

# HOW GOD CHANGES YOUR BRAIN

Breakthrough Findings from a  
Leading Neuroscientist

ANDREW NEWBERG, M.D.,  
AND  
MARK ROBERT WALDMAN

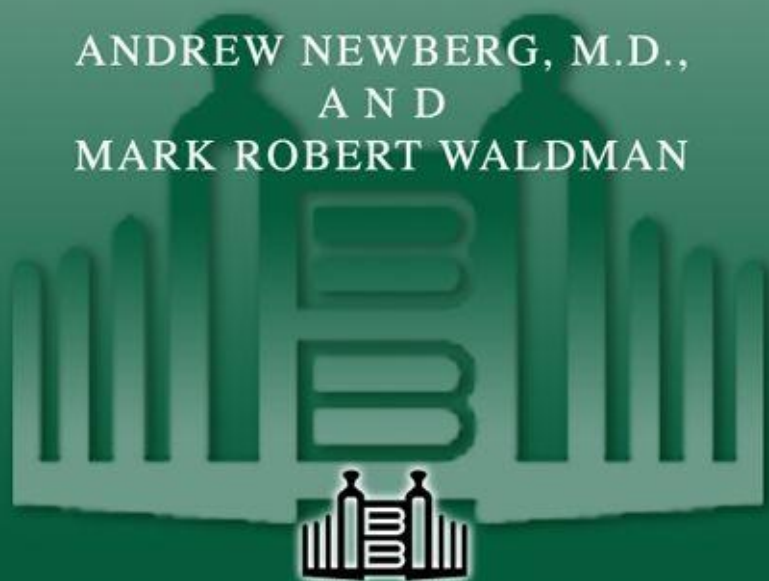


BALLANTINE BOOKS

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# HOW GOD CHANGES YOUR BRAIN

*Breakthrough Findings from a Leading Neuroscientist*

ANDREW NEWBERG, M.D.,  
AND  
MARK ROBERT WALDMAN



BALLANTINE BOOKS  
NEW YORK

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TO OUR STUDENTS, PATIENTS, AND  
RESEARCH PARTICIPANTS:

*You have helped to redefine the religious landscape of contemporary American society by demonstrating the beauty, diversity, optimism, and health benefits associated with the spiritual practices of the world.*



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# AUTHOR'S NOTE

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Throughout most of this book Mark and I will be speaking to you with a united voice, for we have closely collaborated on the research we present. Thus, we liberally substitute *I* and *we*, and only occasionally specify ourselves as individuals, since the anecdotes we relate tend to reflect our shared experiences and values. However, when *I* is used to talk about the brain-scan research conducted at the University of Pennsylvania, it is in reference to myself, as are most of the anecdotes that refer to childhood and college experiences. But research is never a solitary venture, so you'll often find references to *our* work, which includes not just Mark, but also the members of my research staff at the university, without whom I could not possibly conduct the work I do. For a list of those who have contributed to the research gathered in this volume, please see the acknowledgment page at the end of this book.

Of all the fields of science and medicine, neurophysiology is one of the most difficult topics to talk about in simple terms, especially when it comes to issues concerning consciousness, logic, emotional processing, and the reality-processing mechanisms of the brain—issues that are essential to address when dealing with the neurological correlates of spiritual experiences and religious beliefs. We have made the information as “user friendly” as possible, but generalizations often leave out important qualifications and concerns. Therefore, for those who desire additional information, we have provided extensive peer-reviewed references—over a thousand—in the endnotes to substantiate the conclusions we have drawn.



## RELIGION AND THE HUMAN BRAIN

*Our time is distinguished by wonderful achievements in the fields of scientific understanding and the technical application of those insights. Who would not be cheered by this? But let us not forget that knowledge and skills alone cannot lead humanity to a happy and dignified life. Humanity has every reason to place the proclaimers of high moral standards and values above the discoverers of objective truth. What humanity owes to personalities like Buddha, Moses, and Jesus ranks for me higher than all the achievements of the inquiring and constructive mind.*

—ALBERT EINSTEIN, *THE HUMAN SIDE*



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# WHO CARES ABOUT GOD?

## *Prelude to a Neurological and Spiritual Revolution*

God.

In America, I cannot think of any other word that stirs up the imagination more. Even young children raised in nonreligious communities understand the concept of God, and when asked, will willingly draw you a picture—usually the proverbial old man with the long hair and a beard. As children grow into adults, their pictures of God often evolve into abstract images of clouds, spirals, sunbursts, and even mirrors, as they attempt to integrate the properties of a reality they cannot see. In fact, the more a person thinks about God, the more complex and imaginative the concept becomes, taking on unique nuances of meaning that differ from one individual to the next.

If you contemplate God long enough, something surprising happens in the brain. Neural functioning begins to change. Different circuits become activated, while others become deactivated. New dendrites are formed, new synaptic connections are made, and the brain becomes more sensitive to subtle realms of experience. Perceptions alter, beliefs begin to change, and if God has meaning for you, then God becomes neurologically real. For some, God may remain a primitive concept, limited the way a young child interprets the world. But for most people, God is transformed into a symbol or metaphor representing a wide range of personal, ethical, social, and universal values. And, if you happen to be a neuroscientist, God can be one of the most fascinating of human experiences to explore.

For the past fifteen years I have investigated the neural mechanisms of spirituality with the same fervor that a minister contemplates God. Some religious rituals do nothing more than relax you, others help to keep you focused and alert, but a few appear to take practitioners into transcendent realms of mystical experience where their entire lives are changed.

Our research team at the University of Pennsylvania has consistently demonstrated that God is part of our consciousness and that the more you think about God, the more you will alter the neural circuitry in specific parts of your brain. That is why I say, with the utmost confidence, that God can change your brain. And it doesn't matter if you're a Christian or a Jew, a Muslim or a Hindu, or an agnostic or an atheist.

In *Why God Won't Go Away*, I demonstrated that the human brain is uniquely constructed to perceive and generate spiritual realities.<sup>1</sup> Yet it has no way to ascertain the accuracy of such perceptions. Instead, our brain uses logic, reason, intuition, imagination, and emotion to integrate God and the universe into a complex system of personal values, behaviors, and beliefs.

But no matter how hard we try, the ultimate nature of the universe continues to elude our brain. Some of the bigger questions remain. Where does life originate, where does it end, and what ultimate purpose does it serve? Is there a spiritual reality, or is it merely a fabrication of the mind? If there is a God, does such an entity reach out to us like the hand that Michelangelo painted on the ceiling of the Sistine Chapel? Or is it the other way around: Does our mind reach out to embrace a God that may or may not be real?

Neuroscience has yet to answer such questions, but it can record the effect that religious beliefs and experiences have upon the human brain. Furthermore, it can tell us how God—as an image, feeling, thought, or fact—is interpreted, reacted to, and turned into a perception that feels meaningful and real. But neuroscience cannot tell you if God does or doesn't exist. In fact, as far as we can tell, most of the human brain does not even worry if the things we see are actually real. Instead, it only needs to know if they are useful for survival. If a belief in God provides you with a sense of comfort and security, then God will enhance your life. But if you see God as a vindictive deity who gives you justification for inflicting harm on others, such a belief can actually damage your brain as it motivates you to act in socially destructive ways.

Having an accurate perception of reality is not one of the brain's strong points. Indeed, as Mark Twain pointed out in *Why We Believe What We Believe*,<sup>\*1</sup> the human brain seems to have difficulty separating fantasies from facts.<sup>2</sup> It sees things that are not there, and it sometimes doesn't see things that are there. In fact, the brain doesn't even try to create a fully detailed map of the external world. Instead, it selects a handful of cues, then fills in the rest with conjecture, fantasy, and belief. Rather than being a hindrance, such neurological ambiguity allows us to imagine and create a world filled with utopian, utilitarian, and sometimes useless things—from eye protectors for chickens to electronic corneas for the blind.

Likewise, when it comes to thinking about God, our brain creates a vast range of utopian, utilitarian, and sometimes useless theologies—from complex moral value systems to the number of angels that can fit on the head of a pin. But no matter how comprehensive our theologies become, our brain is rarely satisfied with its concepts and images of God. The end result of this remarkable contemplation has been the creation of thousands of differing spiritual practices and creeds.

Indeed, the more one contemplates God, the more mysterious God becomes. Some embrace the emergent ambiguity, some are frightened by it, some ignore it, and others reject it in its entirety. But

the fact remains that every human brain, from early childhood on, contemplates the possibility that spiritual realms exist. Believers like Isaac Newton, agnostics like Charles Darwin, and atheists like Richard Dawkins have all given serious consideration to humanity's fascination with God, because the moment God is introduced to the human brain, the neurological concept will not go away.

Recently there has been a spate of antireligious books—among them, *The God Delusion*, Richard Dawkins; *The End of Faith*, Sam Harris; and *God Is Not Great*, Christopher Hitchens—that argue that religious beliefs are personally and societally dangerous. But the research, as we will outline throughout this book, strongly suggests otherwise. Nor do we believe that these authors represent the views of the vast majority of scientists or atheists. For example, though I am not specifically religious, I'm open to the possibility that God may exist, whereas Mark, my colleague and co-researcher, prefers to look at the universe through a purely naturalistic and evidence-based perspective. Yet we both appreciate and encourage religious and spiritual development—as long as it does not denigrate the lives or religious beliefs of others.

For the past four years, Mark and I have been studying how different concepts of God affect the human mind. I have brain-scanned Franciscan nuns as they immersed themselves in the presence of God, and charted the neurological changes as Buddhist practitioners contemplated the universe. I have watched what happens in the brains of Pentecostal practitioners who invited the Holy Spirit to speak through them in tongues, and have seen how the brains of atheists react—and don't react—when they meditate on a concrete image of God.<sup>3</sup>

Along with my research staff at the University of Pennsylvania and the Center for Spirituality and the Mind, we are currently studying Sikhs, Sufis, yoga practitioners, and advanced meditators to map the neurochemical changes caused by spiritual and religious practices. Our research has led us to the following conclusions:

1. Each part of the brain constructs a different perception of God.
2. Every human brain assembles its perceptions of God in uniquely different ways, thus giving God different qualities of meaning and value.
3. Spiritual practices, even when stripped of religious beliefs, enhance the neural functioning of the brain in ways that improve physical and emotional health.
4. Intense, long-term contemplation of God and other spiritual values appears to permanently change the structure of those parts of the brain that control our moods, give rise to our conscious notions of self, and shape our sensory perceptions of the world.
5. Contemplative practices strengthen a specific neurological circuit that generates peace, peacefulness, social awareness, and compassion for others.

Spiritual practices also can be used to enhance cognition, communication, and creativity, and over time can even change our neurological perception of reality itself. Yet, it is a reality that we cannot objectively confirm. Instead, our research has led us to conclude that three separate realities intermingle to give us a working model of the world: the reality that actually exists outside of our brain, and two internal realities—maps that our brain constructs about the world. One of these maps is subconscious and primarily concerned with survival and the biological maintenance of the body. But this map is not the world itself; it's just a guide that helps us navigate the terrain. Human beings, however, construct a second internal reality—a map that reflects our *conscious* awareness of the universe. This consciousness is very different from the subconscious map formed by our sensory and emotional circuits. We know that these two internal maps exist, but we have yet to discover if, and to what degree, these two inner realities communicate with each other.<sup>4</sup>

Overall, our consciousness represents a reality that is the farthest removed from the world that



actually exists outside of the brain. Thus, if God does exist, there would be three separate realities to consider: ~~the God that exists in the world, our subconscious perception of that God, and the conscious images and concepts that we construct in a very small part of our frontal, temporal, and parietal lobes.~~ It has been my goal to show that spiritual practices may help us to bridge the chasm between the inner and outer realities, which would then bring us closer to what actually exists in the world. I still don't know if it's possible, but the health benefits associated with meditation and religious rituals cannot be denied.

# ORGANIZATION OF THIS BOOK

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In the first two sections we will explore the neural correlates of spiritual experiences that our research has uncovered. The third section is filled with practical exercises that anyone can use to enhance the physical, emotional, cognitive, and communication processes of the brain.

In Chapter 2—“Do You Even Need God When You Pray?”—we’ll describe our recent study showing how spiritual practices improve memory, and how they can slow down neurological damage caused by growing old. Our memory study also demonstrates that if you remove the spiritual references, religious rituals will still have a beneficial effect on the brain. We’ll also show you how to create and personalize your own “memory enhancement” meditation.

In Chapter 3—“What Does God Do to Your Brain?”—we’ll explore the neural varieties of meditation and prayer, explaining how different parts of the brain create different perceptions of God. We’ll tell you how God becomes neurologically real and show you how different neurochemicals and drugs alter your spiritual beliefs.

In Chapter 4—“What Does God Feel Like?”—we’ll share with you the surprising findings from our online Survey of Spiritual Experiences. Our data suggests that God is more of a feeling than an idea, that nearly everyone’s spiritual experience is unique, and that these experiences often generate long-lasting states of unity, peacefulness, and love. Furthermore, they have the power to change people’s religious and spiritual orientations, as well as the way they interact with others.

In Chapter 5—“What Does God Look Like?”—we’ll show you what we discovered when we compared adult drawings of God with pictures drawn by children. We’ll explain why some atheists maintain childhood images, while others draw sophisticated renditions, and share with you how agnostics tend to react when they explore their notions of God. We will also explain why each of us may have a single “God” neuron or circuit that slowly expands the more we contemplate religious ideas.

In Chapter 6—“Does God Have a Heart?”—we’ll describe how Americans project different personalities onto God, and how each of these perspectives affect the neural functioning of the brain. We will also explain how God culturally evolved from an authoritarian, punitive deity to become a force that is filled with compassion and love. This “mystical” element of God affects a very important part of the brain, called the anterior cingulate, which we need to nurture as we engage in a pluralistic world filled with different perceptions of the divine.

In Chapter 7—“What Happens When God Gets Mad?”—we’ll delve more deeply into the neurological dangers of anger, fear, authoritarianism, and idealism. We will also explain why everyone—believers and nonbelievers alike—is born with a built-in fundamentalist framework that is deeply embedded in the neurological circuitry of the brain.

In Chapter 8—“Exercising Your Brain”—we’ll tell you about the eight best ways to keep your brain physically, mentally, and spiritually tuned-up. Three of these techniques are directly related to the neurological principles underlying meditation, but I think several of them will surprise you, especially the one that we think may be most essential for maintaining a healthy brain. They are all relatively easy to do, and we will give you pointers on how to integrate them into your daily life. We’ll even show you how you can arouse your precuneus—which may be the central circuit of human consciousness—in less than sixty seconds.

In Chapter 9—“Finding Serenity”—we have used the findings from our neurological research to create a personalized “brain enhancement” program that will help you reduce stress, become more attentive and alert, develop greater sensitivity and empathy, and generally improve the overall functioning of your brain. We’ll explain the three key principles of meditation and guide you through

twelve exercises that you can practice at home. Included are three simple techniques to defuse anger, the emotion most likely to interfere with the normal functioning of your brain.

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In Chapter 10—“Compassionate Communication”—we integrate the techniques from the previous two chapters into a new exercise that can be done while you are engaged in conversation with someone else. In less than fifteen minutes a compassionate and intimate dialogue unfolds that undermines the normal defensive behaviors we usually employ in social situations. We are currently conducting brain-scan research to document the neurological benefits associated with this “Compassionate Communication” exercise, and we will instruct you on how to practice it with family members and friends. We’ll also enumerate twenty-one strategies that you can use to effectively resolve interpersonal problems.

# EXPLORING THE COMPLEXITIES OF GOD

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One of the main purposes of this book is to help readers expand their understanding and appreciation of spiritual practices and experiences. In fact, religious beliefs are vastly more complex and diverse than public opinion polls show. From a neurological perspective, God is a perception and an experience that is constantly changing and evolving in the human brain, and this implies that America's spiritual landscape is virtually impossible to define. You can't nail God down for good or for bad. And you can't intuit a person's innermost values based upon their creed or the church they choose to attend. If more people realized that everyone was talking about something fundamentally personal and different, perhaps a degree of distrust would fall away.

Although our studies have focused primarily on Americans, we believe that the same diversity of religious belief exists in other cultures. Even within the American fundamentalist community, it is difficult to make generalizations because many fundamentalists are loving, caring, and tolerant of other religious beliefs, contrary to what other people may lead you to believe.

Our research also disclosed that when it comes to God, there are few “true believers,” for even the most devoted believers expressed some doubts about the validity of their spiritual beliefs.<sup>5</sup> Even the majority of young atheists that we've interviewed expressed uncertainty about their disbeliefs. Indeed, current research reflects a growing tendency of people who are unwilling to identify themselves with any single system of belief. But you have to ask enough questions. For example, if a survey only gives the respondent the choice of a few options, the results will come out black and white. Thus, we chose to give our survey participants free rein in describing their religious beliefs and spiritual experiences. Instead of coming up with a simple set of categories, we uncovered a rainbow of colorful descriptions and beliefs. In one of our questionnaires, we even found evidence showing that educated young adults are far less prejudiced than previous generations of believers. And this bodes well for the future.

Ultimately, it is a mistake to assume that any self-assigned label, category, or description of religious belief accurately captures a person's value system or morality. Furthermore, our research suggests that the more a person contemplates his or her values and beliefs, the more they are apt to change.

The recent spate of antireligious “scholarship” that has landed on the bestseller lists should also be viewed with skepticism. Mark and I are particularly disappointed with the lack of empirical evidence that these writers have cited that even mildly suggests that religion is hazardous to your health. The psychological, sociological, and neuroscientific data simply disagree. The problem isn't religion. The problem is authoritarianism, coupled with the desire to angrily impose one's idealistic beliefs on others.

One should also remember that during the twentieth century, tens of millions of people were killed by nonreligious and antireligious regimes, while far fewer have been killed in the name of an authoritarian God. Even when it comes to suicide bombings, half of the people involved have been found to be nonreligious.<sup>6</sup> Instead, their acts of violence were carried out for purely political and socially motivated reasons. As we documented in our previous book, human beings have a neurological and biological propensity to act in profoundly hostile ways. On the other hand, our research shows that the majority of spiritual practices suppress the brain's ability to react with anger or fear.

There is, however, a shadow side to religious and political *organizations*, especially when their tenets stipulate that there is only one absolute and undeniable truth. When such individuals band together, they unconsciously foster an “us versus them” mentality that neurologically generates fear and hostility toward people who hold different beliefs. Neuroscience tells us that the moment we see an angry face, or hear angry words, our brain kicks into overdrive, generating stress chemicals that will make us fight or run. Anger generates anger, and the angrier a group of people get, the greater the possibility that violence will erupt.

Over the past three decades, fear-based religions and politics have grown in power and popularity, and although their numbers are beginning to decline,<sup>7</sup> many national leaders, politicians, and Nobel laureates consider some of these “fundamentalisms” to be genuine threats to world peace.<sup>8</sup> Some surveys have estimated that only 1 percent of the worldwide Christian community are willing to take violent action against those who disbelieve, but that still adds up to a lot of angry people. My question is this: What happens when those millions of angry Christians try to confront the millions of militant non-Christians in the world?

Jesus said, “Love your enemies, do good to those who hate you, bless those who curse you, pray for those who mistreat you.”<sup>9</sup> This, indeed, is a difficult task to do, but I'm surprised how often this biblical passage is ignored by some fundamentalists, even when dealing with other Christians. When Mark asked one ultraconservative pastor about Jesus' directive to love your enemy, he responded pithily, “I can love you, but I don't have to *like* you!” Mark was shocked by such unwarranted hostility, but the question that concerned me more was whether the pastor was an exception or the norm.

So far, in our informal interviews with numerous leaders of American fundamentalist churches, we have found that most are extraordinarily friendly and civil. Many will tell you that they prefer to not associate with followers of other religions, and some will “shun” you if you choose to leave the church,<sup>10</sup> but there are also congregations that will accept people with different beliefs with open arms. Mark even had a group of Pentecostal ministers bless him—in tongues!—for our neuroscientific work. In other words, you can't judge people by their beliefs, but you can judge them by how they behave toward others.

Fortunately, the majority of religious leaders in America encourage interfaith dialogue and

exchange, and some of the fastest-growing churches embrace a multid denominational spirituality that blends Christian, Jewish, Muslim, and Eastern religious philosophies.<sup>11</sup> What strikes me the most about these contemporary places of worship is the warmth and friendship extended to every participant, regardless of one's race, ethnicity, or faith. But some writers—like the aforementioned Richard Dawkins, Sam Harris, and Christopher Hitchens—make little distinction between fundamentalist and liberal theologies, arguing that religion as a whole presents a primary threat to the world. The evidence is not there, however, and in America, only a small percentage of groups use religion to foster discriminatory political agendas.<sup>12</sup> In fact, as we will highlight throughout this book, most research conducted in psychology and the social sciences finds religion either neutral or beneficial when it comes to physical and emotional health. The enemy is not religion; the enemy is anger, hostility, intolerance, separatism, extreme idealism, and prejudicial fear—be it secular, religious, or political.

In the relatively brief span of American history, religious movements have played critical roles in the promotion of human rights, helping to abolish slavery, establishing rights for women and children, and spearheading the civil-rights movement of the twentieth century.<sup>13</sup> Religious institutions feed the hungry, shelter the homeless, and protect battered women throughout the world. Episcopal churches now ordain gay and lesbian priests. Catholic, Jewish, and other religious groups fight for interreligious tolerance, and many theologians openly respect atheism and encourage agnostic discourse. And when it comes to promoting world peace, one only has to look at the number of religious leaders who have won the Nobel Peace prize: Martin Luther King, Jr., Bishop Desmond Tutu, the Dalai Lama, and Mother Teresa, to name just a few.

Our research, along with major studies conducted at other universities, points to a general decline in traditional religions that has been quietly going on for thirty years. But it has been replaced by a growing interest in spirituality, a term that describes a broad range of individual values and personal theologies that is not connected to traditional religious institutions. Thus, God is as popular as ever, but as we will describe throughout this book, it is a God that significantly differs from historic religious beliefs. Indeed, if our survey measurements are correct, each new generation is literally reinventing God in an image that points toward an acceptance and appreciation of our pluralistic world.

To survive in a pluralistic society, we must evolve our spirituality *and* our secularity, integrating religion and science in a way that can be beneficial to all. But to do this we must overhaul antiquated religious notions that interfere with the religious freedoms of others. Most important, we will need to devise innovative ways to promote peaceful cooperation between people, especially between those who hold different religious views. In this respect, scientists, psychologists, sociologists, theologians, and politicians must forge new cooperative alliances in order to improve our global interactions with others.

Contemplating God will change your brain, but I want to point out that meditating on other grand themes will also change your brain. If you contemplate the Big Bang, or immerse yourself in the study of evolution—or choose to play a musical instrument, for that matter—you'll change the neural circuitry in ways that enhance your cognitive health. But religious and spiritual contemplation changes your brain in a profoundly different way because it strengthens a unique neural circuit that specifically enhances social awareness and empathy while subduing destructive feelings and emotions. This is precisely the kind of neural change we need to make if we want to solve the conflicts that currently afflict our world. And the underlying mechanism that allows these changes to occur relates to a unique quality known as *neuroplasticity*: the ability of the human brain to structurally rearrange itself in response to a wide variety of positive and negative events.<sup>\*2</sup>

In the last two years, advances in neuroscience have revolutionized the way we think about the brain. Rather than seeing it as an organ that slowly matures during the first two decades of life, then withers away as we age, scientists now look at the human brain as a constantly changing mass of activity. In mammals, dendrites—the thousands of tentaclelike receptors extending from one end of every neuron (or nerve cell)—rapidly grow and retreat in a period of a couple of weeks. In fact, recent evidence has shown that neuronal changes can take place in literally a matter of hours. “The development of particular neurological connections or skills does not occur gradually over time,” says Akira Yoshii, a brain researcher at the Massachusetts Institute of Technology. “Instead such changes tend to occur suddenly, appearing in short intervals after robust stimulation. It is as if there is a single important trigger and then a functional circuit rapidly comes online.”<sup>14</sup>

The Nobel laureate Eric Kandel, who proved that neurons never stop learning, demonstrated another important dimension of neuro-plasticity. If you alter the environmental stimulus, the internal functions of the nerve cells will change, causing them to grow new extensions called axons capable of sending different information to other parts of the brain.<sup>15</sup> In fact, every change in the environment—internal and external—will cause a rearrangement of cellular activity and growth. Even more interesting, every neuron has its own “mind,” so to speak, for it can decide whether to send a signal, and if it does, how strong a signal to send.<sup>16</sup>

Scientists used to believe that neurons deteriorated with old age, but the mechanisms are far more complicated than that. For example, we now know that certain neurochemicals wear out, and that alters nerve cell activity and growth. Sometimes neural connections die off, and sometimes they become too active and overconnected, bringing chaos and confusion to our internal organizational maps. Our research with memory patients suggests that meditation can help maintain a healthy structural balance that will slow the aging process.

Brain-scan technology allows us to watch a living brain in action, and what we see is amazing. Each feeling and thought changes the blood flow and electrochemical activity in multiple areas of the brain, and it appears that we never repeat the exact same feeling or thought. In fact, the mere act of recalling a single memory changes its connection to other neuronal circuits—another interesting example of the enormous plasticity of the brain.

How fast do the neural connections change within the brain? Imagine filming a hundred years of growth in a forest full of trees, then playing it back in fast motion. You'd see branches growing and dying off at an incredible rate. In mammalian brains, similar changes can take place over a period of several weeks, and I suspect that in humans the neural changes occur more rapidly in the frontal lobe where many of our spiritual concepts are formed.



If we combine all of the research on neuroplasticity, we must conclude that neurons do not have fixed properties or positions.<sup>17</sup> Instead, they are changing all the time, triggered by competition, environmental changes, and education.<sup>18</sup> Learning takes place continually, and memories are being constantly revised. New ideas emerge, flow briefly into consciousness, then quickly fade away to make room for the next brief moment of awareness.

So what does neuroplasticity have to do with God? Everything, for if you contemplate something complex or mysterious as God, you're going to have incredible bursts of neural activity firing different parts of your brain. New dendrites will rapidly grow and old associations will disconnect. New imaginative perspectives emerge. In essence, when you think about the really big questions in life—be they religious, scientific, or psychological—your brain is going to grow.

## NEUROSCIENCE 101

In this book, we'll keep the brain anatomy to a minimum. However, when it comes to understanding how God and spiritual processes affect the brain, there are six structures that you want you to keep in mind: the frontal lobe, limbic system, anterior cingulate, amygdala, thalamus, and parietal lobe. On page 44 you'll find a drawing of these structures, but I'd like to show you a simple way to envision these important parts of the brain.

First, put two imaginary almonds (without the shells) in the palm of your hand. These are the two halves of your *amygdala*, which governs your fight-or-flight response to a perceived or imagined fear. Next, place two halves of an imaginary walnut (again, no shell) into the palm of your hand. This is your *thalamus*<sup>\*3</sup> which sends sensory information to all the other parts of the brain. It also gives you a sense of meaning, and what reality may actually be.

Now, make a fist and bend your forearm so your knuckles are pointing to the ceiling. Your forearm is your spinal cord, and your fist (along with the almond halves and the walnut) is the *limbic system*, the oldest part of the brain that every reptile, fish, amphibian, bird, and mammal has. Your limbic system is involved with memory encoding, emotional response, and many other bodily functions.

Next, take four sheets of eight-by-ten-inch paper and place them on top of your fist. Crumple the paper up so it fits snugly, and *voilà!*—you have a human brain. Those four sheets of paper are the approximate size and thickness of your neocortex, and all the memories, beliefs, and behaviors you have learned over a lifetime are stored on them, along with all of your visual, auditory, motor, language, and cognitive processing centers of the brain. Thirty percent of the paper is your *frontal lobe*, which sits directly behind and above your eyes. It controls nearly everything you are conscious of: your logic, reason, attention, language skills, and voluntary motivation.

Notice where the crumpled paper touches your thumb. That area approximates the location of the *anterior cingulate*, which processes social awareness, intuition, and empathy. It also contains a unique type of neuron that only humans and a few primates have. These neurons have only been around for about 15 million years, whereas your amygdala (the almonds in your fist) has been happily generating fear for 450 million years. Spiritual practices specifically strengthen the anterior cingulate, and when this happens, activity in the amygdala slows down.

There's one more area that I want you to keep in mind: your *parietal lobes*, located above and slightly behind your ears. They take up less than a quarter of those sheets of paper, but provide you with a sense of yourself in relation to other objects in the world. When activity in this area decreases, you can feel at one with God, the universe, or any other concept you are consciously focusing on.



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