

THINKING ABOUT RELIGION AND EXPERIENCING THE BRAIN: EUGENE D'AQUILI'S BIOGENETIC STRUCTURAL THEORY OF ABSOLUTE UNITARY BEING

by *H. Rodney Holmes*

Abstract. Religious experiences, including mystical states and experience of the divine, are the ultimate reality of human existence that demand an account. Eugene d'Aquili weaves together that account using paradigms of thought which historically have made mutually exclusive claims about the nature of religious experience. While pointing out the deficiencies of the theory from a narrowly scientific point of view, this paper recognizes that neuroscience, or any other solitary discipline, is incompetent to explain religion. This paper emphasizes the significance and truth of d'Aquili's holistic theory, a religious vision which itself explains science and philosophy.

Keywords: mystical experience; mysticism; naturalism; neurology; neuroscience; realism; religious experience.

Religion, therefore, as I now ask you arbitrarily to take it, shall mean for us *the feelings, acts, and experiences of individual men in their solitude, so far as they apprehend themselves to stand in relation to whatever they may consider the divine.*

"[D]ivine," as employed therein, shall mean for us not merely the primal and enveloping and real, . . . divine shall mean for us only such a primal reality as the individual feels impelled to respond to solemnly and gravely, and neither by a curse nor a jest.

—William James, *The Varieties of Religious Experience*

No doubt professional science meetings in the next century will be much like the professional theology meetings in this century. Since Weber and Durkheim, it has been easy to justify studies of religion in the secular academy. It is clear on the one hand that religious

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[*Zygon*, vol. 28, no. 2 (June 1993).]

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ideas have shed their particularly religious clothing and donned the attire of secular culture. And it is equally clear, on the other hand, that the cut and fabric of the ecclesiastical robes are styled by fashion designers in New York and Paris. What the theologian finds difficult is showing the sociologist that there is an emperor.

With the recent emergence of professional philosophers, historians, and especially sociologists of science, it is becoming increasingly difficult for scientists to make truth claims about the objects of their study. In light of the glaring misuses of Western science during the last two centuries, how can any scientist hope to show anything about human biological and cultural evolution, human development, or sexually dimorphic brains? Moreover, how can a scientist hope to illuminate any truly fundamental question about the nature of the universe, such as: Is its fundamental nature consonant with the second law of thermodynamics, the anthropic principle, or the Gaia hypothesis? In short, can there be any real content to the words of the twentieth-century theologian or the twenty-first-century scientist? Obviously, answers to academic questions like this are a fabric woven while negotiating tenuous pathways amongst the black holes of naive realism and the abysses of social constructivism and linguistic relativism.

Eugene d'Aquili speaks directly, and in the most positive terms, to the most humanly essential of fundamental questions. He is concerned, scientifically and philosophically, with the real mind, its two modes of functioning, and its two genuine experiences—everyday and mystical religious. Open to critical investigation here is the rarer mode, religious experience. With Husserl it is analyzed directly, and with the geneticist Waddington it is produced (*not* caused) by the brain. Being an alternate reality, it is produced not by everyday brain activity, but by an alternate activity of neural structures.¹ It is the neurological production of the mystical state of Absolute Unitary Being (d'Aquili and Newberg 1993), the essential experience of God, and the significance of d'Aquili's synthesis that are the topics of this essay.

D'AQUILI AND THE GREAT CHAIN OF SCIENTIFIC PHILOSOPHERS OF MIND

Since Plato and Aristotle, and until Marx, two alternative metaphysics have been at odds in the West: mysticism and naturalism. Descartes galvanized the discussion of the problem of mind by analyzing it in the terms of dualism with which modern discussion usually begins and, unfortunately, ends. At the turn of this century,

psychology was framed for modern times by William James, a frame too quickly ignored by the fragmented sciences which followed.

Besides d'Aquili and his colleagues, only one other thinker of the late twentieth century has dared to ask seriously and comprehensively the most Western of questions, What is the *origin* of consciousness? That was Julian Jaynes. In *The Origin of Consciousness in the Breakdown of the Bicameral Mind*, Jaynes found it necessary to do two things. First, in order to give a modern answer, he had to offer an account of the neuroanatomy and neurophysiology underlying speech and other symbolic thought. Second, he found it necessary, curiously, to write off the content of religious experience as hallucinations. D'Aquili gives a superior account because he takes seriously the religious experience itself.² No other informed writer has even attempted to meld neuroscience, philosophy, psychology, and religion since William James.

The question facing d'Aquili is how to give an adequate account of our perception of a *Mysterium Tremendum*, a Wholly Other, that is, of the empirical reality that we have religious experience and know that we have it. The problem is that modern scholarship is disciplinary in nature, and this mystery is too complex for disciplinary methods and questions to be sufficient exclusively. D'Aquili narrows the problem to say we are too entrenched in Cartesian dualism:

In other words, our experience at any moment of consciousness is produced by our nervous system, with or without stimulation from events occurring in the external world. The difficulty in grasping this vital connection is fundamental to the Western "natural thesis" about self and world, and is thus very hard to overcome because the schism between experience and body is severely conditioned. Nevertheless, the structure of experience is that part of the nervous system mediating experience. (Laughlin, McManus, and d'Aquili [1990] 1992, 43)

D'Aquili's remedy is to broaden the scope. Understanding d'Aquili requires one to comprehend Husserl and Merleau-Ponty, to have a working knowledge of modern neuroscience, to have familiarity with contemporary theology, to develop an anthropology and non-Marxist sociology, and quite possibly to have had a mystical experience. I, for one, can affirm the authors' own words, "Understanding this view will require as much effort and study on the part of the reader as it has of the authors" (Laughlin, McManus, and d'Aquili [1990] 1992, xii). The value to d'Aquili's reader is probably not that the reader will by force of argument be made to accept his view; rather, having thought through all these dimensions with him, the reader will have a more comprehensive framework and a

deepened appreciation of the essential nature of religious being in this modern world—not a bad payoff for readers of *Zygon*.

A PRIMER OF NEURONAL D'AQUILI

Over a century ago William James (1874, 1877) foresaw an emerging discipline, neurophysiology, and he warned it against reducing psychological experience to the anatomy and physiology of the brain. Today an adequate account of human religious nature must include neuroanatomy and neurophysiology, if for no better reason than to fend off the naysayers who naively believe that religious experience and mental illness are isomorphic. D'Aquili has been working out a nonreductionistic account. Interestingly, the neuroscientific papers are published in *Zygon*, and, this issue marks the publication of an account that is sufficiently detailed to stand up for critical discussion. The magnum opus of his phenomenological account of mind and consciousness is the coauthored book *Brain, Symbol, & Experience* (Laughlin, McManus, and d'Aquili 1990). Particularly, d'Aquili plumbs great depths in the various articles on myth and religious experience that have been, and are concurrently, published in *Zygon*. If these are the aorta and coronary arteries of his thought, this primer concerns the carotid arteries which nourish the brain: (1) "The Neurobiological Bases of Myth and Concepts of Deity" (1978); (2) "The Myth-Ritual Complex: A Biogenetic Structural Analysis" (1983); (3) *Brain, Symbol & Experience* (Laughlin, McManus, and d'Aquili [1990] 1992); and (4) "Mystical States and the Experience of God: A Model of the Neuropsychological Substrate" (d'Aquili and Newberg 1993).

At the considerable risk of oversimplification, I would summarize his biostructural theory this way. D'Aquili believes there are two ways a human brain can function. In the normal mode, everyday experience is that of matter and time, and the output of the brain is locomotion. In short, neural impulses normally follow certain pathways to produce the perceptions associated with our five senses and the movements of our muscles associated with the motor systems of the brain. But neural impulses can also travel a fundamentally different path through the same labyrinth of neural circuits. In this rare mode, senses, time, and movement lose their usual perceptual boundaries. This mode of brain functioning produces a state of Absolute Unitary Being (AUB) and a mystical, religious experience.

The complete narrative d'Aquili might have told goes something like this. Sisyphus, a very persistent man, pushed his round boulder to the peak of a tall mountain. Two ravines coursed down from the

mountain peak, and for three thousand years the boulder rolled down only one of them. But one day Albert Camus died, the boulder rolled down the other ravine, and the hero Sisyphus had an epiphany.³ That is because the tumbling boulder is like the functioning of the brain, and the ravines are like the brain's anatomy with its gyri and sulci. The funeral ritual of Camus changed the course of the boulder, that is, the mode of brain functioning in Sisyphus.

This *Myth of Sisyphus* is demythologized in the four d'Aquili writings presently under consideration. The metaphor of the boulder to explain the modes of brain function is portrayed in "Neurognostic Function" in *Brain, Symbol & Experience* (Laughlin, McManus, and d'Aquili [1990] 1992: 53-57). How the funeral ritual caused the brain of Sisyphus to change to its religious mode is the topic of "The Myth-Ritual Complex" (1983). How the content of the epiphany is produced by the new biogenetic structures (that is, the old neuroanatomy and the new neurophysiology) is the topic of "The Myth-Ritual Complex" (1983) and "The Neurobiological Bases of Myth and Concepts of Deity" (1978). The exact specifications of the brain anatomy and the two physiologies are laid out in "Religious and Mystical States: A Neuropsychological Model" (d'Aquili and Newberg 1993). The promise of a new life for the hero is made throughout d'Aquili's writings, but it is offered as a short phenomenological demonstration of "bracketing of experience" in *Brain, Symbol & Experience* (Laughlin, McManus, and d'Aquili [1990] 1992, 31-32), and as a technical explanation in "Religion as a System of Self-Maintenance and Self-Transcendence" (1991).

Just how, neurologically, does ritual cause the brain to change modes? First, d'Aquili explains, the brain is made up of approximately several trillion nerve cells called neurons. These neurons are clustered together in groups, each of which is called a nucleus. The major cells in each nucleus are connected to each other either directly or with smaller interneurons, and a cell can also be connected to itself in a "feedback circuit." Each cell can "excite" or "inhibit" its neighbors and itself. D'Aquili speaks almost exclusively of excitation, and the phenomenon of "reverberating circuits"—neuro-jargon from the electronic circuit builders of the 1960s that refers to the ability of a cell to re-excite itself, or the cells of a nucleus to re-excite themselves so as to create a so-called positive feedback loop. Looking ahead, the trick for d'Aquili will be to get these circuits going, maintaining a self-excitation, and spreading from nucleus to nucleus, from brain structure to brain structure, until the whole brain is ringing like a loudspeaker does when the microphone is placed directly in front of it and the amplifier is turned up.

But back to nuclei. Each nucleus, or cluster of cells, is connected to other nuclei by axons, long, limblike extensions of nerve cells. The brain can be literally taken apart into major structures, like the brain stem, the hippocampus, or the cortex. Each of these structures is chock-full of nuclei, individual neurons, and axons connecting one nucleus with another and one structure with another. As it turns out, after one hundred years, we are getting a fairly decent idea of what these structures do, what individual nuclei do, and a rudimentary map of the brain.⁴ Knowing that ultimately it would not be possible to succeed, and in an intellectual effort requiring tremendous work and considerable courage, d'Aquili determined that science knew just barely enough about how neurons, nuclei, and structures are constructed and work together in the normal state that with extensive data from other disciples he could construct a theory of how certain areas of the brain ". . . may be involved in the genesis of various mystical states, the sense of the divine, and the subjective experience of God" (d'Aquili and Newberg 1993: 181).

And here is how it works (d'Aquili and Newberg 1993, 186 ff.).⁵ The sense of Absolute Unitary Being (AUB) is an ecstatic and blissful feeling, a free-floating-in-space-and-time, a space absolutely pure, uncontaminated by any sense of touch, sound, or vision. To produce AUB, it is necessary that these everyday senses be cut off, although not by plucking out or plugging up primary sense organs. Rather, removal of feeling (deafferentation) is achieved when the reciprocally interconnected structures of the brain which underlie blissful feelings (e.g., prefrontal cortex, lateral hypothalamus, and median forebrain bundle) stimulate or excite themselves maximally in a "reverberating circuit." To follow the metaphor introduced above, this positive feedback becomes so metaphorically "loud" or technically blissful, that no other sound (metaphoric or technical) *can* be heard. Just as while the microphone and loudspeaker are ringing, the preacher cannot be heard, while the AUB is active, secular sounds cannot impinge. Like all other good things in life, reverberating circuits in the nervous system (from reflexes in the spinal cord to AUB) must end some day, through mechanisms such as "refractory periods" and "post-synaptic desensitization," or colloquially, "neuronal fatigue."

The only remaining question is, Where can I get one of these religious experiences? There are two varieties of religious experience available, the do-it-yourself model and the store-bought model from church. Meditative states can be intentionally self-induced, in which case their neurological origins are in the prefrontal cortex (as explicated in full in 1993); or AUB can be initiated by religious ritual when the senses stimulate the same brain structures (the sound and

feel of rhythmic music and dancing; the smell of sacrificial smoke or incense; the sight of fire, feathers, and paint, or the sight of candles, robes, tapestry, and stained-glass windows). Once these structures are turned on (by the five senses) and their content is cognitively combined with emotion and narrative, they become self-stimulating to the conscious exclusion of the original five senses (1983).

In short, the brain has one anatomical structure and two essential modes of function. The mode that produces everyday experience of the real material world is described in medical textbooks. The mode that produces the real religious world is described in Eugene G. d'Aquili's writings. His "Biogenetic Structural Theory of Mystical States and Absolute Unitary Being" (1991) in general, and the neurobiology which he lays out in particular (d'Aquili and Newberg 1993), is nothing short of a tour de force. One can only despair that it is not also a coup d'état.

A MONO-SYNAPTIC NEURAL REFLEX TO AN ALGESIC D'AQUILI

Just as certainly as the reading of d'Aquili will trigger a religious experience of AUB in no one, neither will a biogenetic structural analysis of the neuropsychological substrate convince the neuroscientist that this alternate mode of functioning is real. This critique follows from the disciplinary standards of neurophysiology. It attacks d'Aquili's science at two levels, at the whole brain level as portrayed by electroencephalograms (EEG), and at the cellular level, which concerns itself with the electrochemistry of neurons (Laughlin, McManus and d'Aquili [1990] 1992) and the exact connections between neurons (d'Aquili and Newberg 1993). Readers who do not have the stomach for scientific casuistry can seek pleasure by avoiding the pain of this section. To be absolutely forthcoming, it is my judgment that d'Aquili's theory is unproved where it could be (EEG analysis), misleading where it need not be (panpsychism of neurons), and it is almost as complete as is possible given the state of today's knowledge (connections of nuclei and structures within the brain). On the whole, this theory has tremendous heuristic value because d'Aquili has dared to go where no one has gone before. The price he will pay in criticism by neuroscientists will also be the cost of building a framework by which all readers can truly construct a better understanding of the nature of religious experience.⁶

Is there scientific proof that the brain operates in a different mode to produce religious experience? Although d'Aquili cites the scant evidence that is published in credible journals, this evidence remains

somewhat suggestive but finally unconvincing. Bluntly stated, the single example of an EEG during an AUB is both insufficient and ambiguous (cited in d'Aquili and Newberg 1993). The study is difficult to extrapolate from, or even to interpret in itself, if only for the excellent reason that science concerns itself with reproducible results. Furthermore, clinical verification need not await an expensive PET scan of the rare AUB. EEG studies of the lesser trance states would have easily detected a brain functioning in this alternate mode.⁷ EEG studies of various meditative states are legion, but in mainstream neuroscience, the results are judged to be highly controversial. The Marxist sociologists of science might be correct when they say this is because the powerful establishment refuses to accept the data. But in my judgment the data predicted by d'Aquili's model would be so unambiguous that verification, or in Popper's terms falsification, by objective criteria has been long possible, often attempted, and not yet achieved.

Do neurons work the way d'Aquili tells us they work? Well, yes and— . First, although nobody has counted, most scientists estimate that there are about 10 billion neurons in the brain, not several trillion⁸ (Laughlin, McManus, and d'Aquili [1990] 1992, 35). Exactly the opposite problem exists for the concentration of cells in the cortex: the authors estimate too few (Laughlin, McManus, and d'Aquili [1990] 1992, 37). As mentioned above, major cells are often connected by interneurons; contrary to the authors' claim, however, interneurons are very well studied (Laughlin, McManus, and d'Aquili [1990] 1992, 37). Admittedly, this is nit-picking, and at its most microscopic level at that, but these are matters that appear in the first chapter of textbooks—so already the neuroscientist is growing uneasy.

The neuroscientist is a bit more uncomfortable with the portrait of the neuron itself. Cells are *not* organisms (Laughlin, McManus, and d'Aquili [1990] 1992, 34 and 40): Why obscure a long-standing and important distinction? The answer is even more disturbing: Panpsychism. In a section titled "The Hedonistic Neuron" the authors explicitly claim that "neurons actually are goal-seeking" and that the goal is pleasure:

The cell membrane can *depolarize* . . . or it can *hyperpolarize* . . . Those synapses that increase depolarization and the flow of ions are called *excitatory* synapses; those that increase hyperpolarization and block the flow of ions are called *inhibitory* synapses. Klopff's thesis is that neurons purposely seek to maximize excitation (depolarization) and to minimize inhibition (hyperpolarization). Excitation is equivalent to "pleasure" at the level of the organism and inhibition equivalent to "pain" or "displeasure." The goal of the cell is *not* merely to fire (output),

but rather to fire in a way that increases its own excitation. . . . That is, a cell continuously strives to “learn” how best to respond to the effects of its synaptic inputs in order to maximize the effects of excitation and minimize the effects of inhibition. (Laughlin, McManus, and d’Aquili [1990] 1992, 37–38)

What the authors are doing here is laying the groundwork for what eventually becomes the reverberating circuit mechanism for AUB, and the pleasantness of AUB. Their presentation of cellular physiology began by obscuring the distinction between cell and organism, and ended by placing mind and purpose within the cell. Mary Midgley (1979) criticized this way of thinking in Richard Dawkins’s book *The Selfish Gene*, and the same criticisms would apply to this book.⁹ The fundamental discontinuity between this way of thinking and modern science is put best by Marjorie Grene, particularly in her passages contrasting Aristotelian teleology with modern biology (1974). What concerns me here is that this way of thinking has misled the authors into errors that the neuroscientist must reject. Whereas I am quite sympathetic with their desire to reject mechanical reductionism, to go to the other extreme is to step outside the bounds of acceptable neuroscientific reasoning:

The advantage of both Klopff’s and Changeux’s views to our project is that they offer accounts of cognitive processes based upon the understanding that living *cells*, not some vague sort of inorganic microchips, are interacting to form neural systems within the organism. “The overall conclusion is that intelligent brain function can be understood in terms of nested hierarchies of heterostatic goal-seeking adaptive loops, beginning at the level of the single neuron and extending upward to the level of the whole brain” (Klopff). Klopff’s view also emphasizes the organization of the nervous system, a crucial factor in explaining how complex organizations develop in adapting to the environment within the general constraints imposed by the genome—incidentally, a point insisted upon by Piaget. . . . (Laughlin, McManus, and d’Aquili [1990] 1992, 42)

What is truly unfortunate is that it is not necessary to use this neural physiology (Laughlin, McManus, and d’Aquili [1990] 1992) as underpinning for the brain mechanisms of AUB (d’Aquili and Newberg 1993). Mainstream neuroscience could have been used as a groundwork for explaining AUB exactly as it is used as a groundwork for explaining epilepsy.

In a similar vein, the explanation is misleading because of its misplaced emphasis. To focus on neuronal “excitation” (or technically, depolarization), action potential, and Excitatory Post-Synaptic Potentials (EPSP) is to be making a half truth. Positive feedback and reverberating circuits are certainly present, but the opposite is far more predominate. Technical oversights which skew the understanding are exemplified virtually point by point in the extended quotation above. All neuronal axons, dendrites, and

terminals both depolarize and hyperpolarize. Technically, an action potential is the depolarization, overshoot, repolarization, and sometimes hyperpolarization of the neuron. The result is the release of neurotransmitters from the synaptic terminal. Whether the transmitter has an excitatory or inhibitory effect (EPSP or IPSP) depends upon the transmitter and the receptor mechanism of the next neuron, and most certainly not upon pleasure/pain intentions of the discharging neuron. Indeed most of this feedback to a discharging neuron is *negative* feedback by a mechanism called presynaptic inhibition; in effect neurons turn themselves off, thereby becoming able to respond to the next incoming stimulus. If the authors were right about excitation and pleasure, then most neurons would in fact be masochistic—a rare occurrence in nature indeed. The problem with the authors' portrait is that positive feedback is not preponderant but relatively rare. Although this point seems trivial in isolation, it is crucial for these authors, who elevate it as the fundamental cellular mechanism underlying AUB. Empirically it is quite dubious that these reverberating circuits could operate at the level of the entire brain, epilepsy notwithstanding. Conceptually the authors may be tempting the reader to believe that just as individual neurons have senses of purpose, so also they have religious experience.¹⁰

What began as panpsychism (mind in everything) has become pantheism (God in everything). Having placed mind squarely within the neuron (panpsychism), d'Aquili and his coauthors must also conclude by the same line of reasoning that individual nerve cells have mystical experience of oneness with God. It may very well be that their mysticism overlaps best with Whiteheadian metaphysics, but that is a very different system of justification from positivistic natural science. This may be precisely the difference between having a mystical and a naturalistic view of the world, hence of the brain.

These criticisms boil down to a matter of perspective: What difference does it make whether the brain has 10 billion or 10 trillion neurons (especially when nobody has or will ever count them)? What is wrong with blurring the distinction between cells, organs, and organisms? What difference does it make whether most neurons tend to turn themselves on or off, especially when one is developing an analogy or a metaphor which may point to a truth that is obscured by adhering to technicalities? What is wrong is that one is in danger of losing the critical basis for evaluation, hence not being able to know what the truth is. Or as Langdon Gilkey puts it, when laws are removed from their system of justification and applied in another context, they become dogma. The danger is that ideology masquerades as science.¹¹

Finally, and imperatively, what remains to be said are some words about the neuroanatomy of the paper currently being published in this volume (d'Aquili and Newberg 1993). D'Aquili's problem is much like Darwin's. Darwin knew that the primary objection to his theory was the fragmentation and the sparseness of the fossil record. Darwin's two-chapter answer was to marvel, considering the difficulties, that the record is as complete as it is (and probably to have faith that the further completion of the record would bear him out—as it has). My major objections to, and marvel at, this paper are similar, but I have doubts that neuroanatomy will prove to be as charitable to d'Aquili as paleontology has been to Darwin.

"It would be counterproductive to try to describe all the possible synergistic circuits, some of which may arise from structures that are not even included in this diagram" (d'Aquili and Newberg 1993, 29). By implication, one sees what is fundamentally wrong with all the neuroanatomy in this work: it is too general. Each of these structures, such as the hippocampus, has dozens of nuclei. The way that brain structures are connected is not structure to structure, but nucleus to nuclei (and of course that means by definition, "connected by neurons to neurons"). To be truly meaningful to the neuroanatomist, this entire section should have been written at the level described by the statement, "the agranular insular cortex and prelimbic cortex project to the central nucleus of the amygdala." The authors say that structure 1 is connected to structure 2, and 2 to 3, and that is how neural traffic gets from 1 to 3. The anatomical problem is twofold. As it turns out, neuroanatomists know that structure 1 has nuclei *A*, *B*, and *C*; 2 has *L*, *M*, and *N*; and 3 has *X*, *Y*, and *Z*; and since nucleus *A* connects to *M*, and *N* to *Z*, there is no way that neural traffic can actually get from structure 1 to 3.

The second problem is, contrary to the authors' hypothesis, even in reverberating circuits, neural excitation cannot spread from one nucleus to another (say from *M* to *N* within structure 2) in the absence of synaptic connections. In short, it may be counterproductive in terms of readability to describe the circuits, but it is *necessary* in terms of scientific judgment to do so. I fear (and I am as certain as I can be short of doing the literature search myself) that the circuit proposed in this piece (d'Aquili and Newberg 1993) does not exist at the level of actual connections between specific nuclei. Furthermore, whereas the physiology of one giant reverberating circuit depends upon all the connections being excitatory, many of these connections would be inhibitory. In fairness, the authors' work would be increased exponentially with the addition of this information, and much of the information simply is not known. But

until it is known and presented, the neuroanatomy remains unverified.

To conclude this unpleasant section, the basic maxim of neural reflexes remains true: What goes around comes around. I see two fundamental bases for response to my criticisms; all others are friendly arguments. First, I may have misread or misunderstood the theory—if so, certainly no misrepresentation or underestimation was intended. Second, it is entirely possible that the neuroscientific basis of my critique may be weak—if so, I roundly deserve a full rebuke. Fortunately, to the extent that I am wrong on either of these two bases, by that amount must be increased the estimation of d'Aquili's already substantial thesis.

EMERGENT RELIGIOSITY, EVOLVED BRAIN

What would be an alternative explanation of human religiosity that draws from modern neuroscience? In my estimation it would be based on three essential features: (1) The brain constructs reality by bottom-up, genetically provided mechanisms. Individual neurons do not have consciousness, or religious sentiment. (2) Human cognitive abilities (most notably the aesthetic sense, the sense of history rather than mere memory, and language rather than mere communication) are emergent phenomena. Stages in the emergence of these cognitive abilities (making tools, standing upright and leaving the tropics, and burying the dead) are correlated with the evolutionary precursors of contemporary human brains. (3) We are made human by these processes, which have become our dominant cognitive strategy. This cognitive strategy (symbolizing) produces holistic thinking, which implies mental construction of abstract wholes, conception of how things might be other than how they immediately are to the senses, and evaluation of the significance of things against our idealized abstractions. Conception and interpretation of things, including ourselves, in terms of the Ultimate is human religiosity.

I differ from d'Aquili because I am neither panpsychic nor panentheistic. I agree that profound religious experience is described best by Rudolph Otto, followed closely by William James. But I differ by believing that meditative and trance states, and even mystical states, are neurologically the same as normal states of consciousness (that is, various states of wakefulness and perhaps some states of sleep). Biologically I would say that just as clearly as our brains differ from the chimpanzees, the dolphins, and the crabs, so also as clearly differs our consciousness itself. Ultimately we are the "religious savants" of the living world. D'Aquili and I would

certainly agree that our most truly human nature is our religious nature. We would echo William James to say that all our "states of mind are more or less religious."¹²

CONCLUSION

At the end of the day, the question to be called is the reality of d'Aquili's vision. The value of d'Aquili's theory cannot be known through fragmentary criticism, but in the kind of knowledge that comes from apprehending the whole. Eschewing the temptation to reduce religious experience to social conditioning, d'Aquili, with William James, is an empiricist whose beginning point is the reality of the experience itself. What is perceived in this alternate variety of human experience is Ultimate Reality Itself, the Ground of Being Itself, and a *mysterium tremendum et fascinans* or Wholly Other of the divine being. Whereas James took his anecdotal accounts of religious experience to packed houses of skeptical Scottish theologians, today's social scientists tell us that these stories are not isolated. Most people report having had a religious experience at least once in their lives, an experience that is mystical, and of singular and ultimate importance at the time. No science, philosophy, or theology is competent to explain, or to explain away, what these people know to be actual. To travel with Eugene d'Aquili is to illuminate the ultimate reality of what it means to be religiously human.

NOTES

1. In terms borrowed from genetics, "neurognosis canalizes the developmental entrainment of neural systems into functional creodes that, in a successful organism or species, moderates and integrates the bipolar demands of growth and adaptation" (Laughlin, McManus, and d'Aquili [1990] 1992, 56).

2. In fact, d'Aquili documents what Jaynes's hallucinations really were (1983 and in d'Aquili and Newberg 1993, 185-86).

3. Sisyphus was condemned for his misdeeds to Hades where his eternal task was to roll a large stone to the top of a hill, whence the stone always rolled down again. Albert Camus (1913-60) was an existential novelist and philosopher who wrote an essay (*Le Mythe de Sisyphe*) which illustrated the absurdity of life. If the eternal damnation of Sisyphus to a view of an absurd world follows from the persistent mode of brain functioning which d'Aquili says "maintains our presumed subjective isomorphism with the world," then the alternate vision and fate could be made possible only by an alternate mode of thinking that was directly produced by the myth-ritual complex following the death of his condemning gods, who had become mythically embodied by Camus. Paradoxically, d'Aquili offers a way out of the tragedy of a world view in which human beings are determined by forces greater than they are, whether those forces are the Fates or Nature. Ironically, this is done by his religious synthesis of mysticism with naturalism. I would pose to Gene d'Aquili the following question: Have you ever thought of your work in classical terms?

4. At the 1992 annual meeting of the Society of Neuroscience, the National Institute of Mental Health informed the general neuroscience community about the Human Brain Project, "a federally-funded initiative which will facilitate and coordinate the

development of tools aimed at integrating neuroscience information across disciplines and across geographic locations." This will do for the science of the human brain what the Human Genome Project is doing for our DNA.

5. Hopelessly and always a teacher, I cannot resist offering a tip to the nonscientist. Scientists read figures and illustrations *first* and the text second (if at all). The way a neuroscientist would work through these technical sections of d'Aquili and Newberg (1993) is literally to keep one finger on figures 3 and 4, literally tracing the pathways while reading the text. I can promise you that when you reach the end of the section, although you could not pass a multiple choice exam on the material, you will understand it—really!

6. William James simply did not have data available to him—indeed the "Neuron doctrine" was not yet doctrine, and certainly not dogma. Julian Jaynes's theory was not falsifiable. It is not possible to perform electroencephalograms on the ancestors of Homer. Jaynes's neurology was also too vague, even for the early 1970s, to determine whether there was any merit to his science. The numerous charlatans in this area have plagued all honest inquirers from James to d'Aquili.

7. What d'Aquili proposes is the same magnitude of alteration in consciousness, and the same magnitude of EEG changes associated with epilepsy: Partial (or focal) and generalized (or nonfocal) epileptic brain seizures should be equivalent to d'Aquili's AUB and trance states, respectively. Whether epileptic brain seizures should be called "reverberating circuits" is another question.

8. Trillion means 10^{12} in the American system, and 10^{18} in the British system.

9. Mary Midgley in "Gene-juggling": "Genes cannot be selfish or unselfish, any more than atoms can be jealous, elephants abstract or biscuits teleological" (1979, 439), and "Up till now, I have not attended to Dawkins, thinking it unnecessary to break a butterfly upon a wheel. . . . What this shows is that, in the absence of a serious and realistic psychology of motive, people will clutch at straws. Moral philosophers, in particular, have so thoroughly and deliberately starved themselves of the natural facts needed to deal with their problems that many of them are reduced to a weak state in which they lack resistance to even the most obvious absurdities" (1979, 458). Richard Dawkins's response appears in 1981, "In Defense of Selfish Genes," *Philosophy* 56: 556-73.

10. "If one follows Klopff's strictures too closely, then cognitively and developmentally crucial processes such as play and symbolization must be treated strictly as emergent processes, intrinsic to the development of the organism, but extrinsic to the neurons that make up the organism's brain. To look for the concomitant, intrinsic activity of cells to play in the organism would perhaps be more productive—just as Klopff has done with pleasure and pain (reward and punishment)" (Laughlin, McManus, and d'Aquili 1990, 40). Perhaps I misunderstand d'Aquili and his coauthors, but it seems clear to me that play, symbolization, and religiosity *are* emergent properties. Ultimately Klopff, even though he himself possibly made his way to emergence rather than panpsychism, has turned out to be a red herring for our authors. For d'Aquili and myself, symbolization is a crucial concept. For me, symbolization of the Ultimate is what religiosity is all about. Symbolization is the cognitive precondition for religion, but it is also an evolutionary emergent property of the human brain.

11. This would be the ultimate sin, and the Marxist sociologists of science would be right. That would be hell for the scientist.

12. "Things are more or less divine, states of mind are more or less religious, reactions are more or less total, but the boundaries are always misty, and it is everywhere a question of amount and degree" (William James [1902] 1990).

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