

## The Synapse and the Sacred

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### Books Discussed:

*How the Brain Works*, by Mark W. Dubin (Blackwell Science, 2002)

*The Feeling of What Happens: Body and Emotion in the Making of Consciousness*, by Antonio Damasio (Harcourt, 1999).

*The Executive Brain: Frontal Lobes and the Civilized Mind*, by Elkhonon Goldberg (Oxford University Press, 2001)

*Hare Brain, Tortoise Mind: How Intelligence Increases When You Think Less*, by Guy Claxton (Eddo Press, 1999).

*The Developing Mind: Toward a Neurobiology of Interpersonal Experience*, by Daniel J. Siegel (Guilford Press, 1999)

*The Balance Within: The Science Connecting Health and Emotions*, by Esther M. Sternberg, (Freeman, 2000)

The human brain is the most complex structure in the known universe. Just for starts, the numbers involved are mind-boggling: the brain has one hundred billion neurons. That's 100,000,000,000 cells—and that's only one-third of what's up there. There are twice as many glial cells (from the medieval Greek, *glia*, meaning glue) whose functions remain as yet fairly opaque. From what we can tell, glial cells merely provide what we can imagine as architectural and administrative services, but the history of neuroscience is replete with biological structures that were mistakenly thought to be doing nothing much.

Such numbers are nothing compared to the structural and functional complexities of the brain. Neurons are wildly hairy little things, bristling in all directions with long, thin input

structures called “dendrites.” Somewhere, usually, there is a single output wire, the “axon,” which in some circumstances can be as much as several feet long.

At their far end, axons fray out--sometimes modestly, sometimes exuberantly. At the very tips of these frayed ends, one finds anywhere from one thousand to five or six thousand “synapses,” which are specialized structures for conveying electro-chemical signals to receptor sites on the dendrites of other neurons. (Serotonin is one of many such neuro-transmitters released by synapses; Prozac, the anti-depression medication, indirectly increases serotonin levels. Dopamine is another fairly famous neurotransmitter: its production is impaired in Parkinson’s disease, which afflicts the current pope.) Through the vast tangle of these long thin structures, each neuron has connections to something like 10,000 other cells, which works out to roughly one million billion such connections.

Then consider this: each neuron and fire and then reset to fire again within .5 milliseconds. That is, each neuron can fire *two thousand times each second*. Through this elaborate apparatus, the number of possible on-off patterns in the brain is fabulously large—perhaps ten times ten one million times, changing every .5 milliseconds. I get a headache just thinking about it.

In 1637, Descartes suggested that the mind is a thinking substance utterly distinct from the material body. He proposed that the mind itself—the thought processes of consciousness—is the manifestation of our immortal, immaterial soul. At the same time, the first great modern neuroanatomists were doing forbidden human dissections at the new, secret amphitheatre at the University of Padua medical school (Sternberg, pp. 17-23). As philosophers pursued the great Cartesian challenge—how can I be certain of the reality of anything correspondent to my sensory impressions?—anatomists and then neurobiologists looked for answers to the same questions in very different places.

Imagine, for the moment, the tune “Happy Birthday.” Hear it in your mind. Now imagine wiggling toes, but do not do so. In each instance, the part of the brain you would have used to hear the tune or to move your toes lit up with thousands and thousands of electrons buzzing at one another. That’s not the Cartesian “malicious demon” deceiving

us about the material world, because the patterns of neural activation are not exactly the same as those activated by real songs or real wiggling.

We know such things because new technologies such as CAT scans, fMRI scans, PET scans and so forth now allow neuroscientists to monitor brain anatomy and activity. A quick PET scan could have assured Descartes whether or not he could successfully distinguish between sensory perception of real objects or events and the machinations of a malicious demon. People who do have trouble distinguishing between the real world as reported through sensory organs and what they (falsely) imagine to be real usually do end up in hospitals, being evaluated for schizophrenia, brain tumors, and other kinds of brain damage. Cartesian skepticism is a fascinating intellectual exercise, but only that.

Far more fascinating, in our day, are an array of neuroscientists who combine the souls of philosophers with cutting-edge technical expertise in a fast-evolving field. All of those I have selected for review are also terrific writers—engaging, humane, witty, at times elegant—despite the challenges they offer to those of us who have never studied anatomy of any kind whatsoever. I found that I had to keep a deck of small yellow stickies at hand to post on pages with diagrams and definitions. More recently, however, I have found an even better resource: Mark Dubin's *How the Brain Works*. Each chapter is ten or twelve pages on some important function (thinking, feeling, sensing, etc.), concluding with a four or five paragraph summary.

Across the board, Dubin's level of detail felt exactly right someone like me, simply an amateur reading on her own. Graphic design is top-notch: the pictures were visually coherent at first glance, and the labeling always made sense. (In that regard, *How the Brain Works* reminded me of those wonderful Time-Life guides to hanging wallpaper or household plumbing.) The appendices organize unfamiliar vocabulary and concepts into a variety of useful little reference guides. Books of this quality are a real blessing to the adventurous reader who wants to explore a new field that is rich in pastoral, spiritual, and indeed theological implications. I recommend it warmly.

The single most intriguing book on my list is Antonia Damasio's *The Feeling of What Happens*. Damasio is a neurologist—a physician who treats disorders of the brain—at

the University of Iowa. He is also quite familiar with the philosophy of consciousness, many of whose classical issues he pursues here from a new and marvelously fruitful perspective: this is the kind of book I give as Christmas presents to that small group of friends who count on me to give them something unexpectedly intriguing to read.

Damasio's particular concern is exploring and explaining the biological circumstances that allow us to become conscious. That's an intriguing story all on its own, amply illustrated with well-told vignettes of what he has learned from patients with malfunctions in one or another location within the brain. For our purposes, however, I'd like to focus on a set of distinctions he makes that seem to have become standard in the field.

He uses the word "emotion" to name the collection of bodily responses one has as part of the activity of apprehending something. These responses are "an embodiment of the logic of survival"—that is, pleasure versus pain, approach vs. withdrawal, good vs. evil, etc. (p. 42, p. 55). They are crucial guides to what he calls "survival-oriented behaviors" (p. 56), and so they are always part of any perception. Sometimes, or to some extent, we can become conscious of these responses, and his term for that is "feelings" (p. 42). Everyone has been aware at times of having feelings that seem murky, or not quite within "reach" of consciousness. We are experiencing at that point is the boundary line between emotions and feelings.

"It is possible," he suggests, "that feelings are poised at the very threshold that separate being from knowing and thus have privileged connection to consciousness" (p. 43). In common parlance, we do talk about people having feelings about which they are not conscious, or about recognizing even in ourselves that our feelings are not entirely clear, or have inexplicable origins, etc. That is, we are aware that our emotional life sometimes perches on the liminal edge of consciousness itself.

What intrigues me is how Damasio illuminates the role of emotions in critical thinking. "Well-targeted and well-deployed emotion seems to be a support system without which the edifice of reason cannot operate properly. These results and their interpretations call into question the idea of dismissing emotion as a luxury or a nuisance or a mere evolutionary vestige" (p. 42). That's a claim he first made in his best-seller *Descartes' Error: Emotion, Reason and the Human Brain* (1995).

*Descartes' Error* described a very bright, highly-functional professional who suffered damage to his frontal lobes as the result of a non-cancerous tumor. The man's intelligence was perfectly intact, but he seemed without visceral emotional responses to reality around him, and certainly without conscious feelings even about the tragedies in his own life. As a result of this emotional impairment, he was unable to deploy his intelligence in any rational way. He was unable to guide his choices by the "survival value" of the options before him—and thus he could not hold a job, manage his own personal and financial affairs, or live independently.

Emotionally "disconnected" people often make terribly naive or short-sighted decisions, it seems to me: this fellow's "disconnect" was complete in that regard, despite the fact that he continued to score at very high levels on all the ordinary neurological assays of intelligence. Those tests evaluate one's ability to think, not to make and implement good decisions. Only life tests that, and this man's life had become a hopeless shambles.

Damasio's work encourages patient attention and due respect for our "gut responses" and visceral, intuitive sense of things. That's good advice not only because the gut is particularly rich in direct connections to the brain, but also because the Spirit is active within our lives in exactly this kind of liminal, elusive way. Interior perceptions are often elusive, Damasio suggests, because there is much more evolutionary pressure for us to attend to lions and tigers and bears in the outer world (pp. 28-29). Spiritual traditions and practices, however, may train and sustain us in the arts of elusive inner perception. They may also serve to refine and to deploy human intellectual gifts, especially those which culminate in wisdom, which is the art of good judgment in complicated, difficult situations.

Guy Claxton approaches exactly the same point through a very different kind of psychological research. *Hare Brain, Tortoise Mind: How Intelligence Increases When You Think Less* brings to bear an incredible array of empirical psychological studies demonstrating that we know much more than we are conscious of knowing, and that we make far better decisions when we give ourselves time to collect and to process this subterranean information. *Hare Brain, Tortoise Mind* is thought-provoking but a quick, easy read—and furthermore it's dangerously encouraging for those of us quite naturally

inclined to staring out the window in a spontaneous, wordlessly contemplative blankness.

At a more practical level, there are enormous implications for vestry or faculty meetings. For instance, always schedule an interlude of silent prayer after discussion has reached its natural conclusion but before taking a vote. Better yet, perhaps, introduce the silent prayer with a bidding litany giving thanks for *this* and asking for God's help to do *that* and generally acknowledging all the competing goods called into conflict by this particular predicament. Then some well-focused, deeply mindful silence, then a paper ballot. If we want to turn our raw intelligence into good decisions, then we have to take this kind of physical opportunity to let all those neurons fizzle back and forth "reactivating" all the relevant and potentially relevant neural networks and obscure visceral intuitions correspondent to our rich, thoughtful wisdom and long experience .

Elkhonon Goldberg takes this topic yet another step in *The Executive Brain: Frontal Lobes and the Civilized Mind*. The frontal lobes are behind the eyes and forehead; it is only fairly recently that anyone has understood what they do. Now it is understood that they manage what are called the "executive" functions of conscious—decision-making, essentially, or leadership in all its complexity. Goldberg's book needs to be read selectively: Chapter Five diverges into technical disputes with other specialists; Chapter Four fails in its efforts to introduce neuroanatomy to newcomers. But everything else is fascinating—in equal measures entertaining and useful.

His discussion of frontal lobe syndromes—caused by dementias, strokes, trauma, etc.-- might prove very useful for pastoral care situations where one person comes in complaining about the odd behavior or peculiar decisions of someone else. Having read *The Executive Brain*, I would be quick to insist upon medical evaluation of anyone who is acting "out of character." The fact that the person involved sees absolutely nothing wrong doesn't count: if judgment is "off-line" somehow, it may be physically impossible for them to recognize that their behavior has become peculiar. The brain is so soft and so fragile that even small, noncancerous tumors can wreak havoc, especially if they are not caught early—which the right kind of scan can do.

I also understand now that my very frail, 90-year old aunt's indecisiveness about moving into a sheltered environment is simply part of her general, low-grade loss of mental acuity. It's not reasonable to think that she will make the decision on her own eventually—although that's what everyone in the extended family has been saying for the last ten years. Difficulty making decisions--not forgetting things--is the earliest symptom of dementia, which wreaks its havoc first on the frontal lobes.

On a lighter note, Goldberg's chapter on "decision-making styles" is great fun. His accounts of such topics as gender difference and left-handedness struck me as simply uncanny in their accuracy (I'm left-handed). My husband, who is right-handed, shrugged it all off. That doesn't change the fact that when he can't find his keys or his gloves, he calls to me; and we both know he does a better job than I ever would at loading the van with kid's belongings when we are taking them back to college. Of course, we have been at this for thirty years or so: we have had time to learn how to mesh our problem-solving skills efficiently. Maybe Goldberg's account could ease the learning curves of staff or vestry who need to work together or to make decisions together.

Those who practice or teach pastoral counseling of any sort may also enjoy Daniel Siegel M.D., *The Developing Mind: Toward a Neurobiology of Interpersonal Experience*. This is a dense, ambitious work, as one would expect from a publisher like Guilford. Siegel endeavors to synthesize what neurobiologists are learning about brain function with what the therapeutic and psychiatric communities understand about minds. His primary audience is readers with pastoral or counseling experience but little or no prior knowledge of brain function.

When I was first trying to read neurobiology, beginning three or four years ago, coming upon this book felt like a blessing straight from heaven. His biological descriptions are concise and they appear only as they are needed: I suspect he is an excellent classroom teacher. *The Developing Mind* is focused very cleanly upon the array of questions that I think will matter most to general readers: what can neuroscience tell us about human relationships and communities, and about the impact of our own histories upon our present responses? Siegel generously repays the effort his work requires: this would be an excellent classroom text.

The last of these intriguing books comes from within the long and sturdy tradition of physicians who are also first-rate writers (Oliver Sacks, Lewis Thomas, William Carlos Williams, to name a few in this century). Janet Sternberg sees neuroscience as a deeply human, highly situated endeavor; and so she delights in portraits of the people and the places germane to the story she tells. And what a story!

Her title is quite apt: *The Balance Within: The Science Connecting Health and Emotions*. Everyone knows that stress disposes anyone to physical illness. I vaguely remember some chart in *Psychology Today* perhaps thirty years ago scoring various life-events as stressors: among the top items was getting married, moving to a new city, and starting a new job. (I remember because I was about to do all three things—and I did succumb to an epic head cold about three weeks after the wedding.)

Neuro-immunology has come a very long way indeed since I was in college, thanks to the combination of computers, scanning capabilities, and extremely precise chemical assays of minute amounts of neurotransmitters. Sternberg describes the steps and stages and questions of all that research in lively, satisfying detail. I certainly needed my deck of yellow stickies to flag her intelligent illustrations, but I found it all quite manageable because she writes so well. *The Balance Within* is thought-provoking work for anyone who copes now and then with “stress-related disorders” or even with chronic diseases for which stress is particularly hazardous. I think it is crucial reading for anyone who offers pastoral care to those struggling to manage such things within the context of faith.

Sternberg also addresses an array of questions that matter to me as a believer, not a biologist. As she points out, memories, human relationships, and prayer can have as vivid a neuroimmunological impact as moving, marrying, and changing jobs. When I settle into a pew, take a deep breath, close my eyes, and feel my tense shoulders relax, that’s not “all in my mind.” It’s in my mind because it is in my brain, and in all those zillions of neurons and all their biochemical and electrical connections to my gut and to all the rest of me as well. How God and Christian tradition have managed to elicit such powerful visceral reactions is beyond our ability to describe in detail, but the general mechanisms are well described.



At the “Science and the Spiritual Quest” conference I attended at Harvard last October, Nobel Laureate particle physicist William Phillips argued very forthrightly to an international panel of equally high-power physicists that the God in whom he believed seemed more than subtle enough to interact with creation without leaving fingerprints. The stunningly complex individuality of the human brain provides more than enough opportunity for consciousness to make contact with the Holy in ways far more elusive than we will ever be able to track or to document. The power of God is fully compatible all those billions and billions of synapses freely wiring and re-wiring and re-arranging all their own synapses.

That’s a comforting thought. I think I’ll close my eyes, center my attention, relax my shoulders, and sit here not-thinking that thought.

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