

Seeking God in the Brain — Efforts to Localize Higher Brain Functions

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Neuroscientists have long eschewed global questions about brain function, and books reviewing the current state of neuroscience usually allocate only a small section to “higher functions.” But with the advent of novel imaging techniques such as positron-emission tomographic scanning and functional magnetic resonance imaging, attitudes have begun to change. It is now feasible to visualize functions of discrete brain regions while subjects are engaged in diverse activities — doing arithmetic, composing songs, writing poetry, or watching pornographic movies. Information about which parts of the brain are activated during various mental activities has supplemented and, in general, confirmed previous insights derived from observations of alterations of thinking and feeling associated with brain lesions, epilepsy, and the use of diverse drugs.

Efforts to elucidate higher brain functions have intersected with a burgeoning literature on the neural underpinnings of not only language and art but also religion. At one extreme, some scientists, such as Francis Collins, in *The Language of God*, have even used what we know of molecular biology and brain function to argue for the existence of a personal God.¹ Collins reviews anthropologic data emphasizing the universality of the search for God among a diverse group of primitive and advanced cultures over many thousands of years; he interprets this universality as implying that some basic structure in the brain “needs God.” Similarly, noting that humans have an intuitive sense of right and

wrong, Collins suggests that this characteristic, too, originates in an intrinsic structure of the brain. He goes so far as to conclude that the moral law was implanted in our brains by God, but many scientists have argued, from the same universality, that moral, altruistic behavior is programmed into the brain because it facilitates social behavior that leads to the preservation of the species.

Others have used similar data to argue that all of religion is an artifact of evolution. Neuroscientist David Linden, for instance, has recently suggested specific mechanisms whereby evolutionary alterations in the structure of the brain might account for the development of religion as well as love, memory, and dreams.² As the brain evolved, he explains, the overgrown cerebral cortex came to overlie the more primitive, emotion-regulating limbic structures, which in turn surmount the most primitive brain-stem structures and the associated hypothalamus. Linden argues that the accidental linking of these portions of the brain accounts for many of the tribulations of humankind — anxiety and other emotional disturbances arise in substantial part from the ongoing war between the “rational” higher centers and the emotion-laden limbic system. Linden argues that if an “intelligent designer” had assembled the brain, it would surely have done an elegant, impeccable job, but the more we learn about the brain, the more clearly we see that it is an ad hoc concatenation of structures designed for unrelated functions — a sort of Rube Goldberg con-

traption. Though the brain somehow manages to function rather elegantly, breakdowns manifested in emotional and other disturbances are all too frequent.

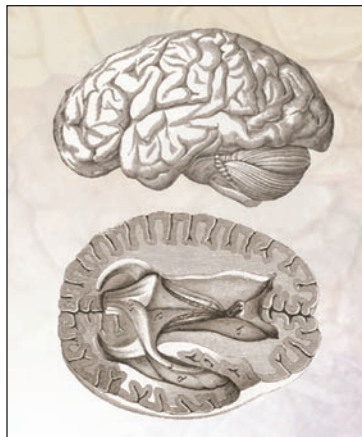
Linden speculates about the neural mechanisms that may underlie religious impulses. He regards religious ideation as reflecting beliefs — such as the concept of a virgin birth or the notion of a God who knows every thought of every human being — that violate our everyday perception of reality. He likens such conceptualizations to the confabulations that persons with split brains arrive at in order to make sense of the incompatible data encountered by the two separated hemispheres.

In his recent book *The Soul in the Brain*, British neurologist Michael Trimble looks to his area of expertise, epilepsy, to explore a possible relationship between the human brain and religion: religiosity, he notes, is often brought to the fore by seizures.³ Trimble points out that some of the greatest religious figures in history had what were probably complex partial seizures, which are known to be associated with religious ideation. For instance, during Saint Paul’s conversion on the road to Damascus, he is said not only to have suffered 3 days of blindness but also to have fallen to the ground frequently and experienced ecstatic visions. Muhammad described falling episodes accompanied by visual and auditory hallucinations. Joseph Smith, who founded Mormonism, reported lapses of consciousness and speech arrest, noting that

“When I came to . . . I found myself lying on my back looking up at heaven.” Joan of Arc reported, “I heard this voice [of an angel] . . . accompanied also by a great light.”³

Trimble recalls that in *The Varieties of Religious Experience*, the 19th-century psychologist William James also highlighted the trances, visions, and auditory hallucinations associated with religion, emphasizing the ineffable, altered state of consciousness of most religious mystics. Such mystical states, encountered in most religions, remarks Trimble, are extraordinarily similar to the mental states elicited by psychedelic drugs such as LSD and mescaline. Almost 50 years ago, the psychiatrist Walter Pahnke came to this conclusion on the basis of experiments in which the psychedelic drug psilocybin was administered to students at the Harvard Divinity School. More recently, Roland Griffiths and colleagues have replicated these studies in a more rigorous fashion and found that subjects receiving psilocybin reported long-lasting changes in a religious sense of self.⁴ Drugs whose mechanism of action is understood can be powerful tools for elucidating the molecular basis of mental states — we know much more about the neurotransmitters that mediate emotions, for instance, from studying the actions of antidepressant drugs than from direct manipulations of the brain — and psychedelic drugs are known to act as agonists of one subtype of serotonin receptors.⁴ Since serotonin neurons arise from a discrete set of raphe nuclei in the brain, it may be possible to narrow the search for the biologic cause of at least one type of religiosity to these few cells.

But given the variability of what we mean by “religion” and “poetry,” attempts to localize such purported functions within the brain are always fraught with hazards. With his focus on epileptic causes of both religious and creative impulses, Trimble enu-



merates several candidate regions, most of them in the temporal lobe — an area that receives a substantial input from serotonin neurons — which is consistent with what we know of sites of action of psychedelic drugs. In this issue of the *Journal*, Sanai and colleagues (pages 18–27) report on a study in which they mapped sites involved in diverse modes of language use in patients with gliomas who were undergoing debulking of their tumors. They found a far wider dispersal than might have been expected, with parietal and temporal as well as frontal regions providing important contributions. However, any extrapolation from a mapping of brain areas that mediate language use to likely cerebral contributions to religious or creative dispositions would be highly speculative.

So where do all these brain explorations lead us? In seeking a general relationship between religious states, poetry, and music,

Trimble ascribes all three to the right, nondominant side of the brain. He assumes that integration of the activity of the right-sided emotional brain with that of the left-sided analytic brain gives rise to the greatest intellectual achievements in the arts. I suspect that major advances in science, too, are the product of more than pure reason — in the finest scientists I have encountered, I have always detected a notable creative, artistic flair.⁵ Artistic, intuitive approaches are evident even in the most abstract intellectual achievements, such as Einstein’s theories. Needless to say, a simple dichotomy of right and left brains is a gross oversimplification. Nonetheless, as imaging technology and associated cognitive testing become ever more sophisticated, we may be able to discriminate ways in which religious and creative sensibilities relate to one another and to brain areas that mediate emotions that are deranged in psychiatric illness. Whether any of these advances will provide the answer to the cerebral basis of religion, if one exists, is anybody’s guess.

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1. Collins FS. *The language of God: a scientist presents evidence for belief*. New York: Free Press, 2007.
 2. Linden DJ. *The accidental mind: how brain evolution has given us love, memory, dreams, and God*. Cambridge, MA: Belknap Press, 2007.
 3. Trimble MR. *The soul in the brain: the cerebral basis of language, art, and belief*. Baltimore: Johns Hopkins University Press, 2007.
 4. Griffiths RR, Richards WA, McCann U, Jesse R. Psilocybin can occasion mystical-type experiences having substantial and sustained personal meaning and spiritual significance. *Psychopharmacology (Berl)* 2006;187:268-83.
 5. Snyder SH. The audacity principle in science. *Proc Am Philos Soc* 2005;149:141-58.
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