







# How Does the Brain Experience God?

INTERVIEW ON NEUROTHEOLOGY  
WITH ANDREW B. NEWBERG

Interviewed by EMILY ESFAHANI SMITH

Andrew B. Newberg is a neuroscientist and Professor and Director of Research at the Marcus Institute of Integrative Health at the Thomas Jefferson University and Hospital in Philadelphia. A pioneer in the neurological study of religious and spiritual experiences, a field known as “neurotheology,” his research includes taking brain scans of people in prayer, meditation, rituals, and trance states, in an attempt to better understand the nature of religious and spiritual practices and attitudes. Newberg is also the author or co-author of numerous acclaimed books, including *How God Changes Your Brain: Breakthrough Findings from a Leading Neuroscientist*, *Why God Won’t Go Away: Brain Science and the Biology of Belief*, and, most recently, *How Enlightenment Changes Your Brain: The New Science of Transformation*. He recently spoke to SUFI magazine about his research.



**Can you give readers a broad overview of your research—what do you study?** The name of my field is neurotheology. “Neurotheology” is an interesting term. I’d like to make some specific points about it. One is that it really represents a two-way street—it’s not the neuroscience of religious and spiritual beliefs and it’s not a religious or spiritual perspective on what science can say and its limits. It’s science and religion coming together in a way that hopefully helps us understand who we are as human beings. It’s a field that’s seeking to illuminate these two parts of the human experience—science and technology along with theology and religion.

It’s also a field that’s fairly comprehensive compared to other academic disciplines. The “neuro” in “neuro-theology” doesn’t just mean neuroscience—though it includes that, too. But it also means the study of health, physiology, psychology, and anthropology, all as they relate to spiritual experiences and beliefs. Likewise, while theology is its own discipline, what my colleagues and I are referring to also includes rituals, different types of religious and spiritual experiences,

drug-induced states, medical-induced states, and other practices. We study these topics using a variety of methods, from survey studies that ask people about their spiritual experiences to highly technical brain imaging studies that peer inside the mind of religious practitioners during worship—in particular, during meditation and prayer.

**How did you come to this field of study?** Spirituality is something that I have been exploring since I was a kid. I was always asking questions about religious and spiritual beliefs. It was curious to me that we are all looking at the same universe and yet aren’t coming to same conclusions—there are vastly different religious beliefs and practices. As I tried to make sense of these different perspectives of reality, I thought I’d look to science as a way to gain more clarity. The brain, I reasoned, must be very involved in this process of how we experience reality. But as I got older, I realized that science has its own limitations, so in college I started looking at philosophy and religion, and reflecting internally on the question of reality—





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it became a philosophical meditation. I would sit for hours and reflect on what I call the “Big” questions such as, “What is the nature of reality? How do we know what is really real? What is truth?” I was trying to find the answers.

But, I didn’t need to find the answers because, in some way, there was never an answer to be found. Then eventually, some of my mentors encouraged me to start studying the questions that had preoccupied me since my childhood in a laboratory setting, and that set me on the path to neurotheology.

**What are some of the questions you’re trying to answer in your research?** We are trying to understand the relationship between our religious and spiritual selves and the human brain. What are the ways that the brain allows us to experience religious feelings and thoughts, and what are the ways that it hinders us? I’m particularly interested in what’s going on inside the brain during intense religious experiences, like moments of transcendence, awe, and mysticism.

A lot of my work involves neuroimaging. I look at the

brains of different people, such as Sufi and Buddhist practitioners, nuns in prayer, and non-meditators taught how to meditate, to see what changes occur in the brain when people are engaging in those spiritual practices—both as they’re meditating, and over the long term. So if you’re a longtime meditator, is your brain different than that of a non-meditator? How? And does this have consequences for your health and well-being?

My other colleagues have looked at the effects of a drug-induced mystical experience, using psilocybin—the active ingredient in “magic mushrooms”—to see how a mystical experience changes people. We’re also beginning to do work using a technique called transcranial magnetic stimulation, in which we actively stimulate certain regions of the brain to see if we can induce certain spiritual experiences, inhibit them, and how stimulating the brain might change our religious and spiritual beliefs.

One of our most recent studies was an online survey asking people about their most intense religious experiences. We

asked them for their basic information, and also about their medical and spiritual histories. Then we had them describe in narrative form those spiritual experiences and the effect they had on them to see what people are truly feeling when they say they're having a deeply religious and spiritual experience.

**Can you describe your findings? What is going on inside the minds of spiritual practitioners while they're worshipping?**

Like William James before us, my colleagues and I are trying to unpack the core elements of intense spiritual experiences. But unlike William James, we are relying on a combination of brain imaging data and survey research. After studying thousands of people, we've found five essential features of a mystical experience:

First, a sense of intensity. Most people describe these experiences as the most intense experiences they've ever had, in both a sensory and emotional sense.

Second, a sense of clarity. These are experiences that essentially explain to them what the world is, they get it now, they understand the world in a way they haven't before.

Third, a sense of unity. They feel that they have become one with something bigger, like God or the universe, or some sort of universal consciousness. Whatever the goal of the practice or belief system is, they feel a sense of incredible connectedness and oneness during these mystical moments.

Fourth, a sense of surrender. They're not making the experience happen; it's something that's happening to them. We've seen this when we've studied Sufi practitioners and Muslims in prayer in particular—there's a shift from something that you're trying to do, like meditate or pray, to something that's happening to you and not really in your control.

Fifth, there is permanent change in how a person thinks about the world. The mystical experience changes how they think about their relationships, their job, their sense of meaning and purpose, their fear of death—all of these things change dramatically as a result. We've found that these experiences change your brain in a powerful way that lasts a lifetime.

**And you've found that these five elements are associated with specific brain functions or changes in the brain, right?**

Yes. The sense of intensity is associated with limbic parts of the brain. The limbic system, as it's called, is one of the older parts of the brain and is thought to play a large role in our emotional and intuitive experiences. We see the limbic areas turning on during these types of experiences.

In terms of sense of clarity, we think that a central structure called the thalamus is involved. The thalamus takes in sensory information and allows different parts of the brain to communicate with each other. It regulates our sense of reality.

So during a peak religious experience, there's probably more activity in the thalamus as it makes all of these novel connections in the brain that bring to us a sense of clarity or

understanding. The sense of unity occurs in association with a structure called the parietal lobe, located in the back of the brain. This part of the brain helps us create our sense of self, by taking in sensory information about the environment and locating our bodies in space. But during these beliefs, we see a decrease of activity in the parietal lobe—which makes sense. As the brain stops working to separate the self from the not-self in space, people feel connected with their surroundings or even something greater.

As for the sense of surrender—when we are willfully doing something, the frontal lobe shows more activity. This is the part of the brain that's involved in executing actions, forming intentions, and reasoned analysis. But when we feel a sense of surrender, the activity in the frontal lobes decreases. This can often feel dramatic, because during meditation or prayer you are actively engaging the frontal lobe, so it's really ramped up; you're being very willful and intentional. Then, when the activity in the frontal lobe suddenly drops, you lose all those feelings of willfulness, so there's this overwhelming feeling of surrender. The example I use is of a ladder: if you climb two steps of a ladder and then jump off, nothing happens. But if you climb up a ten foot ladder and jump off, then something dramatic will happen. So it's not the decrease in activity itself that's important, but the magnitude of the decrease.

**Why do these changes occur? It sounds like they're sudden. When we meditate or pray, as you say, the frontal lobe is highly active—but, then, at some point, if the experience intensifies or peaks, there's a drop in activity. Why does that happen?** We don't fully know. The speculation is that your brain gets really ramped up during rituals—and when one area gets particularly ramped up, it can't sustain that level of activity forever, so there's a sudden shift. It's like the whirling dervishes who dance and spin, and then they drop to the ground. These different parts of the brain I described are working and working and then suddenly shut down.

Another hypothesis involves the autonomic nervous system, which connects the brain to the body. It has an arousal arm, which is called the sympathetic nervous system, and a calming arm called the parasympathetic nervous system. When you're afraid or excited or anxious, that's the sympathetic nervous system at work. When you feel safe, secure, and loved, that's the parasympathetic system at work. In everyday life, there's a balance between the two—and when one turns on, the other shuts down. If arousal kicks in because you have to give a presentation at work, that's not the time for the calming mechanism to be active. Conversely, in



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bed at night, you want the calming parasympathetic nervous system to turn on, and not the anxious sympathetic system. That’s why when you have a big event the next day, it’s hard to sleep—one system is intruding on the other.

So during these intense religious experiences, if you’re doing a very intense ritual, like whirling or chanting, you’re revving up the arousal side of autonomic nervous system, and evidence shows that if that continues to happen, then you can have what we call a spillover—or a sudden turning over to the other side, in this case the parasympathetic system that will make you feel calm and at peace. The same is true of the other side. If you are doing calming meditation, like the Catholics’ centering prayer, then suddenly the arousal side can kick in, leaving you with a powerful sense of arousal in the midst of bliss. In both cases, there’s a shift in how different parts of the

brain are operating, so that you go from one system to the other. It’s because your body ultimately wants to be in balance.

**Based on your research, would you say there such a thing as a “unity of religious experience” in the brain?** Certainly there are ways in which these belief systems are similar and distinct. The similarities come into play during the most intense types of spiritual experiences. The mystical experiences of Muslims, Buddhists, Christians have a lot of overlap in those core elements I described, though how the practitioners ultimately interpret them can be different. When somebody says “I had a mystical experience and I felt God” and someone says “I had a mystical experience and felt universal consciousness,” we can ask if those are the same experience interpreted differently, or are two completely different experi-

ences? That's what we're still working on. But I do think there's a fair amount of overlap in these experiences.

As for what's going on in the brain, the changes seem to be specific to the experience itself rather than to tradition. If a nun has the experience of becoming one with God and a Buddhist has the experience of becoming one with universal consciousness, that oneness feeling is associated with changes in the parietal lobe. Now there may be some distinctions in the brain when someone feels at one with God versus at one with the universe, and there may be specific neurons that distinguish these different beliefs—but we haven't found those yet, so it's difficult to know for sure how similar or different these experiences are. But they seem to share general patterns.

**How can you study what's happening in the brain during spiritual states? Can you describe the methodology of your studies?** This is an interesting challenge. To some degree, it will be very, very difficult to see what's going on in the brain during a mystical experience because you never know when the experience is happening. After all, if you interrupt the person you're studying who is having the experience, then they're no longer having it. But we try our best to get as close as possible to studying it. We use brain imaging technology. There are two main types we use. One is called functional magnetic resonance imaging, or fMRI. Here, the subject lies down in a large scanner that covers most of his body like a tube. We ask the practitioner to meditate or pray in the scanner. Meanwhile, the scanner is taking pictures of the brain to reveal how the brain changes during those religious states. The downside of fMRI is that the person has to be in a scanner during the experience, which means they can't move.

Another technology is called SPECT imaging, which gets around the problem of movement. This one involves us injecting a person with a small amount of a radioactive tracer, which gets locked into the brain at the time you do the injection. We did this for the Sufis we studied, for example, because their practice involves moving around, swaying, and chanting, and so you can't monitor their brains in a scanner. With SPECT imaging, we put an IV catheter in the subjects, and run the line away from them so they have ability to move around. Then, after 20 minutes or so, I inject the tracer through the line. They continue the practice for 10-15 minutes, and then when they're done, we take a picture of their brain in a scanner to see what was happening at the height of their meditation.

For the Sufi group, we had a few of them in a room together meditating. They told us that they would get a more intense experience in a group. They meditated for about 30-40 minutes, mostly seated, with the catheters in them. After we looked at the data, we found a decrease of activity in frontal lobe regions, which was associated with their feelings of surrender.

**You've also studied Buddhists, Catholic nuns, and Pentecostals. Tell me a bit about those studies.** The Buddhists and the nuns were doing a concentration based practice—the nuns

doing centering prayer, and the Buddhists were concentrating on an image. And so what we tended to see in those studies was an increase in the activity in their frontal lobes because they were focusing on these different items. In the nuns, we also saw increased activity in the language area of the brain because they were doing a verbal practice, whereas we saw activity in the visual area of brain for Buddhists. When we looked at their brains at the peak state, they had heightened activity in the frontal lobe, but decreased activity in the parietal lobe, which is responsible for your sense of self.

The Pentecostals were speaking in tongues. At first, they were singing in English, but then they started slipping into singing in tongues—and then they moved into fully singing in tongues. Once they were exclusively singing in tongues, we injected them with the radioactive material through the catheter—as we had done with the Sufis—and then scanned them after they were done. They showed decreased frontal lobe activity because they gave themselves wholly over to practice. They felt that the spirit of God was moving through them, and they felt a sense of surrender to that.

**Some people are deeply engaged in meditation and prayer, while other just go through the motions of these rituals. Do their brains show the same pattern of activity?** That's been one of the long-standing questions—how engaged does one have to be? We have some examples from our data that speaks to this question. In one study, we looked at a single individual who was a proficient meditator. We asked him to meditate on the concept of God even though he didn't believe in God. We found that his brain didn't show much change. The data suggests that if you're going through motions, not a lot of areas of the brain turn on. You might get a mild experience of some kind—maybe you feel relaxed and reduce your stress—but you're not going to find that intense mystical experience. That's only going to happen if you're really engaged and involved.

Time matters, too. As a general statement, the longer a person does these practices, the more likely it may be that he will have a very intense experience. That doesn't mean that you can't have an intense experience if you're new on the path. And there are examples in our data of people having these experiences automatically and spontaneously. But for the most part, the people who have been practicing meditation or prayer for long periods of time are more likely to have intense spiritual experiences during their rituals, and to show more brain changes during them.

I should point out that there is not a huge amount of data on duration. Is it amount of years that matters? If you do an hour a day for five years, is that the same as half an hour a day for ten years? Does it matter how long you do it, how intense you do it? Is ten years when you are 17-27 the same as ten years at 55-65? We have no answers to these questions yet.

**You've talked about the brain changes that occur immediately during and after a mystical state. But what about the more long-term changes—are the brains of long-term meditators different than the brains of non-meditators or**



**novices?** There are indeed specific differences. Long-term meditators—or meditators who have been at their practice for 15 years or more—have thicker frontal lobes than non-meditators, which makes sense. You use your frontal lobe when you're concentrating, and the more you use it, the thicker it becomes—like a muscle. Our studies also show that people end up with not just thicker frontal lobes, but more active ones, which is associated with more concentration and better memory. There are also changes in the thalamus. Long-term meditators have more asymmetry in the thalamus, meaning one side of the thalamus is more active than other. If the thalamus is very involved in sensory processing and experiences of reality, then changes here relate to how we experience reality. So if you are engaged in these practices for long periods of time, your perspective on reality is changing. How the change is happening or how it changes one's perspective is unknown. But there is a change. One possibility is that there is a change in how open and compassionate people feel, and that the asymmetry in the thalamus is somehow mediating that, but we don't know exactly.

**Some people talk about how we have an instinct to believe in God or that humans are, by nature, religious—that we evolved to be spiritual. Do you think that's true? Do you think we're programmed for spirituality?** The way I like to talk about it is that our brain is built in a certain way—and how it got built, I don't know—but it's built in a way that allows us to engage in religious and spiritual experiences very easily. In my book *Why God Won't Go Away*, my co-author Eugene d'Aquili and I argued that there are two guiding mechanisms in the brain: a self-maintenance mechanism and a self-transcendence one. On the one hand, the brain helps us survive by negotiating the world and keeping our bodies appropriately regulated. On the other hand, the brain helps us to move from one life moment to the next. We are still the same person we were 5 years ago and 20 years ago, but we have also changed. The brain has changed. We continue to transcend our self throughout our life. Religion and spirituality might represent the ultimate in self-transcendence by going beyond the self to become something greater than the self.

**Can you say something here about the self-transcendence mechanism?** Religion, you could say, grew out of both the self-maintenance and the self-transcendence systems. Religion certainly helps with survival. They enable us to create cohesive societies and give people a moral code by which to live. They also help us to interact with the world effectively, holding holidays around planting, eating, and so on. But religion also satisfies our brain's yearning for transcendence. They've created rituals that help us step outside of ourselves. Ultimately, the mystical elements of most traditions may represent the highest level of self-transcendence that we're capable of achieving, where we become something more or greater than what self is during its usual self-maintenance mode. So long as the brain helps us with self-maintenance and self-transcendence, and as long as religion helps us with

those two basic functions, it strikes me that religion would be as natural to humans as eating and drinking—and part of the human experience for a very long time. And whether that's the case because of the forces of evolution or God—that's up for debate. Both are reasonable conclusions.

**Some people might think that reducing spiritual states to brain circuitry is reductive—that it diminishes these states to chemical firings rather than experiences that reveal truth and refer to some higher reality. What do you think?** I think it depends on how you interpret the data. Some people say, "Ok, here's the brain scan, there's nothing more to these experiences than what's happening in the brain." And others say, "Of course you can see these experiences in the brain—if God is talking to you, it will show up in the brain." I don't think reductionism is necessary. In my research, we are looking at the relationship between the brain and our spiritual selves, and understanding that link is important. If I think about an automobile, there will be a change in my brain, but that doesn't say anything about whether automobiles exist or not. There's an inference that something exists—but what it is, how it is, and whether or not it truly exists is up for grabs. Brain scans show if you see a car versus imagine it, your brain lights up in similar ways. So it goes back to how we experience reality—and what reality really is.

**Have any philosophers or theologians informed your work?** Certainly William James. He was one of the first people who tried to categorize religious experiences. His masterpiece, *The Varieties of Religious Experience*, looks at these experiences from a psychological perspective, and doing that was ultimately a precursor to neurotheology. I think his ideas have stood the test of time, though I think we have to be careful about over-pathologizing those experiences. My colleagues and I are in the process of working on a book that updates James' work with what we now know. I've also always been fascinated with Descartes and his writings on doubt. Spinoza, too, has been an influence. He was someone who integrated science, philosophy, and theology. He talks a lot about God in the context of nature and science, and how the physical world is an expression of the divine. I like the way he bound religion and science in a manner that elevated both.

**What's surprised you most in your research?** I don't know if this is a surprise, but one of the big takeaways I've come away with is a profound appreciation of everyone's belief systems. We are all trapped within our brains, looking out on an infinite world trying to make sense of it—and the fact that we come to any kind of conclusion about what this all means, is amazing. The different conclusions we come to have to do with our genes, upbringing, culture, experiences, and the people around us—these things all lead us to say "I believe X and you believe Y." Maybe this is idealistic, but I don't think that one side is wrong or that another is right, but that people think differently and interpret their experiences in the world differently. We need to respect that and find some peace in it.