

Study Guides for Faith & Science Integration

Summer 2017

Is Christian Theology Threatened by the Development of Neuroscience? (Leader's Guide)

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Recommended Citation

Eppinga, R., Huizinga, A., & Marcus, L. (2017). Is Christian Theology Threatened by the Development of Neuroscience? (Leader's Guide). Retrieved from https://digitalcollections.dordt.edu/faith_science/11

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Leader's Guide to

Is Christian Theology Threatened by the Development of Neuroscience?

*A Study of *Touching a Nerve: Our Brains, Our Selves**

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Summer 2017

How to Use This Material?

This study of how we understand neuroscience and neurophilosophy using Patricia Smith Churchland's *Touching a Nerve: Our Brains, Our Selves* is composed of 5 modules. Each module contains a set of guided reading and discussion questions for each chapter, as well as important terms that may be present in the assigned chapters for that module. The Reading and Reflection questions that are to be completed before each meeting and are meant to help the participant wrestle with the concepts introduced in those chapters. The questions are meant to foster discussion, but your group should by no means limit itself to the questions contained in these sections.

This study is intended for **informal, small group** discussion, such as that of a Bible study or small group. The themes presented in each submodule may be unpacked on its own, but it is the hope of the authors that the entire study may be useful to the interested reader (leader and participant alike). The study is also aimed toward **high school students, college students, and post-college adults** with an interest in how science and the Christian faith interact.

As you read, it is our hope that you will come across (and come up with) questions which challenge you, both in understanding your personal faith and in understanding science. In these questions, you will have the opportunity to grow through asking and answering these questions: Why has the church historically believed in this answer or that answer? How might you be challenged to defend your answer?

Planning and Preparing for a Session

The material assumes that each session will last for about 30-45 minutes. It also assumes that each participant will have read the assigned chapter(s) and considered the Reading and Reflection questions ahead of time.

It must also be noted that the provided discussion questions are intended as a guide for your discussion, but you should by no means restrict your discussion to these questions. Try to keep your group's discussion relevant to the general themes addressed in the module, but be flexible.

Equipped for Service

This "Leader's Guide" is meant to **equip leaders** of these small group discussions, and thus the following pages are far more detailed and expansive than the average participant may judge necessary for complex discussion. We offer information from other references and suggested answers to questions posed in the text. This has been done in the hope that you, as the leader, may more easily facilitate and moderate discussion amongst your peers in the small group. Your small group may be made up of the generation that initiates change in how the common Christian comes to understand these questions and answer – in the service of your peers, do not underestimate your own significance as a leader or co-leader.

Who is the author of *Touching a nerve*?

Patricia Smith Churchland is a Canadian-American professor emerita of philosophy at the University of California, San Diego (UCSD), where she has taught since 1984. At the time of publication of *Touching*, she was also the recipient of a MacArthur Fellowship. She is often noted for her contributions to neurophilosophy and the philosophy of mind.

Read more about the author at <http://patriciachurchland.com/>.

Note: Churchland is not a Christian. While you read, you may be challenged by much of what she says. However, keep in mind that faith and science are both ways in which God reveals His truth to His people, and thus there should be no conflict between the two. Due to sinful humankind's potentially fallible interpretations of Creation and Scripture, we sometimes struggle to mesh these two perfectly (and Churchland is often quick to recognize and criticize those problems, both in past and present interpretations). Just because we cannot always understand doesn't mean that we shouldn't keep asking tough questions of both faith and science in order to challenge ourselves as readers and human beings. Young-earth creationist readers will also note that throughout this guide, as throughout the book *Touching a Nerve*, the mechanism of evolution is assumed (a Christian might argue the same, through the lens of evolutionary creationism, but that is not meant to be the emphasis of this particular study guide).

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Module 1: Neurobiology and Identity

Chapters covered: "Me, Myself, and My Brain" and "Soul Searching"

"Me, Myself, and My Brain"

1. In this first chapter, Churchland raises several questions that might be troubling readers as neuroscience continues to develop. "Is neuroscience going to tell me I do not know who I am? Should that bother me?" Have you ever wondered about such questions before? Did you have such questions in mind when you first picked up this book or this study guide? Explain your answer.

2. As is obvious, Churchland believes that in neuroscience, more knowledge is always a good thing. Do you agree? Is *not* knowing ever more valuable than knowing? Is any kind of knowledge ever to be considered "forbidden fruit, a Promethean fire, a Pandora's box, a Faustian bargain, an evil genie released from a rightly sealed bottle" (13)? Why or why not?

3. Why did the cardinals of Galileo's day show a "Deep resistance to [the] knowledge" which Galileo sought to prove? Why did Harvey's colleagues decry his findings?

Suggested Answer: "The general answer is that they cared because of what they believed about the physics of the universe... This cosmology was derived from biblical text... A specific, long-held worldview was fundamentally challenged, and the challenge generated fear of what might replace that worldview... If you believe something to be absolutely certain and foundational, it is profoundly shocking to find that your 'truth' may be mushy, or worse, quite likely false" (14-15). Harvey's discovery of the heart as a muscular pump told a very different story than that which was conventionally accepted. In response, scientists of the day decried his findings in favor of what Churchland calls "the familiar strategy of *let's pretend*. Let's believe what we prefer to believe." Harvey challenged "a whole framework of thinking," and that made it dangerous for the science of the day.

4. Churchland writes, "Religion could either drop dogma and go with science, or religion and science would move apart" (16). Why is this a frightening choice? Are these the only two answers to the question of perceived conflict between religion and science?

5. Think about the last scientific hypothesis or claim that you heard. E.g., "free choice is an illusion, "the self is an illusion," "love is just a chemical reaction" (19). Consider more recent claims circulating the internet today: "drinking tons of coffee is actually good for you," "one glass of red wine every day is healthy," "certain vaccines cause autism," etc. How well-supported were these claims? Did you find yourself questioning how much of what you heard and saw was marketing and manipulation?

6. Is realistic optimism a vice (23)?

7. How does the author argue that mechanism is more comforting than magic?

Suggested Answer: Churchland argues that the apparent comfort of ignorance which magic upholds often evaporates when something goes wrong. That is, we like to think the world is beyond our influence and control, but the reality of a world beyond our understanding is actually a terrifying one, whereas a world of mechanism and natural laws is something we can grasp hold of.

8. What are the values in studying science (and neuroscience in particular) which the author advocates on page 32?

Suggested Answer: She writes, "...although much is still unknown about the nervous system and how it works, what *is* known begins to free us from the leaden shackles of ignorance. It makes us less vulnerable to flimflam and to false trails. It grounds us in what makes sense rather than in the futility of wishful thinking. It adds to the meaningfulness of life by enhancing the connections between our everyday lives and the science of how things are. Harmony and balance in our lives are deepened and enhanced by that connectedness."

"Soul Searching"

1. What are the pros and cons of the map analogy (34)?

Suggested Answer: The map, like the neural model, may not *resemble* all aspects of the features it describes, but it does “constitute a *representation*” of those features in the environment; the brain, too, models aspects of the external world and in so doing creates “the informational structure that allows us to interact productively with things in the external world.” Thus, it makes sense that different species of brains have evolved to map their worlds (environments) differently, mapping only what is relevant to the survival of the animal and only to the degree of detail that is necessary. The map is spatially a faithful model. However, a map is separate from the body of someone using it, while the brain is not. The brain *is* the person examining the neural organization model. Additionally, while human cartographers design maps, no human designer played a part in the brain becoming what it is today.

2. Why is it problematic to state that "The 'designer' of brain organization is not a human cartographer, but biological evolution" (35)? Without delving into the debate on evolution, what assumptions are made by the author's statement?

Suggested Answer: The author assumes the non-existence of a guiding force behind biological evolution, such as the higher power of a Creator. Using the word "designer" is dangerous because it deliberately replaces a Creator (an "Intelligent Designer") with a process (biological evolution). The Bible tells us that God created and sustains such processes; He upholds nature, including the inner workings of nature, and the evolutionary creationist would argue that God could certainly have used such a process as biological evolution. You cannot under any circumstances *replace* God with science, although science should be used to explore and explain His Creation.

3. How does a naturalist differ from a supernaturalist (45)? Which of the two do you consider the author to be? Which of the two do you consider yourself to be?

Suggested Answer: A naturalist seeks explanations for how things work by searching in the natural world. A supernaturalist looks for explanations beyond the mortal, physical realm. The author is certainly a naturalist.

4. How does Churchland describe Christian dualism? Although her bias is evident, is her description accurate?

5. To which two functions did Descartes limit the control of the brain? What was his conclusion about all mental functions (48)?

Suggested Answer: Descartes limited control of the brain to two basic functions: 1) executing movement commanded by the soul, and 2) responding to external stimuli, such as a touch to the skin or the light entering the eye (pg. 47). He concluded that all mental functions— “perceiving, thinking, hoping, deciding, dreaming, feeling” —all are the work of the nonphysical soul and *not* the brain.

6. Why might a Christian find it problematic to say that "In principle, a dualist could experimentally work out the details of a soul theory, finding out how souls work and what their properties are. Hypotheses could be tested. Experiments could be run. In principle, there could be a natural science of the soul... In practice, however, there is no natural science of the soul... as things stand, brain science seems to have the leg up on soul science. This suggests that soul theory is floundering because there is no soul" (52-53)? Compare this perspective to Hebrews 11:1 in any Bible translation of your choosing.

Suggested Answer: Churchland doesn't seem to believe in anything that cannot be explained scientifically, with physical evidence. This opinion directly contrasts Hebrews 11:1, that "Faith is the substance of things hoped for, the evidence of things not seen." Interestingly, despite the fact that a demand for the physical evidence behind any statement denounces the concepts of faith and the soul, the existence of faith and the soul would not and do not make science any less valuable.

7. "It hardly needs noting that it is preposterous to infer that something is *unknowable* simply because it is not known—especially when the science is in its very early stages" (57). Considering the claims Churchland has already made on page 55, is this a hypocritical statement? Why or why not?

8. Is there anything from the last two chapters that you have not understood and would like to discuss, or anything that you find particularly surprising or interesting and cannot help bringing up?

Terms

Orchard run: fruit that has been picked from the tree and shipped from the orchard before it is "prettied up" for the supermarket; apples may vary in size and color and may have marks from branches or hailstones; they are unpolished but tasty (25)

Coevolution: "brain equipment" has evolved to match "body equipment" and vice versa; they evolve together (co-evolution)

Saccadic: involving rapid movement of the eye between fixation points

Resolution: the degree of detail

Abstract: existing in thought or as an idea but not having a physical or concrete existence

Causal: relating to or acting as a cause

Somatoparaphrenia: a condition in which subjects with damage to the parietal cortex of the right hemisphere may believe that limbs on the left side, such as an arm, do not belong to them

Efference copy: movement signal copy distinguishing my movement from external movement (a *copy* of the movement signal that goes to other areas of the brain, such as the visual cortex, which is sent in order to tell your brain that you, not something in the world, is moving)

Fusiform: a very specific place in the cortex which, when damaged (such as by a stroke), causes a person to lose the capacity to recognize a familiar face

Consilience: the condition of fitting with the rest of the body of knowledge

Neurons: (nerve cells) a specialized cell transmitting nerve impulses

Cartesian dualism: the particular brand of dualism advocated by Rene Descartes and his followers

Fundamental element: a building block of the physical world that cannot be broken down into further elements; people used to believe that earth, water, fire, and air were the fundamental elements or *building blocks* of reality and could not be condensed any further

Savasana: ("Corpse Pose") a pose usually done at the end of a yoga practice in which practitioners lie flat on their backs with the heels spread as wide as the yoga mat and the arms at the sides of the body, palms facing upward

Module 2: Heaven and Morality

Chapters Covered: "My Heavens" and "The Brains Behind Morality"

"My Heavens"

1. What is the difference between *truthiness* and truth (65)?
2. What is the "assumption" of a near-death experience (67)?

Suggested Answer: The "assumption" is that being *nearly* dead is enough to get a peek at the afterlife.

3. How would you distinguish a religious experience from a hallucination? Explain.
4. What assumptions are present in the following statement from page 71: "if heaven really awaits..."?

Suggested Answer: Churchland's assumptions with the above statement include that 1) Heaven awaits all, 2) Heaven involves tunnels and light and peacefulness.

5. Church discusses near-death experiences involving heaven, but she never mentions near-death experiences involving hell. Are there accounts of these experiences occurring as well?
6. Have you ever felt temporary paralysis upon waking from a dream? Describe the experience.

7. What do you think about the following statement: "You can love your children fully without importing that bit of silliness [miraculous divine design]" (80)?

8. In the same vein of questioning as above, respond to the following statement: "God often utterly fails to provide" (81).

9. Churchland writes, "...false optimism can end up being..." (81). How would you respond to someone who argues for faith healing over or against modern medicine? Is it Christianly to do so?

10. What is *blind faith* (82)? Should a Christian have blind faith? Why or why not?

"The Brains Behind Morality"

1. How, according to Churchland, does morality emerge (85)?

Suggested Answer: Morality supposedly emerges from "the positive feelings of humans toward courage or kindness and in the negative feelings toward brutality or child neglect."

2. Why might mammals have evolved with learning brains instead of reflexive brains (87-88)?

Suggested Answer: "Biologically speaking, it is more efficient to build brains that can learn than to build genomes that build brains with reflexes for every contingency that might crop up during life. When a brain learns, wiring has to be added... [which is] much less complex than altering a genome so that it builds a brain that can know at birth how to react in many different circumstances."

3. What does *smart* mean, according to the author?

Suggested Answer: "By *smart*, I mean they can solve problems and are cognitively flexible" (88).

4. What is the key to biological well-being?

Suggested Answer (105): "Balance, Aristotle's watch-word."

5. Which mammalian "trick" gets us both flexibility and well-honed skills (104)?

Suggested Answer: "Learning, especially by imitation, is the mammalian trick that gets us both flexibility and well-honed skills."

6. If you had been on the co-op board considering the case of Aubrey Crabtree, what would you have done? Why?

7. Churchland writes, "practices for truth-telling and promise-keeping... are a fairly obvious solution to a common social problem" (110). Do the rest of the social standards you know conform to such a pattern? Does Churchland's assertion make sense to you?

8. Do you consider yourself a moral being? Why or why not? Judging by the standards of the author, are you a moral being? Why or why not (111)?

9. Without quoting a political document, list some of what you consider to be "universal human rights." Would your answer differ from the answer of someone who lived 200 years ago? What, if anything, does this prove?

10. After reading this chapter, are you convinced that moral behavior and moral norms do not require religion of any kind? Why or why not (117)?

11. Is there anything from the last two chapters that you have not understood and would like to discuss in-group, or anything that you find particularly surprising or interesting and cannot help bringing up?

Terms

Severe anoxia: a total depletion of the level of oxygen in the tissues of the body

Coma: a state of deep unconsciousness that lasts for a prolonged or indefinite period, caused especially by severe injury or illness

Brain death: (irreversible coma) irreversible brain damage causing the end of independent respiration, regarded as indicative of death

Vegetative state: a state characterized by absence of responsiveness and awareness due to overwhelming dysfunction of the cerebral hemispheres, although autonomic and motor reflexes and sleep-wake cycles are preserved

Minimally conscious (MCS) state: a disorder of consciousness distinct from persistent vegetative state and locked-in syndrome; unlike persistent vegetative state, patients with MCS have partial preservation of conscious awareness

Hypoxia: deficiency in the amount of oxygen reaching the tissues

Hypercapnia: excessive carbon dioxide in the bloodstream, typically caused by inadequate respiration

Hyperventilation: the condition of breathing at an abnormally rapid rate, increasing the rate of loss of carbon dioxide

Vestibular hallucination: a hallucinated type of vertigo, which may consist of such diverse sensations as dizziness, disequilibrium, light-headedness, and feelings of floating or falling

Supernumerary: present in excess of the normal or requisite number

Neuro-oddities: (78) oddities of the brain for which we do not yet have complete explanations

Frontal cortex: (91) a part of the brain concerned with motor function

Prefrontal cortex: the gray matter of the anterior part of the frontal lobe that is highly developed in humans and plays a role in the regulation of complex cognitive, emotional, and behavioral functioning; an area concerned with control, sociality, and decision making

Hypothalamus: (93) a region of the forebrain below the thalamus that coordinates both the autonomic nervous system and the activity of the pituitary, controlling body temperature, thirst, hunger, and other homeostatic systems, and involved in sleep and emotional activity

Irascible: having or showing a tendency to be easily angered

Ungulate: a hoofed mammal

Neonate: a newborn child or mamma;

Module 3: Aggression

Chapters covered: "Aggression and Sex" and "Such A Lovely War"

"Aggression and Sex"

1. Does Churchland's explanation of the biology behind aggression allow for the existence of a sinful human nature? Why or why not? Can a Christian believe in a human nature inclined to sin and still be interested in the biology of aggression and the science behind that "sinful" nature?

2. Churchland asserts that transsexual tendencies are "purely biological" in most cases. How might the recognition of this (as a biological variation and not an imagined concept) affect the way Christians view and interact with their homosexual (and struggling) brothers and sisters? Might it make Christians more sympathetic to their battle?

Suggested Answer: Yes, of course it might make Christians more understanding of the (biological, mental, actual) struggles that some face, including some Christians! As an aside, if you and your small group are particularly interested in the biology behind homosexuality and transsexuality—as well as how Christians can and should be talking about these issues—consider a follow-up study on gender dysphoria or on the evolution of mankind. Two such studies should, at the time of this publication, also have been made available through the Digital Collections @Dordt.

4. What are four (or more) elements/dimensions of aggression (144-149)?

Suggested Answer: 1) testosterone, 2) balance between testosterone and stress hormones, 3) social conditions and customs, 4) the neuromodulator *serotonin*, 5) the gas *nitric oxide* which is released from neurons and dampens aggression, 6) conditional necessity of defense of offspring—vasopressin and vasopressin receptor density in males, presence of progesterone and oxytocin in females, 6) density of projections from prefrontal cortex to subcortical areas involved in aggression...

"Such A Lovely War"

1. Churchland writes, "The fewer myths we have about aggression and its origins..." (161). How can we counteract such myths today?
2. Have you ever challenged a local or social norm? How did it feel to do so? Does your experience support the author's assertion that "Speaking out or resisting... sends stress hormones climbing" (162)?
3. How does this chapter add new weight to the generic saying "If all your friends jumped off a bridge, would you?"
4. Discuss the following statement from page 166: "If prosperity were..."
5. Is there anything from the last two chapters that you have not understood and would like to discuss in-group, or anything that you find particularly surprising or interesting and cannot help bringing up?

Terms

Timorous: showing or suffering from nervousness, fear, or a lack of confidence

Deleterious: causing harm or damage

Congenital adrenal hyperplasia (CAH) : the result of an enzyme deficiency that occurs in both males and females and which can have many outcomes but could include a person with XX chromosomes but male external genitalia; a genetic condition that affects one's adrenal glands' production of cortisol and hormones such as aldosterone and testosterone, leading to one being born with ambiguous genitalia despite having normal internal reproductive structures

Module 4: Consciousness and Sub-consciousness

Chapters covered: "Free Will, Habits, and Self-Control" and "Hidden Cognition"

"Free Will, Habits, and Self-Control"

1. What offsets the high cost of mammalian dependency at birth (170)?

Suggested Answer: "...the great advantages of new kinds of learning, such as imitation, trial and error, and the ability to recollect particular events and places... also... by the increased capacity for self-control."

2. What is *contra-causal* free will? Do you ascribe to this belief, including the "assumption of a non-physical soul... a dubious assumption" (180)?

Suggested Answer: The idea that "your will (whatever that is) *creates* a decision by reason (whatever that is)" (179).

3. What, according to Churchland, is the "regular" sense of free will?

Suggested Answer: "If you are *intending* your action, *knowing* what you are doing, and are of sound mind, and if the decision is not coerced (no gun is pointed at your head), then you are exhibiting free will" (180-181).

4. Discuss this statement: "...there may be no right answer" (183).

5. Consider the belief that an immoral act is determined only "when someone has caused an injury or harmed another" (185). Do you agree? Does the Bible seem to agree?

6. On page 193, the author writes "Just as attorneys and judges need to learn..." Do you agree? Should this knowledge be introduced as a requirement for such positions? How?

"Hidden Cognition"

1. "...unless the context is ominous, two persons regularly and subtly mimic..." (195). Have you ever found yourself consciously mimicking another's body language during conversation? Consider undertaking the experiment Churchland mentions, in which you deliberately repress such mimicry. What findings do you report from such a conversation?

2. Have you ever thought about the fact that "Speaking is a highly skilled business, relying on unconscious knowledge of precisely what to say and how" (198)? Reflect on this statement.

3. Have you ever given a prepared lecture or speech with only "the gist" in mind? How about an over-prepared one? Do you agree with Churchland that one is always easier and smoother than the other?

4. Would you agree with the author that elephants, dolphins, and ravens think without language (202)? Why is this interesting?

5. The Golden Rule "relies on the assumption that all of us pretty much share the same moral perspective, that we are all morally decent" (223). Does this argument diminish the wisdom of Luke 6:31? What is the context of the verse?

6. Is there anything from the last two chapters that you have not understood and would like to discuss in-group, or anything that you find particularly surprising or interesting and cannot help bringing up?

Terms

Neocortex: (170) a part of the cerebral cortex concerned with sight and hearing in mammals, regarded as the most recently evolved part of the cortex

Trichotillomania: (176) a compulsive desire to pull out one's hair

Ticing: (181) a behavior characterized by meaningless actions referred to as *tics*

Recidivism: (191) the tendency of a convicted criminal to reoffend

Antiandrogen treatments: (191) treatments involving the use of drugs that block the action of androgens (male sex hormones)

Cutup: (194) a person who is fond of making jokes or playing pranks

Tendentious: expressing or intending to promote a particular cause or point of view, especially a controversial one

Covert speech: (210) thinking in the form of sound – “hearing” one's own voice silently to oneself, without the intentional movement of any extremities such as the lips, tongue, or hands

Florid: elaborately or excessively intricate or complicated

Cotard's syndrome: (216) a rare mental illness in which the affected person holds the delusional belief that they are already dead, do not exist, are putrefying, or have lost their blood or internal organs

Advanced anorexia nervosa: (217) a serious eating disorder primarily of young women in their teens and early twenties that is characterized especially by a pathological fear of weight gain leading to faulty eating patterns, malnutrition, and usually excessive weight loss

Emotional valence: emotional significance; the extent to which an individual is attracted or repelled by an object, event, or person

Module 5: Conclusions

Chapters covered: "The Conscious Life Examined" and "Balancing Act" (Epilogue)

"The Conscious Life Examined"

1. How do you feel about the fact that "About a third of our lives is spent in sleep. But not because we are lazy" (226)? Do you recognize the importance of regular sleep? What about this statement: "...students who force themselves to sleep less are likely depriving their brains of the very thing they need for the grades they seek: consolidation of memory" (227)?

2. What is the difference between chronic coma and a persistent vegetative state? Research, and discuss.

3. Do you believe in multi-tasking? Does Churchland? Why or why not?

Suggested Answer: Churchland does not believe in multi-tasking. She writes that "consciousness has a limited capacity... When we think we are multitasking, we are probably shifting attention back and forth between two or possibly three tasks, each of which is familiar and which we can perform with minor vigilance" (240).

4. What are the five features of the *global workspace* theory?

Suggested Answer: 1) the sensory signals of which you are conscious are highly integrated and highly processed by lower-level (nonconscious) brain networks, 2) there must be integration of sensory signals with relevant background knowledge—with *stored* information, 3) consciousness has a limited capacity, 4) *novelty* in a situation calls for consciousness and for conscious attention, and 5) information that is conscious can be accessed by many other brain functions, such as planning, deciding, and acting (pg. 240-241).

5. What is *small world* organization of brains?

Suggested Answer: "Not every neuron is connected to every other neuron" (245).

6. Why is the efficiency of rich club organization important (247)?

Suggested Answer: "...the brain can keep wiring costs down and head size can be kept within a reasonable volume... Wiring uses energy and takes up space, so a small-world organization with hubs is more efficient than having every neuron connected to every other neuron. And transient connectivity via the rich clubs can be fast, brief, and efficient."

7. What are the 3 especially prominent properties in the neurobiology of consciousness (248)?

Suggested Answer: 1) rich club neurons and their ability to make fast connections to other rich club neurons, thereby providing the scaffolding for rich integration of information; 2) global ignition for brain events that reach consciousness; and 3) the central thalamus, with its role in enabling specific contents of awareness during the awake and the dreaming states.

8. What separates humans from animals, scientifically? What would a Christian argue about the separation of humans and animals? What, Biblically, is distinct to mankind?

9. Have you ever been aware but not paying attention? Do you agree with the stated claims of Churchland, Cohen, and colleagues regarding awareness?

"Balancing Act" (Epilogue)

1. "Unequivocally, we need the media to report scientific discoveries in a way that is both accurate and understandable. Such a feat takes a highly knowledgeable journalist who has the writing talent to put the hay down where the goats can get it" (256). What do you think of this statement?

2. Can science read your mind (260)?

Suggested Answer: No.

3. Find or submit a question on brainfacts.org (still active as of the writing of this guide, July 2017). Did the answer (or lack of an answer, depending on lack of evidence) surprise you?

4. Why do people believe vaccines are linked to autism (261)? What happened to the doctor who published this report? What can be done now about the dangerous spread of misinformation this claim represents?

Suggested Answer: A man named Andrew Wakefield posited an erroneous claim in a 1998 report in the journal *Lancet* that "autism is caused by the measles-mumps-rubella vaccine." His claim was fraudulent and later retracted by the journal, he was found guilty of professional misconduct, and his medical license was revoked. However, many parents believed and still believe the claim "Because it offers a simple answer to what is in fact an extremely complicated and utterly heartbreaking medical condition."

5. Consider and respond to the author's following excerpt: "You do not want to be so skeptical that you learn little and fail to take advantage of scientific progress. You do not want to be so smug that you think you have nothing to learn from science... At the same time, you do not want to be so gullible that you assume that any science blog is as good as any other. Harder still, you

do not want to selectively believe the results you happen to favor... But there is no better system than peer review..." (261-262).

6. Does the description and study of wonderful things diminish the wonder of those things? Does science diminish the wonders of the Creation?

7. Should Christians be threatened by the development of neuroscience?

8. Is there anything from the last two chapters that you have not understood and would like to discuss in-group, or anything that you find particularly surprising or interesting and cannot help bringing up?

Terms

Sleep rebound: (227) the phenomenon that animals deprived of sleep will make it up when allowed to do so

Parasomnias: (229) a category of sleep disorders that involve abnormal movements, behaviors, emotions, perceptions, and dreams that occur while falling asleep, sleeping, between sleep stages, or during arousal from sleep

REM: (231) “rapid eye movement”; one of the five stages of sleep that most people experience nightly, characterized by quick, random movements of the eyes and paralysis of the muscles

Mentation: mental activity

Contents of consciousness: (233) structures that contribute to being conscious of specificities (“this” or “that”); awareness of specific events

Hertz: (235) the standard unit of frequency in the International System of Units (SI), equal to one cycle per second

Transient: lasting only for a short time; impermanent

Epilepsy: a neurological disorder marked by sudden recurrent episodes of sensory disturbance, loss of consciousness, or convulsions, associated with abnormal electrical activity in the brain

Absence seizure: a type of seizure involving staring spells. This type of seizure is a brief (usually less than 10-15 seconds) disturbance of brain function due to abnormal electrical activity in the brain

Masking: (242) the concealment or the screening of one sensory process or sensation by another

Global ignition: the observed pattern of posterior to anterior spreading of activity in the brain

Rich club neurons: especially well-connected neurons

Locally connected neuron: neurons that connect only to other nearby (“local”) neurons

Feeder neuron: neurons which serve to connect local neurons to rich club neurons

Anosmic: (249) characterized by the inability to perceive odor or a lack of functioning olfaction—the loss of the sense of smell

Working memory: (252) the part of short-term memory that is concerned with immediate conscious perceptual and linguistic processing

Saccade: (254) a rapid movement of the eye between fixation points

Aggregate: (258) a whole formed by combining several (typically disparate) elements

Reductionism: (263) the practice of analyzing and describing a complex phenomenon in terms of phenomena that are held to represent a simpler or more fundamental level, especially when this is said to provide a sufficient explanation

Scientism: excessive belief in the power of scientific knowledge and techniques

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