 105). While we are clothed in our temporal bodies, we are of one substance; however, our soul is separable at the time of death, but does not become separate until that time. Since we are of one substance in our temporal bodies, our efforts as educators matter a great deal both in the here and now *and* in eternity.

Research in cognitive psychology provides a glimpse into how this influence can span the temporal and the eternal. Perceptual processing has both a bottom-up and top-down interaction which provides evidence of the oneness of the body and soul. Information is fed into our brain through our senses, and we are limited in our interpretation of the world based upon the sensory input that arrives. This is bottom-up perception. However, a second wave is also at work all the time, and this is the top-down perception. Individuals interpret their world based upon the mental framework, or schemata that have been constructed. As most good educators already know, when new information, or learning, is presented, the learner needs to connect it to her own mental frameworks, or gain assistance in changing these frameworks to accommodate this new experience. As information is fed into the brain, the brain is seeking to make connections with what it already knows about the world and interpreting the incoming data to give it meaning. If

there is no connection between incoming data and existing physical brain structures, the possibility of the information being discarded is great, unless the information is repetitive, interesting, or threatening. Once these structures have been altered to perceive this type of incoming data, an individual's interpretation of future experiences has changed (Smith & Kosslyn, 2007).

What we are as persons is not set indelibly in stone at some early stage in our lives. We are able to change far more than once thought, and while neurological research has as its principal goal clinical recovery following disease or injury, it also touches on fundamental issues of personhood. How we perceive our world is a combination of what we receive from our senses and the beliefs, goals, values, and expectations that are used to interpret and give meaning to the incoming data in order to make sense of it. These beliefs, goals, values, and expectations are developed through the exposure to experiences, and through experiences, the wiring of the brain, then, affects our perception of our world.

Made in the image of God, we are relational beings and our identity is not to be found solely in the physical structures of who we are, but is ultimately to be found in our relationship with God and His Christ. In his well-known text, *On the Incarnation*, Athanasius presents the argument that Jesus Christ was 100% man **and** 100% God (1993). John Stott echoes this mystery of Christ through a brief history of the early councils and the establishment of Christ as the God-man (2001). The first council, The Council of Nicaea in 325 A.D. was called to answer claims from Arius that Jesus was not God, was not eternal, and had a beginning that was separate from God's eternal existence. The Council issued a creed which affirmed that our Lord Jesus Christ was “begotten and not made,” “of the same substance with the Father” (Stott, 2001, p. 89). The second council, the Council of Constantinople (381) was convened to answer Apollinarius, who denied that Jesus had a human mind or soul. The council then affirmed that Jesus was fully human, which led to the third council, which addressed the question of how He could be one person if Nicaea claimed He was God and Constantinople claimed He was human. The language discrepancy was between Jesus the man being “indwelt” by the Word of God as opposed to the “incarnation” where the Word actually became flesh, uniting Himself fully with

human nature. The final council addressed the issue of the nature of Christ: one “divine” nature, or two, “divine nature” and “human nature.” (Stott, 2001). Stott notes this paradox and claims that as finite, fallible humans, we must realize that God is altogether beyond us and that “the incarnation is a mystery we shall no doubt continue to explore throughout eternity” (p. 91).

In applying these words to the question before us, that of our composition being bodies or souls, could we approach this question with the following logic: Jesus Christ is 100% God. Jesus Christ is 100% man. Incarnate God is both spirit and flesh. Humans are created in the image of God. The image of God involves the whole person, in relationship to God. This is a mystery. “Physical”, “mental”, and “spiritual” are complementary categories, all of which are embraced by the totality of what it is to be human.

It is with this view of the mystery of human personhood that Christian teachers and teacher educators should approach their task and their calling. Many people desire a religion that is only for the “soul,” a religion that separates the spiritual realm from the body and matter. But for the Christian, the Son of God became man, complete with a material body. Because of Christ, the human body of the Christian becomes a temple of the Holy Spirit, a spiritual body, after conversion and because of the indwelling of the Holy Spirit. For persons who have yet to receive the gift of the Spirit, a unity still exists between the body and the separable soul. Christianity considers the body as a whole, for God has created life and promises continued unified embodiment on the last day of the general resurrection.

Research in the realm of neuropsychology continues to bombard educators and future educators with information about the functioning of the brain and their responsibility to know how it works in order to be able to teach children and youth well. I agree that this knowledge and understand is important, or I wouldn't include a neuroscientific perspective on what it means “to learn” in my sophomore level course nor would I be teaching a graduate level course which investigates the link between the function of the brain and the process of education. The call to Christian colleges and universities to prepare future educators who can examine neuropsychological research through the

eyes of Christ is important. The popularized scientific perspective that human personhood lacks a “soul” (Dawkins, 2006) needs to be shared in order to present a case for the importance of educators who are Christians and who see the connections between the physical substance of the brain and the eternal life in Christ.

Christians, then, must acknowledge that there is a relationship between the physical changes in the matter of the brain which affects the functioning of the mind, including values, beliefs, ideas, and goals. This process occurs through the various experiences we have throughout our lives, which then changes the physical substrates of our brain, which in turn alters our perceptions of the world and the attitudes and approaches therein. Taking a new look, then, at Romans 12:1-2, brings about a more concrete reality of God's design of humans: *Therefore, I urge you, brothers, in view of God's mercy, to offer your bodies as living sacrifices, holy and pleasing to God – this is your spiritual act of worship. Do not conform any longer to the pattern of this world, but be transformed by the renewing of your mind. Then you will be able to test and approve what God's will is – his good, pleasing and perfect will.* A renewed and transformed mind affects our spiritual ability to approve and test God's will for our lives and this is a spiritual act of worship.

As we encounter new experiences and view them with the transformed, renewed mind of Christ, our physical bodies are neurologically transformed and the renewed perceptions we now have about our world become more Christ-like because our neurological pathways have become altered. This physical alteration is a living sacrifice to a holy and pleasing God and is our spiritual act of worship. With this renewed perception, we now can test future experiences and better discern the will of God, which we recognize as good and pleasing. The spiritual disciplines, such as corporate worship, prayer, meditation, Scripture reading, as well as the classroom experiences of sharing, demonstrating love to our classmates, and comprehending the Milky Way all become ways that we alter our experiences as well as our physical brains which in turn enhances our ability to have the mind of Christ. It is no wonder, then, that Christ's statement that some could not understand His words, even though they heard them, are true (Mark

8:17-18); the neurological structures within their brains could not perceive them as anything intelligible. Once one comes to acknowledge Jesus Christ as Lord and Savior, other Scriptural teachings become understandable and clear.

The discipline of education involves a student's cognitive processes and a teacher's attempts to intentionally alter them in clearly defined ways, traditionally called "teaching and learning". With recent advances in neuroscience, the biological identification of ways that the brain is physically altered as a result of learning is becoming more clearly understood. Recent theological research has examined the connection between the physical matter of the brain with the eternal substance of the soul, with several perspectives posited from the retention of a Cartesian dualistic perspective to a monistic view, or nonreductive physicalist perspective, and a consideration of holistic dualism. These intertwining connections between the brain and the soul become foundational to the calling of a Christian educator. With various experiences, including those that are spiritual, the brain is physically altered and therefore perception of the world and future experiences are also altered. The possibility of the altering of the soul as a result of the physical changes in the matter of the brain must be considered. The role of a teacher, then, is much greater than instilling rote memorization of facts about the world, and even greater than enabling the methods of critical thinking and analysis in his/her students; it is quite possibly changing the brain, the life, and the soul of each student. The Wheaton College Department of Education's conceptual framework of *Teachers as Agents of Change* and the College's motto *For Christ and His Kingdom* become physically concrete objectives for our present and future educators.

In *The Abolition of Man*, C.S. Lewis warns against the separation of the human element of personhood and the inception of a mechanistic model (1947). Although Lewis was not a prophet, ontological reductionism of neuropsychology is a step down the pathway to the abolition of man. When we seek to grow in our knowledge in order to control Nature and to control Man, yet remove our adherence and respect for what Lewis terms *Tao*, or ultimate Value and understanding of the Good, we are working toward the abolition of Man. The key

to preventing this is to remain deeply entrenched in *Tao*, or the recognition of the headship of God and His Christ, as we investigate the complexity of His designs in the Human Being and prepare future educators to do the same. This is the value of the preparation of teachers at Christian Colleges and Universities and to which I for one am committed.

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All Scripture references are taken from the New International Version of the Holy Bible.

One of the bioethical considerations that has arisen is the effect upon normal functioning individuals taking stimulants which were designed to treat disorders such as AD/HD and Alzheimers. These drugs enhance their ability to focus and attend to information, and research has documented increased SAT scores for individuals who have taken Ritalin prior to test administration as compared to those who had not (R. Sapolsky, personal communication, February 2007). Some of the ethical considerations include whether individuals such as pilots, surgeons, and air traffic controllers should be taking stimulants to help decrease error which is caused by lack of attention or focus upon the task at hand.

Recent studies in attention are able to measure students' active engagement in the material during the learning process of encoding, which has been identified with stronger ability to recall information (Smith & Kosslyn, 2007).

Dawkins more directly claims that the human being is really just a carrier for the progeneration of DNA (*The God Delusion*, 2006, p. 3)

Cooper's close and careful analysis of both the dualist and monistic positions in comparison to Holy Scripture is second to none. He finally arrives at the position of a holistic dualism, and while this paper does not enumerate his argument, this text is recommended for those who are interested in experiencing the logic of his conclusions.

This passage states that the "souls of those who had been slain" were "given a white robe," alluding to them having some form of physical body, although possibly not in the fullest form. John also states that he "saw" the souls but not that he "saw" people.

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